

Enhancing IT Service Desk Performance through Six Sigma and ITIL: A Case Study of an Oil Company Contractor in Indonesia

Ahmad Anik Anwar, Nilo Legowo

Bina Nusantara University, Information System Management Department, BINUS Graduate Program,
Master of Information System Management, Jakarta, Indonesia

ahmad.anwar@binus.ac.id, nlegowo@binus.edu

Abstract. There are still few out there who know about the concept of Six Sigma combined with information technology. The Six Sigma approach can be used in every sector, here the author wants to share information related to the application of Six Sigma in the IT field. If an organization is engaged in providing a service to the community, slow response and long repair time will cause dissatisfaction. Recognizing that there are user complaints about the quality of IT Staff performance and the service desk system is currently not running as expected. it is necessary to evaluate it so that it is according to the plan and objectives by what is expected. The purpose of this paper is to improve services on the side of the system and IT Staff by integrating the Six Sigma approach and the ITIL framework. In addition to the limitations of existing features in the current system such as no active directory, untimely notification of reports, and compliance with ISO 270001 as a reason for replacing the new system. From the ITIL framework side, the author focuses on the service operation side, which will suggest changes to the current service desk system. The results of empirical studies regarding Critical Success Factor (CSF) factors that can influence and determine the success of service desk services are performance, efficiency, and accuracy of problem-solving. This is to determine the value of how much difference in DPMO value and sigma value with the current running conditions and to be able to determine the success rate of the recommendations proposed in this study. After calculating based on the level of defects DPMO defects per million found a DPMO value of 169,983.41 with a sigma conversion of 2.45 σ . With a probability of success in handling all problem reports of 83.00% of the total opportunity of 804 cases.

Keywords: IT Services, IT Service Management, Combination ITIL and Six Sigma, Service Desk

1. Introduction

Information technology is instrumental in helping every aspect of work, for example in the business industry, social, cultural and other aspects. One such thing is the Service desk system, which is an IT tool or service that manages customer contacts to provide access to service requests, and incident reporting and build good communication between service providers and customers if something goes wrong with IT services.

The Service desk is an IT tool or service that manages customer contacts to provide access to service requests, incident reporting and build good communication between service providers and customers if something goes wrong with IT services. PT XYZ is one of the oil and gas contracting companies in Indonesia. Vision is to become a global EPCI (Engineering Procurement Construction Installation) company by maintaining customer trust, implementing measurable governance, and focusing on human resource development.

Recognizing that user complaints about the quality of service desk performance are currently not running as expected by service users, then the weak response to problems that arise, the accuracy in problem solving, and the low level of service standards to guarantee and ensure the availability of quality IT services. Therefore, it is necessary to evaluate whether the service desk system that is currently running is by the plan and objectives as expected.

The reason why using DMAIC Six Sigma as a framework in evaluating services and the performance of service desk staff. starting from defining a problem in the IT services environment, the results of the problem definition can be measured and analyzed with various problem analysis tools to control changes in improvements. In addition to the limitations of features in the current system, as reason to plan to replace it with one that is more compatible with the newly implemented technology, including Active directory features and compliance with ISO 27001. The new proposed application is Osticket. Osticket has these features. besides this application provides SLA as a measure in working on tasks for each staff.

Six Sigma and ITIL approaches are methods that can be combined to provide an analysis of a problem that arises from an existing service desk service. to analyze problems such as delays, long response times, and unresolved problems. the author proposes the DMAIC approach.

There are many steps from the ITIL framework, but in this paper the author only focuses on the scope operation side by replacing the current service application that complies with ISO 27001. To improve the quality of current service desk services, it is necessary to evaluate every complaint from users or tickets that enter the service desk to be analyzed and made improvements to maintain user satisfaction. The goal is to improve the KPI of each member of the IT division at PT XYZ.

After conducting observations and questions and answers to related parties, there are complaints about IT services, both in the hardware, software and other categories, for example, such as the telephone not working properly. In every IT service user complaint, users are required to send an email to a predetermined email address with the complaint they are facing. Then the IT party that has been determined provides a solution to the problems that have been faced by service users. Data that enters the help desk can be seen at low, medium and high priority levels. To be able to prioritize work tasks according to the priority level. The following is complaint data from each service desk service user in 2022.

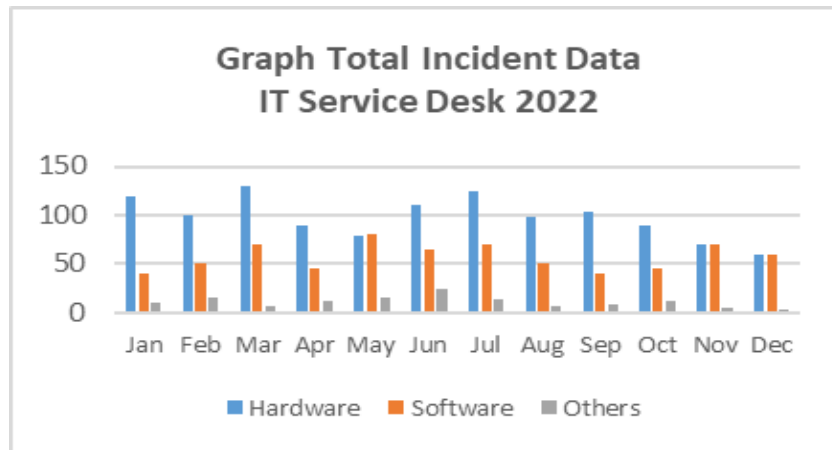


Fig. 1: IT service complaint data
(Source: PT.XYZ Service Desk Data Year 2022)

The types of problems that include hardware are, mouse replacement, laptop blue screen, hard drive replacement, and keyboard not functioning normally, the types of software problems are PO printouts of tax calculations that do not comply with the 11 percent regulation in the SAP application, SAP password reset requests, excel documents hang when opening cost project data, abscession data cannot be pulled and for problems that cannot be defined as software or hardware are, the telephone cannot connect to another extension, the network is not connected to the internet, VPN cannot connect to the server after configuring the new server, getting ms. word corrupt file cannot be opened.

Table 1: IT service complaint data

Month	Total Ticket Problems/Month	Status Open
Jan	127	13
Feb	103	9
March	138	8
Apr	141	15
May	149	21
Jun	173	11
Jul	203	10
Aug	186	11
Sept	237	53
Oct	267	24
Nov	179	17
Dec	94	8
Total	1.797	200

(Source: PT.XYZ Service Desk Data Year 2022)

From the above problems in each period there are obstacles in resolving problems faced by users, in total the accumulation in one year there were 1.797 complaints from users but not all of these problems were handled quickly, there were a total of 200 or equivalent 11.12 % problems that were resolved in a relatively slow time. It is necessary to do an analysis to find out the obstacles

faced in solving existing problems. Service desk efforts are used to test the effectiveness of business process performance (Jankowski, 2013). The Six Sigma concept integrates the three attributes of customer quality, behavioral science and teamwork (Chi-Chuan et al., 2011).

As a guide to best practices in information technology, the ITIL framework is not easy and its risks can change existing standard procedures if a system is not in accordance with current procedures. ITIL implementation is also time-consuming, high priced, and risky (Pereira & da Silva, 2011). Furthermore, Six Sigma methods can help an organization in structuring quality improvement and applying ITIL processes. For a company, such a step is important in building a process design and ensuring that it runs according to high expectations when implemented. We also found a company that implemented Six Sigma in setting up risk management and continuous improvement processes (Probst & Case, 2013). This paper will explore using a methodology between ITIL and Six Sigma to analyse problems and measure the success rate of an IT service.

2. Literature Review

To explain each of the terminology and disambiguation, this chapter also provides related theories related to the research and provides previous research.

2.1. Evaluation

Evaluation is the process of an assessment and measurement of what has been done with the results of the process that has been set before (Fauzi & Suryani, 2019). The results of an evaluation are very useful for improving performance and correcting deficiencies in a project in the future. Evaluation has three stages including:

- Development stage evaluation, the evaluator plays a role in planning to develop a project. The aim is to help the team provide feedback to improve the project.
- Formative stage evaluation, the aim is to improve an objective.
- Summative stage evaluation, carried out after the project has been completed. The goal is to know whether a project has failed or succeeded.

2.2. Service

Service is a means of creating value together with providing services to achieve goals without involving the customer in managing the costs and risks that will arise in the future (Cartlidge, Axelos, 2020).

2.3. IT Governance

Governance in an organization evaluates, provides direction and monitors all organizational activities, one of which is service management. The governance of an organization must maintain oversight of its objectives and ensure that the priorities and goals of the organizational are met (Cartlidge, Axelos, 2020). The importance of information technology governance is mainly in business strategy and business goals, so here are the objectives of IT governance (ITGI, 2003).

- The use of IT can provide business value for the company.
- Evaluation material for user discipline so that it can be held accountable.
- Reduce the occurrence of risks that are closely related to the use of technology and information.

2.4. IT Services

Information technology services are a container for conveying information, the value and benefits can help the services provided by the company that provide benefits to the management of a company. Because this service does not materialize, however, the quality of service is how a type of service can contribute to helping what is needed by the customer (Van Bon, 2017).

2.5. IT Service Management

Activities in an organisation to design, build, operate and control information technology services to be provided to customers (Cartlidge, Axelos, 2020). ITSM is a platform that provides information technology services and manages all aspects of information systems and information technology of an organisation, the goal is to provide services to customers (Menken, 2010).

The main ability in the service management process is to be able to measure the quality of service, effectiveness in service and efficiency in the service process. The following are the benefits of ITSM for an organization (Van Bon, 2007).

- Improve the quality of quality in an information technology service.
- Information technology services can contribute to the effectiveness and efficiency of the company.
- The best practices guide refers to ISO / IEC 9000 to support a culture of change towards the provision of information technology services.

2.6. IT Infrastructure Library (ITIL)

The ITIL framework can be used to help organisations develop technology requirements. The benefits of implementing ITIL in an organisation are that it can add value to their business to be more responsive, implement a new technology, adopt the latest trends and improve the quality of their IT services (Chan et al., 2008). Adopting ITIL in a company is something that many companies are very interested in, many companies that are successful in managing information technology are a mirror of the application of ITIL can improve the performance of a business.

Testing of incident management and fulfilment of requests for a service desk service to improve SLA quality with the ITIL framework "Increasing SLA Performance by Using Service Desk Simulator Learning Tool Base On ITIL" (Sukmana et al., 2021). As an IT organisation that provides a fairly simple ticketing service, the IT service procedure mechanism in providing a service to system users to increase the positive impact on system users by applying the ITSM and ITIL concept "Integration of the Helpdesk System with Messaging Service" (Hardianto et al., 2021).

2.7. Six Sigma

Is an approach to improve business processes as well as reduce inappropriate processes and eliminate deviations a process that can hinder the productivity of a service in a business process that has been designed beforehand a process that can hinder the productivity of a service in a business process that has been designed beforehand a process that can hinder the productivity of a service in a business process that has been designed beforehand. The goal is to reduce the number of process activities that produce inappropriate results in a production process or in a previously designed business process.

Helpdesk is a service that plays an important role in a company in maintaining the satisfaction of a customer's value. to ensure that the service runs effectively, it is necessary to carry out regular evaluation and monitoring "Applying DMAIC serves to eliminate steps that do not have an impact on cloud computing services. designing SLA as the right approach to improving cloud-based services." (Oktadini & Surendro, 2014). There are two methodologies to improve the quality of the Six Sigma approach, as follow (Probst & Case, 2013).

- DMAIC is a methodology to improve a process that is already running in order to measure and identify errors and provide solutions to overcome these problems.
- DMADV The letter D is defined as design and V for verify. DMADV is a methodology for creating a new product and verifying that it meets customer requirements.

2.8. Combination of Six Sigma and ITIL

To design and deliver an IT service that matches the agreed quality, IT organisations need to implement ITSM in improving a service. ITSM governance has stages in implementing the IT Infrastructure Library (ITIL) framework (Chan et al., 2008). The ITIL framework explains the steps

on how to manage infrastructure, develop IT processes, operate an information technology concept. However, when compiling or handling an ITSM project management and want to apply the ITIL framework, where the ITIL framework cannot identify or measure a service quality in creating an improved performance of a process.

ITIL and Six Sigma are complementary approaches to improving a business process, optimising or improving a process, as well as measuring the quality of a service and maximising the IT organisation in building the best service (Aazadnia & Fasanghari, 2008). Whereas, the Six Sigma approach is what an ITSM project hopes to fulfil, from the stage of measuring the quality of a service, then how to improve a service process. In this way IT service management will help in their business strategy goals.

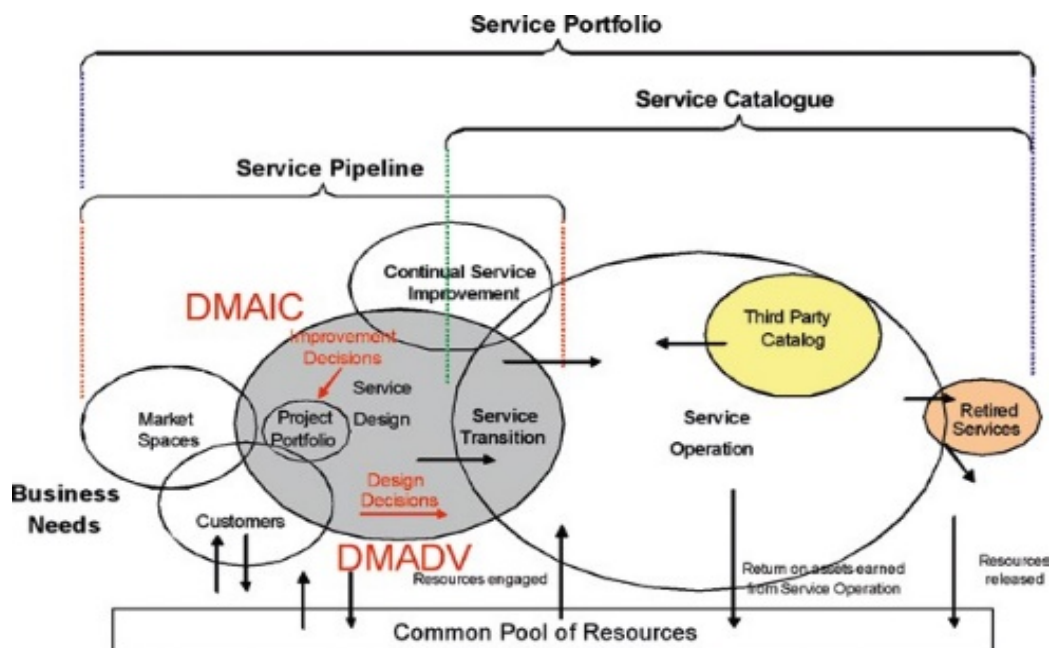


Fig. 2: Combination Six Sigma & ITIL

(Source: Integrating Six Sigma and ITIL or Continual Service Improvement 2013 (Probst & Case, 2013))

By combining Six Sigma and ITIL is the right step in overcoming the limitations of each framework, how in a process they complement each other and collaborate. Both ITIL and Six Sigma are aimed at customer satisfaction not IT, so it is important to know the needs of a customer or voice of the customer VOC. The Six Sigma approach is more likely to be used for goals at each stage of the process, while ITIL is used to tell the steps in achieving a process.

2.9. Service Desk

The service desk is a management in an IT service operation that plays an important role in supporting effectiveness and alignment in every IT service process of an organisation, in a study at the National Defense Agency of the Republic of Indonesia (BPN RI) on maintaining the quality of service operations on the help desk system (Ratnawati et al., 2021).

One of the tasks of the service desk is to provide an IT service to ensure the accessibility of an IT service runs well and helps provide solutions to problems faced by service users. In solving a problem in each problem in the service desk using a level of stages, if an IT staff member cannot provide a solution to the problem, then the problem will be given to a specialist level who often handles the case, and if this level also cannot provide a solution, it will be given to a higher level or stored and monitoring its development until a problem can be resolved or get a solution to the problem it faces

and the problem will be closed by the staff.

2.10. Analysis Tool

1. Goal Question Metric (GQM)

Approach to identifying appropriate measurement models in order to develop a framework that is fit for purpose. GQM is a method to define a measurement model using a collection of data that has been collected for process improvement through data analysis (Parviainen et al., 1997).

- Concept (Goal), where the goal is formed from a process, according to the quality of the object, point of view.
- (Question), the question that has been designed emphasises the need for a goal that will provide the characteristics of a product.
- Quantitative (Metric), where the information obtained is quantitative data.

2. Control Chart

Control charts are used to study how the course of a process changes over time, the lines determined by history are data that has been passed before you can conclude whether from the line can be controlled or cannot be predicted (influenced by other variation factors) (Hambleton, 2008).

3. Fishbone Diagram

A fishbone diagram is a graphic that shows the contributing factors of a particular event. A fishbone diagram can also identify, explore and analyse a cause that will have an impact. This diagram can link factor "x" to a quality. This diagram can also be used as a reference for decision making, factors that affect the cause of an event and the quality that is affected by a cause (Coccia, 2020).

3. Methodology

3.1. Approach and Type of Research

In this chapter the author will explain the steps in detail in the process of answering the problem formulation that has been explained in the previous chapter. And methodology is a research guide in compiling a good and correct research in accordance with the approach that has been determined in the research title, the following is an explanation of each description that has been described previously:

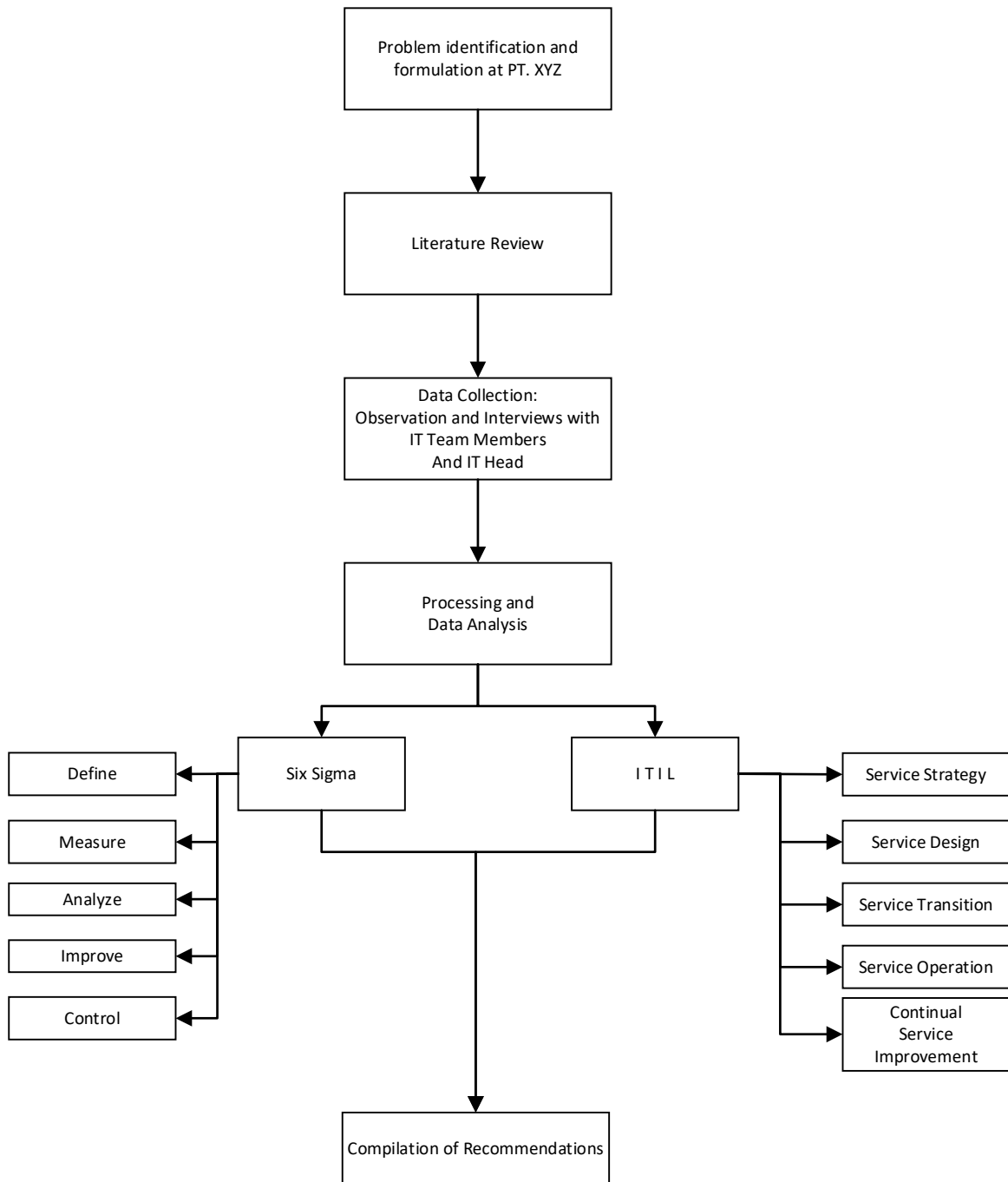


Fig. 3: Framework

In the figure above is the stage of a process in the preparation of this research. Then the next stage is how to recognise and identify a problem that arises in a service desk service at PT.XYZ, then it is necessary to carry out the stages of data collection and observation, interviews with related parties in this case the IT department as a service provider. With these problems can reduce or disrupt the performance of a department against other departments, because it can slow down the preparation of their tasks or work, so that it can be disrupted by a business goal process. From the problems that can be obtained, the information and data obtained then the data is processed based on the priority level and then analysed from each problem that arises. Then how do we solve the existing problems, namely by referring to an approach that can analyse a problem that arises at PT.XYZ

In this case the author uses the Six Sigma and ITIL approaches as analysis and evaluation tools. The analysis stage is important in solving and knowing an existing problem. It is important so that we

can have a reference to the problems we have faced before. Then it is concluded from the results of the analysis to make recommendations from a service desk service that can increase user satisfaction.

3.2. Data Collection

Stages in data collection in the current study by means of surveys, interviews with team members involved in this project and requesting technical documentation information for the needs of the study. The data obtained and collected are primary data and secondary data.

3.3. Data Processing and Analysis

The data processing and analysis stage is the main stage in this research. Then the researcher chose to use the Six Sigma methodology, namely DMAIC as a process flow consisting of define, measure, analyse, improve, and control. ITIL best practice will be used as a guideline in providing proposals for improvement and development of current IT service management (service desk).

- Approach Six Sigma

We apply the DMAIC method in the five-phase process improvement of Six Sigma, to meet within the objectives to be set for ITSM improvement (Dudek, 2011).

1. Define, the probability of a problem occurring,
2. Measure service desk performance,
3. Analyze factors that can affect service desk performance activities,
4. Improve service desk performance, and
5. Control service desk performance.

1. Phase 1 - Define (The probability of a problem occurring.)

The Define stage is to make a clear understanding of the scope and purpose of solving an existing problem, below is the explanation.

- Interview and data collection, identifying a problem that exists in the service desk to related parties in order to explore the information needed. Data derived from complaints from service desk users.

2. Phase 2 - Measuring (service desk performance)

Goal question metric (GQM) method on an existing service can be identified the level of seriousness of the problem with service desk services. To help analyse a problem that arises is a histogram diagram, pareto diagram and control diagram. Calculations are carried out based on DPMO (defects per million opportunities) to achieve the level of service quality of a service desk.

- Determine the types of problems that often arise using pareto diagrams / goal question metric (GQM) diagrams to see the level of seriousness of the consequences or problems that exist.

3. Phase 3 - Analyse (The factors that can affect service desk performance activities.)

After searching from several journal references and literature studies to help analyse a problem that arises, the tools to analyse are fishbone diagrams can be a reference because in this diagram it can be found out, the cause of a problem and Failure Mode and Effect Analysis FMEA is an important process to monitor in reducing the failure rate in a process.

- Based on FMEA measurements can be found out the value of RPN (*Risk Priority Number*). The RPN value is obtained from the S(*Severity*), O(*Occurrence*), and D(*Detection*) indicators. From the results of the value of an RPN that we have obtained, this value can be used as a reference for improvement in the form of a priority scale of an existing problem.

4. Phase 4 - Improve performance

At this stage we also refer to ITIL best practice guidelines so that they are in line with ITSM objectives.

- The problems found will continue to be improved continuously using Failure Mode and Effect Analysis FMEA or other analytical tools. The resulting impact is a proposed improvement in a problem, a new idea in handling improvements.

5. Phase 5 - *Control*

At this stage the function is to control a timeline or improvement activity both in terms of time and quality of a goal so that the quality of a service function really goes well.

- Create Control chart diagram, in order to determine the variations that arise in the process. The resulting impact must be in accordance with the SOP standard Conduct evaluations iteratively, in order to obtain appropriate results.

- Approach ITIL

To evaluate the service desk that is currently implemented, the author only focuses on the ITIL framework in the Service Operation scope to improve the current service desk operations. The steps taken to improve quality, the authors look for evidence related to data from both users and service desks. From the evidence that has been obtained will get a solution to the answer to complaints currently felt by users.

1. Problem identification

Identify what processes need to be improved and enhanced in the current service desk. Training on new technologies is required. Fulfilment in handling the resolution of the list of problems that enter the service desk, improve problem resolution time, and increase scores in user satisfaction.

2. Improvement Plan

Create a plan and schedule with the responsible team. By using ITIL v4 guidelines to comply with the guidelines. Result, can find out what steps in problem solving and get SOP according to the plan that has been applied. and can analyse the root cause of a problem.

3. Implementation and continuous improvement.

It is necessary to make comprehensive improvements to the findings. As well as evaluating, optimising the current system to improve IT user satisfaction from a predetermined plan. Make sure it is tested first before implementation. Result, can increase satisfaction with IT users, and, can reduce the occurrence of problems.

4. Results and Discussion

This sub chapter will define the problem and discuss the steps in analysing problems that can hinder the achievement of a company's business goals. Then the next step is to create and map the metrics in each stage of the process, the goal is to be able to measure the results of a process performance to be more focused.

Table 2: Previous Researches

Study, Year	Title	Methodology	Findings
Aluwani Yvonne Magodi, Ilesmni Afolabi Daniyan, Khumbulani Mpofu, 2022	Application of Lean Six Sigma To A Small Enterprise in the Gauteng Province: a Case Study	Six Sigma Method	This study shows that the application of the Lean Six Sigma tool could solve the challenges of productivity and waste in a bookkeeping and tax consulting SME in the Gauteng province with a direct implication for operational efficiency and customers' satisfaction. The process improvement changes were applied over a period of three months, after which the process performance was reviewed. The case study resulted in a 60.3% reduction in total non-value-added time and an increase in both the value-added time (53.85%) and the amount of uptime (10.74%) (Magodi et al., 2022).
Juan Carlos Quiroz Flores, Francisco Daza-Moran, Angiebett Ramírez-Alva, Martín Collao-Diaz, 2022	Improving Service Level Performance by Implementing Lean Six Sigma In SMES of the Gaming Peripherals Industry in Peru: a case Study	Six Sigma DMAIC Approach	This case study aimed to improve service-level performance in a gaming peripherals SME by incorporating traditional engineering tools into the Define, Measure, Analyse, Improve, and Control (DMAIC) framework, validating its results through a two-month pilot plan, and analysing process improvement via statistical software (Quiroz Flores, J. C., Daza-Moran, F., Ramírez-Alva, A., & Collao-Diaz, 2022).
Neeraj Yadav, Ravi Shankar, Surya Prakash Singh, 2020	Impact of Industry4.0/ICTs, Lean Six Sigma and quality management systems on organisational performance	Lean Six Sigma Approach	This paper compares impact of Industry 4.0 / emerging information and communication Technologies (ICTs), for example, Internet of things (IOT), machine learning, artificial intelligence (AI), robotics and cloud computing, on 22 organisational performance indicators under nine combinations of Lean Six Sigma (LSS) and quality management systems (QMS). .The study confirmed statistically significant difference among 20 organisational

			performance indicators under different combinations of QMS, LSS and ICTs. These indicators include quality performance, delivery performance, sales turnover, inventory level and so forth. However, for two indicators, namely, absenteeism and throughput, significant difference in responses was not established (Yadav et al., 2020).
Mohd Adeel Shamsi, Aftab Alam, 2018	Exploring Lean Six Sigma implementation barriers in Information Technology industry	Lean Six Sigma Approach	The purpose of this paper is to present critical barriers and obstacles faced by Information Technology (IT) industry in the implementation of Lean Six Sigma (LSS) as the business improvement methodology. This research work advocates the development of a strategy for addressing the most critical barrier instead of focusing on all for successful implementation (Shamsi & Alam, 2018).
Jankowski, Janiece, 2013	Successful Implementation of Six Sigma to Schedule Student Staffing for Circulation Service Desks	Sig Sigma Method Approach	The department was able to mitigate significant staffing budgetary reductions and resource reallocations and to overcome the unique challenges of scheduling student labor for a significant portion of service desk hours. This article discusses why the Six Sigma project was undertaken as well as the Six Sigma process steps and the measurement and formalization a of significant procedural change to the circulation department's student scheduling process that resulted in a highly successful outcome (Jankowski, 2013).
Shing-Han, Chi-Chuan, David C, Ming-Chih, 2011	Improving the efficiency of IT help-desk service by Six Sigma management methodology (DMAIC) - A case study of C company	Six Sigma Method (DMAIC)	This research is conducted based on the Six Sigma methodology, DMAIC (definition, measurement, analysis, improvement and control) principle, and it deals with project-related issues to improve the efficiency of information technology (IT) help-desk service through an eHelp-desk system. It is the authors' belief that the use of eHelp-desk system can help case company to improve its service quality and efficiency. In addition, managerial implications and research limitations are discussed at the end of this article (Li et al., 2011).
Justitia, Zaman, Dony Kurniawan, 2021	Evaluating the quality of a help-desk complaint management service using six-sigma	Six-Sigma and adopted COBIT 5	In this study, we evaluated the quality service of help-desk service by finding out the sigma level to discover the root of the problems. The SIPOC diagram shows that the help-desk service was at a high-level. The DPMO value in 2016 was 30.153 and it rose to 80.155 in 2017. It caused

	and cobit 5 framework	framework	the sigma level to drop from 3.37σ in 2016 to 2.90σ in 2017. From the Pareto chart, we know that complaints regarding SIAD and network account for as much as 51.72% and 23.82%, respectively. Meanwhile, COBIT 5 presents solutions to policy and procedure problems by providing best practices on standard operating procedures through domain DSS02 Manage Service Requests and Incidents and domain DSS03 Manage Problems. The combination of Sig-Sigma and COBIT 5 is able to evaluate the service quality of the help-desk service (Justitia et al., 2021).
Miles Herrera, Jos van Hillegersberg, 2019	Using Metamodeling to Represent Lean Six Sigma for IT Service Improvement	Lean Six Sigma and COBIT Framework	We use metamodeling to integrate Lean and Six Sigma to develop an integrated approach of Lean Six Sigma for CI of IT Services. Our Metamodels provide a visual representation to capture and integrate the main elements of Lean, Six Sigma, and Lean Six Sigma and model their interface with the IT Services framework. We apply metamodeling as part of a Design Science Research Methodology (DSRM) and use the Framework for Evaluation in Design Research (FEDS) to evaluate our results using practitioners in the evaluation (Herrera & Hillegersberg, 2019).
Nabila Rizky Oktadini; Kridanto Surendro, 2014	SLA in cloud computing: Improving SLA's life cycle applying six sigma	Six Sigma Framework	DMAIC approach can improve quality of cloud computing service level agreement by eliminating non-value added steps. So that, an organized management, security awareness, and Services Level Agreement (SLA), a contract between a user and a provider of a service specifying the conditions under which a service may be used, will be needed in order to minimize the risk. In this research we will use it to improve SLA life cycle in cloud based academics services (Oktadini & Surendro, 2014).
Yongmei Xu, Fan Zhang, Xiaowen Ye, 2013	Case Study on the Lean Six Sigma Management for Information Technology Service Management Project of G Commercial Bank	Six Sigma Framework	this paper puts forward a process optimization scheme for the production changes of G bank's ITSM with the Lean Six Sigma management theory. Firstly, optimizing the process and improving the internal work efficiency also. Secondly, reducing the variation and the error rate and also improving the system availability. Thirdly, strengthen the business interaction in order that the IT value could be reflected preferably. The last but not least, cutting the overtime is to improve employee satisfaction (Xu et al., 2013).

Huey-Der Chu, 2012	The Application of Six Sigma to Promote Information System Service Quality	Six Sigma methodology	this paper presents a framework that integrates Six Sigma Concept to improve the IS service process. We plotted user complaints against response time (define), drew up a test plan and executed the load testing (measure), collected testing data from different client sites for analysis (analyze), found where the bottleneck was and fixed it (improve) and monitored the status to satisfy users' requirement (control) (Chu, 2012).
Whee Yen Wong, Chan Wai Lee, Kim Yeow Tshai, 2012	Six Sigma in IT Processes, IT Services and IT Products: A Fact or a Fad? Six Sigma beyond Manufacturing in IT Processes, IT Services and IT Products	Six Sigma Method	A suitable and flexible quality improvement initiative can help companies formalize a systematic well-rounded approach covering top management all the way to the operations level in handling day-to-day tasks. Six Sigma is one of the upcoming methodologies gaining popularity amongst IT and non-IT organizations. Six Sigma is no longer a methodology solely for the manufacturing sector. An increase of Six Sigma adoption and implementation into the field of IT project management for medium-to-large scale organizations is observed (W. Wong et al., 2012).
Shing-Han Li, David C. Yen, Chi-Chuan Wu, Ming-Chih Lee, 2011	Improving the efficiency of IT help-desk service by Six Sigma management methodology (DMAIC) – a case study of company	Six Sigma DMAIC Method	By employing this concept with the required survey and data collection to carry out the continuous improvement, a company can truly take advantage of the minimum set of operational variables and the lowest cost procedures, and hence, result in an increasing competitive value for/to the company (Li et al., 2011).
Peter C. Chan, Shauntell R. Durant, Verna Mae Gall, Mahesh S. Raisinghani, 2011	Aligning Six Sigma and ITIL to Improve IT Service Management	Six Sigma and ITIL Method	By integrating the Six Sigma quality methodology, IT management will have the methodology and tools for measuring quality and improving processes. Adopting Six Sigma principles also helps IT managers focus on their business strategy and customers, manage proactively based on facts, and reinforce collaboration across the enterprise (Chan et al., 2009).
Kamran Ghane, 2014	A model and system for applying Lean Six sigma to agile software development using hybrid simulation	Lean Six Sigma Method	Software quality control and quality assurance have close ties with predictability, speed/time, and cost of software development. It's not feasible to quantify software processes in a discrete manner that is required by the Six Sigma methodologies. The discrete simulation that is used in operations such as car manufacturing relies on the fact that system

			activities change state at discrete time points. However this cannot be applied to software development as the activities are not repetitive and they have time estimates at best (Ghane, 2014).
Awkash Modi, Liam Doyle, 2012	Applicability of Lean-Sigma in IT Service Delivery System	Six Sigma approach	Lean-sigma helps the company to gain competitive advantage over its competitors. The success of Lean and six sigma philosophies in manufacturing sector prompts us to think if these philosophies can be applied in IT sector too (Modi & Doyle, 2012).
Yulia Beina Octavius Ong, 2019	Implementation of Six Sigma Concepts to Improve Software Product Quality	Six Sigma approach	Researchers analysed how to improve software products, standardise coding, conduct audio and Active Presenter tests to record the software testing process. audio tests and Active Presenter to record the software testing process, implementing internal sharing regularly to be able to share technical knowledge among team members (Ong & Sfenrianto, 2019).
Anil Kumar, Raghavan Pillai, Ashok Kumar Pundir, L. Ganapathy, 2014	Improving TI Infrastructure Library Service Delivery Using an Integrated Lean Six Sigma Framework: A Case Study in a Software Application Support Scenario	ITIL and Lean Six Sigma Framework	These companies are now willing to improve their ITIL processes in order to become even more efficient. Lean Six Sigma is a methodology that has been suggested as a means to resolve these problems, reducing costs and improving quality. The purpose of this paper is to implement Integrated Lean Six Sigma for Software application support services and evaluate the benefits of continual service improvement over ITIL (Pillai et al., 2014).
Whee Yen Wong, Chan Wai Lee, Kim Yeow Tshai, 2012	Six Sigma in IT Processes, IT Services and IT Products: A Fact or a Fad? Six Sigma beyond Manufacturing in IT Processes, IT Services and IT	Six Sigma Framework	The purpose of this paper is to create a general overview and raise awareness among IT organizations and IT specialists (especially in the region of South-East Asia) regarding the feasibility and possibility of adopting and implementing Six Sigma into the field of IT in the three IT business Laqma areas: IT Processes, IT Services and IT Products, not limiting to a single sub-trade of IT related businesses (W. Wong et al., 2012).

	Products		
Muhamad Afriza Sutarto, 2019	Implementation of Six Sigma in Improving IT Project Quality at DMSI Division	DMAIC Method	<p>Calculating the current six sigma level in the author's company. It can be seen that from 12 months there is a number of jobs (samples) of 4,061 and the number of jobs that are a problem of 1,700 (defects). From CTQ, it can also be concluded that 10 areas of knowledge as criteria for causing defects (opportunities).</p> <p>It can be seen that the current condition that the DMSI division is at level 3.229 at the six sigma level. This is considered good enough, but improvements need to be improved to avoid mistakes that often occur in the DMSI division, especially the project team (Ong & Sfenrianto, 2019).</p>
Veronica Maslim & J. Rolles Herwin Sihombing, 2011	Business Process Importovment Using Six Sigma with DMAIC Methodology approach	DMAIC Method	<p>Research conducting calculations obtained a DPMO value of 79,684.42 where this means that if there are one million incident reports, there will be as many defects as 79,684 incidents and if converted to a sigma value it becomes 2.91σ. This means that the current service desk performance achievement is 2.91σ with a percentage of successful incident handling correctly of 92.03% of the total 845 incident reports. In accordance with the target towards six sigma, the current service performance achievement is still less than half the target value. It is necessary to analyse the causes of problems and improvements continuously or continuously to get to six sigma (Sihombing et al., 2011).</p>
M. Chang, 2018	Operational Excellence—Lean Six Sigma, Web-Based Applications, and SOA	Lean Six Sigma Method	<p>Lean Six Sigma unites tools and techniques from Lean and Six Sigma methodologies to produce real results. It uncovers process waste, reduces non-value adding activity, and increases organizational capability (Singh et al., 2023).</p>
Patricia Long, Jamison Kovach, David Ding, Elizabeth Cudney, Sandra Furterer, 2012	Information Technology (IT) System Changes-A Design for Six Sigma Case Study	Six Sigma Method	<p>This work describes a case study that used the Design for Six Sigma (DFSS) methodology to establish a process for effectively managing IT system changes for a mid-size accounting 'rm. This structured design approach provided an underlying framework for this organization to translate users' needs/expectations into the design of a new system that helped to improve the communication and awareness of system changes</p>

			within the IT department (Cudney & Furterer, 2012).
Rajesh Radhakrishnan, 2011	Applying Six Sigma Concepts, Techniques and Method for Service Management: Business and IT Service Management (BSM & ITSM)	Six Sigma and ITIL Method	Six sigma methodologies have been applied within the IT Service Management disciplines primarily for Service and Process Improvement and Optimization. The focus of these projects range from service definition to service systems to service automation (i.e. making service less labour intensive). As such, six sigma methods and techniques have a major role to play in both design and improvement of services and service management processes (Radhakrishnan, 2011).
Yoon, Kwan-Sik, 2010	A Case Study on Implementation of ITSM using 6 Sigma Technique Focused on Service Desk	Six Sigma Method	In this study, we analyze a success case in which 6 Sigma was applied to Service Desk function which is one of the most important functions of ITSM. Through the analyses, this study aims to propose a feasible and specific approach to institutionalize ITSM. To accomplish the objective. the study analyzed specific methods of application of 6 Sigma to ITSM (Yoon, 2010).
Antonio Carlos Tonini, Mauro De Mesquita Spinola, Fernando Jose Barbin Laurindo, 2015	Six Sigma and Software Development Process: DMAIC Improvements	Six Sigma Method	Based on a research performed through a multiple cases study, it is possible to suggest improvements in the DMAIC method. Some of the considered issues are: cost evaluation, time and customer satisfaction impact on business; improvement processes verification; organizational standardization and learning achieved from six sigma projects. The main result is a proposal of a specific roadmap for six sigma projects application in software development process improvement, which includes the treatment of the aspects found (Tonini et al., 2006).
Rick L. Edgeman, David Bigio, Thomas Ferleman, 2005	Six Sigma and Business Excellence: Strategic and Tactical Examination of IT Service Level Management at the Office of the Chief Technology Officer of	Six Sigma Method	These areas of ITSLM were Availability Management, Capacity Management, Financial Management, Service Continuity, and Service Level Management with Service Continuity essentially referring to 'disaster recovery'. In all, the results are synergistic, suggesting that the two lenses can be coordinated to accomplish more in conjunction than can either employed in isolation. Projections by OCTO of potential cost-savings resulting from application of selected suggestions range from \$2 million to \$3 million. Copyright © 2005 John Wiley & Sons, Ltd

	Washington, DC		(Edgeman et al., 2005).
P Long, J Kovach, D Ding, 2013	A design for Six Sigma case Study: Creating an IT change management system for a mid-size accounting firm	Six Sigma Method	This work describes a case study that used the Design for Six Sigma methodology to establish a process for effectively managing IT system changes for a mid-size accounting firm. This structured design approach provided an underlying framework for this organization to translate users' needs/expectations into the design of a new system that helped to improve the communication and awareness of system changes within the IT department (Long et al., 2011).
Anacleto Correia, António Gonçalves, Sanjay Misra, 2019	Integrating the Scrum Framework and Lean Six Sigma	Lean Six Sigma and Scrum Approach	As result, some software companies have been trying to adopt Lean Six Sigma in their development processes, specifically in conjunction with agile methods. By complementing the current generic quality procedures of Scrum method with more formalized and well-proven quality measures from LSS we intend to improve the efficacy and efficiency of Scrum (Correia et al., 2019).
Whee Yen Wong, Shu Wen Yu, Swee Ling Chean, 2019	Pre-Decision Criteria for Successful Information Technology Project Implementation: Six Sigma Practices and Approach	Six Sigma and Scrum Approach	There are numerous factors contributing to successful implementation of Six Sigma; deficiency in any of these factors can ultimately lead to deployment failure which further result in depletion of company resources, team synergy and team motivation in the long run. This paper aims to discuss a set of pre-decision criteria for successful Six Sigma implementation for IT projects. Thus, it is crucial for organization not to rush into Six Sigma practices and approach prior having firm and sound understanding of what successful Six Sigma implementation requires (W. Y. Wong et al., 2019).

4.1. Phase Define

Used P charts to monitor the proportion of nonconforming units of a process based on output report current service desk.

Table 3: Propotion of Defacts Per Month

Month	Total Opportunity	Total Defacts	Defact/Unit	Sigma	UCL	U-Bar	LCL
Jan	127	13	0.102362	0.031709	0.191109	0.127692	0.064274
Feb	103	9	0.087379	0.035210	0.198111	0.127692	0.057272
Mar	138	8	0.057971	0.030419	0.188529	0.127692	0.066854
Apr	141	15	0.106383	0.030093	0.187878	0.127692	0.067505
May	149	21	0.140940	0.029274	0.186240	0.127692	0.069143
Jun	173	34	0.196532	0.027168	0.182028	0.127692	0.073355
Jul	203	42	0.206897	0.025080	0.177852	0.127692	0.077531
Aug	186	11	0.059140	0.026201	0.180094	0.127692	0.075289
Sept	237	53	0.223629	0.023212	0.174115	0.127692	0.081268
Oct	267	24	0.089888	0.021869	0.171429	0.127692	0.083954
Nov	179	17	0.094972	0.026709	0.181109	0.127692	0.074274
Dec	94	8	0.085106	0.036857	0.201405	0.127692	0.053978

The table above explains the proportion of each defect each month. calculate the lower limit and upper limit to determine the non-conformity of each job.

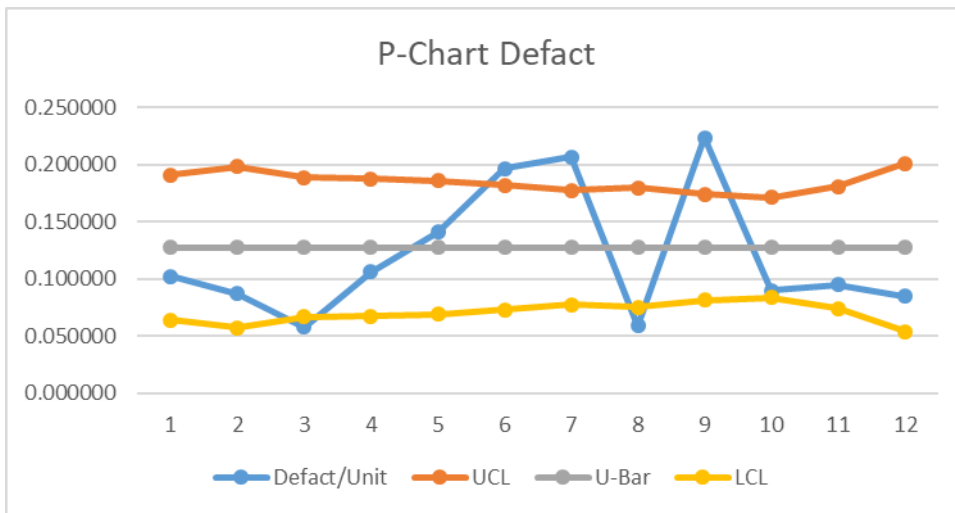


Fig. 4: P-Chart Defact Proportion

The explanation of the image above is used to determine the graph activity of the proportion of each defect opportunity that occurs in conversion into upper limit and lower limit values.

Table 4: Task Report Ticket

Month	Total Ticket Report	Work Completed Same month	Tasks Incompleted	Staff Misassignment	Late Handling
Mar	138	130	8	22	35
Apr	141	126	15	18	27
May	149	128	21	24	21
Jun	173	162	34	39	28
Jul	203	193	42	45	31
Total	804	739	120	148	142

Table 3 shown, in each report, users continue to increase every month. Long processing time and incorrect analysis are one of the causes of the problem solving process. The amount of data obtained from reports that have entered the highest service desk during July 2022. It can be seen that the lowest number of reports, 138 cases, occurred in March 2022. The unavailability of features that can help users perform self-service, such as a knowledge base, FAQ (frequently asked questions), how-to documentation, or user manuals. causes the level of user dependence on service staff. The major difference between the total reports received and those resolved includes several factors:

- Service desk staff are still not aware of the importance of taking action on the system by updating the status after completing the resolution of the problem.

There is a long gap between testing and delivery of a solution, which causes some staff to forget to change the status of incident reports that have been resolved.

Based on the data that has been obtained, the author can identify crucial issues that can affect the level of success in achieving an IT division goal in supporting the company's business goals. The following below is a table that defines several problems related to the current service desk system.

Table 5: Leading Question

CSF	Leading Question
Accuracy	What criteria can be used to determine and measure accuracy?
Performance	What criteria can be used to measure performance?
Time	What is the best way to measure time efficiency?
Availability	What are the criteria used to determine service availability?

4.2. Phase Measure

The measure is part of the quality control of the quality of the service desk that is currently in operation. The purpose of this step is to be used as a reference for the next step, which is the identification and analysis of a defect or failure in current process. Table 2 explains that of the total number of reports submitted per month, several months experienced a continuous increase from March to July. Among them, March had a total of 138 incoming reports with 130 jobs that could be completed and 8 jobs that had not been completed in the same month. In March there were also 22 reports of errors in assigning tasks to staff on duty.

Table 6: Data Defects – Opportunity (Source: service desk)

Defect Category	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Defact	Opportunity
Mistake in problem solving assignment	22	18	24	39	45	148	804
Tasks Incompleted	8	15	21	34	42	120	804
Delay in Handling the Problem	35	27	21	28	31	142	804
Total	65	60	66	101	118	410	2,412

In the table above to find out the DPMO value and Six Sigma conversion value can be seen as follows:

$$DPMO = \frac{1,000,000 \times \text{total defect}}{\text{Total opportunity} \times \text{total opportunity defect}}$$

$$DPMO = \frac{1,000,000 \times 410}{804 \times 3}$$

$$DPMO = \frac{410,000,000}{2,412}$$

$$DPMO = 169,983.41$$

$$\text{Sigma} = 2.45 \sigma$$

The Six Sigma calculation above explains that the Defects Per Million Opportunities (DPMO) value is 169,983.41 of the total million incoming incident reports will have the opportunity to get 2,412 defects, and the six sigma conversion gets 2.45 σ. With a chance of success in handling each problem report 83.00% of the

4.3. Phase Analyze

By extracting information from data that has been obtained from interviews with users and data from incident reporting on the service desk system. The purpose of this step is to find out the critical areas of the process. At this stage of the analysis, the author uses fishbone diagram tools to find out the events in a problem process and as a means of detecting the root of the existing problem.

1. Fishbone Diagram (Mistake in problem-solving assignment)

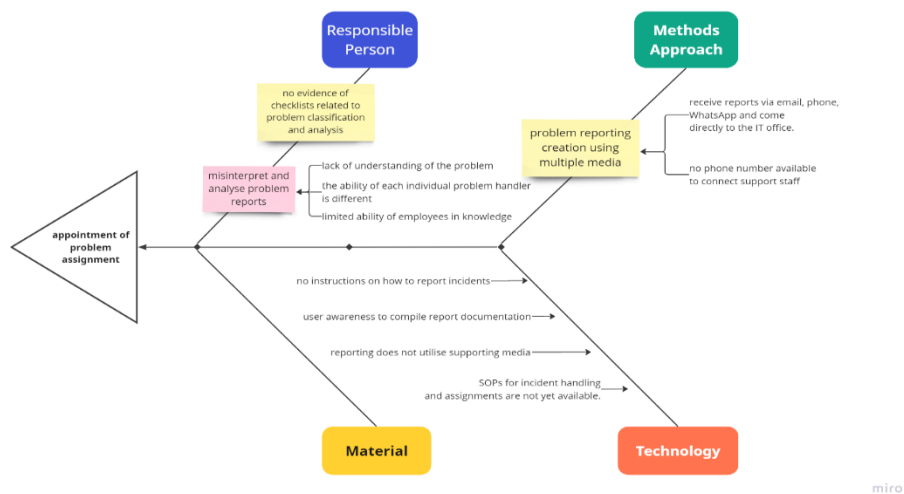


Fig. 5: Fishbone Mistake in problem-solving assignment

The fishbone diagram above, the author sees several causes of errors in assigning staff, as below:

- Misunderstanding of incident reports, limited knowledge of the problem at hand, and lack of documentation of the results of previous repairs are the main contributing factors.
- Reports do not go through supporting media, not running well SOP (Standard Operational Procedure).

2. Fishbone Diagram (Tasks Incompleted)

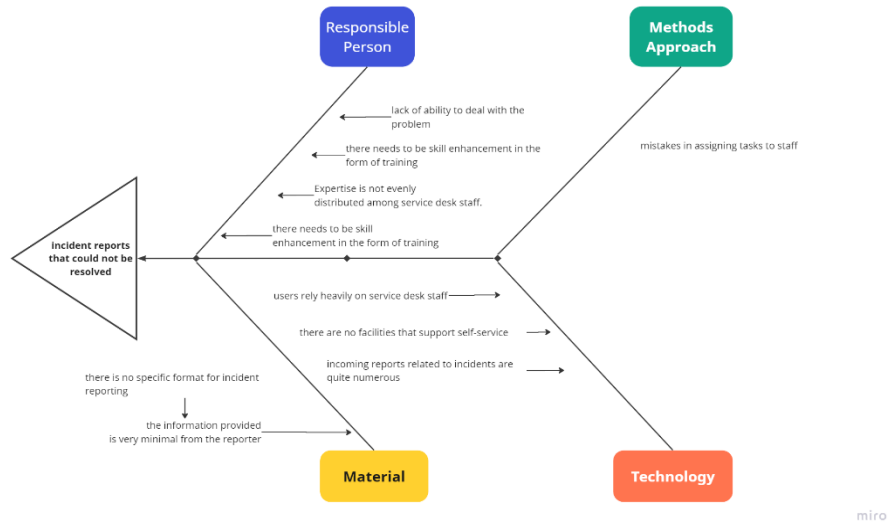


Fig. 6: Fishbone Tasks Incompleted

The fishbone diagram above, we can see the causes and consequences of uncompleted tasks below:

- One of the factors is that those who assign tasks to personal staff do not know about the personal abilities related to the assignment to improve the problems faced.
- Lack of training is also a factor in the delay in resolving a problem.
- The increasing number of incoming reports, results in not all incoming reports can be resolved on the same day or the need for escalation in exploring the problem
- Lack of information related to the description of problem reports sent to the service desk system.

3. Fishbone Diagram Delay in Handling the Problem

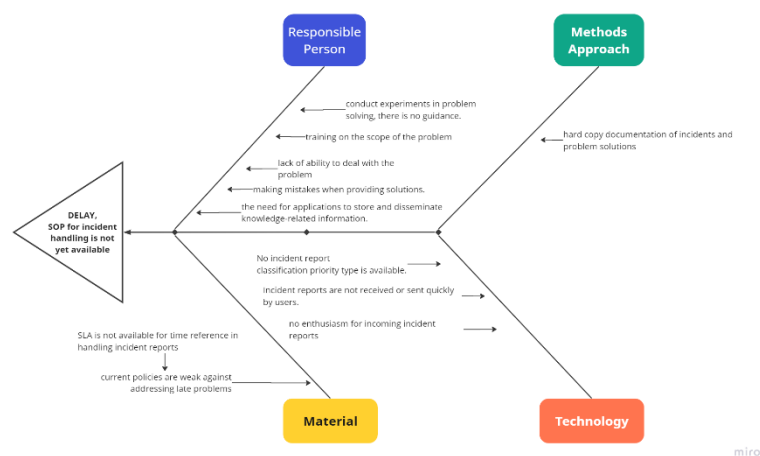


Fig. 7: Fishbone Delay in Handling the Problem

The fishbone diagram above, we can find out the causes and consequences of the delay in handling each incident, as below:

- Mistakes in analyzing, and trial and error in doing each problem handling are factors in the delayed timeframe for problem solutions.
- Another factor in the delay in handling problems is that there is no notification regarding incoming reports and there is no active directory feature.
- Skill and ability to handle problems.
- Policies regarding the tolerance value of fulfillment related to SLA standards in handling problems are too weak.

Table 7: FMEA

Key Proses Phase	Potential Failure Mode	Potential Failure Effects	S	Potential Causes	O	Current Controls	D	Recommended Control	Risk Priority
Reporting Issues	Complaints Not using Service Desk	Problem handling become late	7	problem complaints via chat what-up/verbal	7	Provide advice, if you find a problem send it to the system service desk.	6	Provided socialisation to all departments and create a service desk SOP policy.	294
Resolving Problem Reports	Problem analysis and investigation not accurate	Problem handling not resolved immediately	7	Limited staff capabilities	6	Ask other teams about solutions	4	Conducted knowledge sharing sessions between teams	168
Resolving Problem Reports	Report writing is not clear	Handling problems takes a long time	7	Lack of clarity in delivery of problem reports	5	Asked the user what the report meant.	4	Create documentation related to the report	140
Resolution of Problem Reports	Limited human resource on duty	Not achieving SLA compliance	7	At the same time handling another user's problem	6	Waiting for the team to complete work tasks	6	Lack of service desk human resources, new member requests.	252
Resolution of Problem Reports	A third party check is needed	Not achieving SLA compliance	6	Limited Team Expertise	5	Providing training and exploring communication to third parties	4	The service desk staff needs to be trained.	120
Service Desk Application	There are no alerts/notifications regarding incoming reports.	Not optimal in managing reports on receiving problems from users	7	The features available are very limited.	6	Monitor the current system.	5	Develop a service desk system according to SOP, self-service and FAQ	210

Based on the FMEA calculation described in the table above, it shows that, from each input variable that indicates the cause of failure, the analysis is carried out then the variable is measured using a number that has been declared in the form of a value scale, the cause of a failure will occur.

Table 8: Data Defects – Opportunity

Cause of failure	RPN	Recommended action
Complaints Not using Service Desk	294	Provided socialisation to all departments and create a service desk SOP policy.
Problem analysis and investigation not accurate	252	Lack of service desk human resources, new member requests.
There are no alerts/notifications regarding incoming reports.	210	Develop a service desk system according to SOP, self-service and FAQ .
Problem analysis and investigation not accurate	168	Conducted knowledge sharing sessions between teams
Report writing is not clear	140	Create documentation related to the ticket incident
A third party check is needed	120	The service desk staff needs to be trained.

After analyzing using the FMEA diagram, the basis for making critical-to-quality improvements, from the RPN value, it is known that the value is 294, with the cause of failure of the variable "Complaints Not Using Service Desk", Therefore, the recommendation is to make SOP related to incident reporting and socialization so that incident reports are resolved relatively quickly.

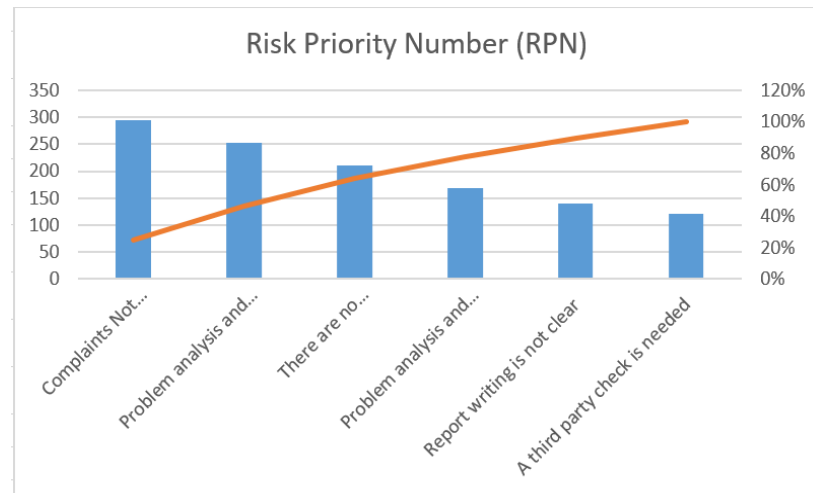


Fig. 8: Pareto Chart RPN Service Desk

In the Pareto diagram above, the RPN value that can be seen, the cause of failure is the variable "Complaints Not Using Service Desk". The fundamental improvement that must be conducted is by socialisation to all departments regarding the procedures for reporting complaints in a disciplined manner using the service desk system.

4.4. Phase Improve

An improvement and development framework will be prepared using the ITIL approach. The author focuses on the ITIL framework within the scope of Service Operation to overcome problems at the PT XYZ service desk. Implementing the proposal is expected to grow the quality of service desk services after determining the performance target at the Six Sigma level. The author proposes improvements that can affect the performance of the current service desk such as people, standard operating procedures, technology, and policies, as follows below:

1. People (staff service desk)

Mistakes in analyzing and investigating an incident can cause the team in charge to be unable to resolve the problem. lack of training and insight into the knowledge and skills of the problem at hand is a major factor. There is a need for staff training to improve the ability of staff to perform, recognize, analyze, and handle each problem.

2. Standard Operating Procedures (service desk)

Many are found in the field that every incident does not go through the service desk, call center, or email, but through WhatsApp chat, verbal or conveyed to staff he knows without going through the service desk system. The implementation of SOP (Standard Operating Procedures) related to how to report problems in accordance with ITIL standards, namely the service desk as a communication system in answering complaints from service users. Regarding incident reports that do not comply with SLA calculations, this can occur when the problem handling process cannot be completed by the team. Some influencing factors include many client projects running simultaneously so that personal support is divided into each project, looking for other teams that are not on duty or waiting for the team to complete the previous task.

3. Technology

The current service desk application does not have a feature to send automatic and real-time notifications via email and there is no active directory feature. This causes the application function to be less than optimal.

To improve service desk performance, the author recommends replacing the service desk application currently used with another service desk application that meets ITSM standards, namely osTicket. OsTicket is an open-source application that already has an active directory feature. One of the reasons the IT division of PT.XYZ uses OsTicket as the active directory.

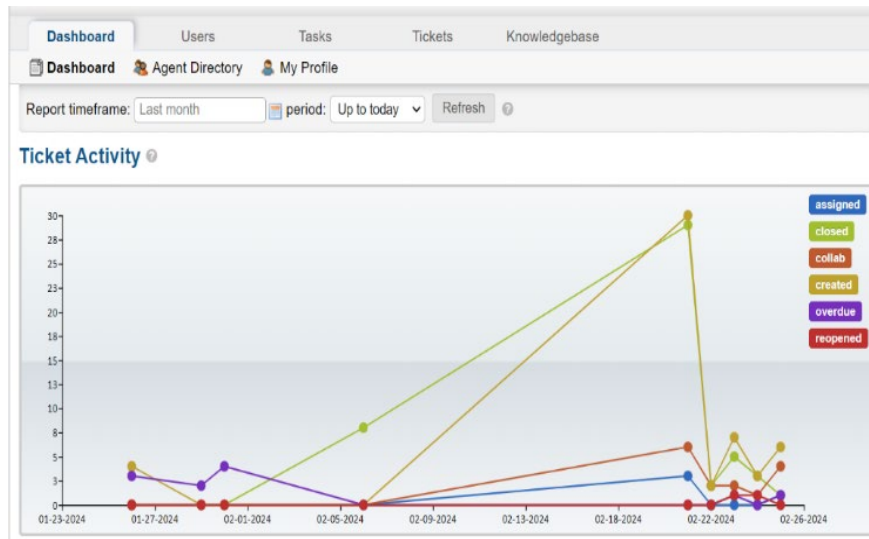


Fig. 9: Dashboard Service Desk-OsTicket Propose

The figure above shows the graph of receiving incident ticket reports at PT.XYZ, we can see that the collection of all incoming tickets, assigned incident tickets to staff, handling incidents and ticket progress(overdue) and ticket completion (closing incident tickets).

Number	Ticket	Date Created	Title	Department	Agent
631		9/7/23 3:48 PM	List Data Mesin DoorLock	IT Department	IT Support Onshore
629		9/7/23 1:53 PM	List Asset IT untuk ISO Onshore	IT Department	IT Support Onshore
628		9/7/23 1:45 PM	List Software ke TEMS Inventory Onshore	IT Department	Frans Sakti
627		9/7/23 1:40 PM	Disposal Asset IT Timas (2)	IT Department	Frans Sakti
626		9/7/23 1:38 PM	List Software ke TEMS Inventory ... (4)	IT Department	Fajar Abdul
15		3/22/23 9:57 AM	PR for Disk Replacement (2)	IT Department	Okta Juliant

Fig. 10: Task List-OsTicke Service Desk Propose

The image above is the total list of incoming tickets with open or closed status. There is a ticket number column, date created ticket which is the issuance of a ticket, title is the title of the problem and the assigned agent is the staff who will repair the incident. Here we can find out all outstanding tickets such as open and overdue, in the from column is the sender of the ticket, and Priority is the level of the ticket that is worked on first by the service desk staff.

4.5. Phase Control

From all the steps of the Six Sigma and ITIL frameworks above that have been implemented, the last step is to monitor each process, so that it runs according to the objectives of the recommendations that have been developed. With this control stage, it is hoped that it can reduce the number of incoming reports and shorten the handling of incidents, if the procedures that have been implemented are carried out properly. Below is the proposed timeline of the work plan.

Table 9: Schedule Implement New Service Desk

Activities	24 May				24 Jun				24 Jul				24 Aug				24 Sep				
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	
Creation of SOP for reporting and sending service desk incidents	■	■																			
Creation of an incident handling checklist form & SLA		■																			
Creation of SOP for problem management		■	■																		
Socialization of SOP problem management		■	■																		
Team building support				■																	
Socialization of scope service desk SOP				■	■																
Training support staff expert service desk							■	■													
Data Migration (users list, etc)							■	■													
Requirement hardware for service desk							■	■													
Requirement software (Database, configuration services) for service desk							■	■													
Deployment coding configuration										■	■										
Testing & bug fixing										■	■										
End user training (All Departments)											■										
Implementation service desk													■	■	■	■					
Evaluation & improve after implementation																	■	■	■	■	

Based on the planned time line schedule, it can be used as a reference in the process of running the new service desk implementation. Due to time constraints, for this control process the author can only make a timeline schedule, the author hopes that the next research can make control of the implementation of the new service desk.

5. Conclusion

The systematic literature review on the performance of the current service desk system. obtaining the data, there are a total of 804 incoming reports from March - June 2022. the non-existent self-service feature has resulted in the opportunity for incident reports to continue to grow. Many factors have affected this figure, such as the capabilities of uneven staff, trial and error in handling problems, and lack of sharing sessions in the team from previous problems.

Based on the value scale obtained from the Risk Priority Number, which shows that "Ticket reports do not use the service desk" as the highest value, 294, "Analysis in handling incidents" is 252 and then the last is "Fiture available at the service desk is less than optimal" is 210. based on the calculation of Six Sigma the level of defects DPMO defects per million opportunities was found 169,983.41 with a sigma conversion of 2.45 σ . With a probability of success in handling all problem reports 83.00% of the total opportunity of 804 cases.

The author recommends that there are important points that need to be improved such as personal staff, SOP procedures that need to be reviewed, and from ITIL approach the need to change the technology adopted by the "service desk system". once implementation the ISO 270001, the author suggests replacing the current system with an OS ticket, besides that OS ticket has an Active Directory for single sign-on. because the current system has gaps in security and vulnerability to mailbox attacks.

References

- Azadnia, M., & Fasanghari, M. (2008). Improving the Information Technology Service Management with Six Sigma. *International Journal of Computer Science and Network Security*, 8(3), 144–150.
- Carlidge, Axelos, A. (2020). An Introduction to ITIL 4. 1–6.
- Chan, P., Durant, S., Gall, V., & Raisinghani, M. (2008). Aligning Six Sigma and ITIL: Implications For IT Service Management. *International Conference on Information Resources Management (CONF-IRM)*, 15(1), 2008. <http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1006&context=confirm2008>
- Chan, P., Durant, S., Gall, V., & Raisinghani, M. (2009). Aligning Six Sigma and ITIL to Improve IT Service Management. *IJESMA*, 1, 62–82. <https://doi.org/10.4018/jesma.2009040104>
- Chi-Chuan, Yen, D. C., & Lee, M.-C. (2011). Improving the efficiency of IT help-desk service by Six Sigma management methodology (DMAIC) – a case study of C company. *Production Planning & Control*, 22(7), 612–627. <https://doi.org/10.1080/09537287.2010.503321>
- Chu, H.-D. (2012). The Application of Six Sigma to Promote Information System Service Quality. *2012 Annual SRII Global Conference*, 744–749. <https://doi.org/10.1109/SRII.2012.112>
- Coccia, M. (2020). Fishbone diagram for technological analysis and foresight. *International Journal of Foresight and Innovation Policy*, 14(2–4), 225 – 247. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096466330&partnerID=40&md5=b707c40745d928d43e16dced5140178d>
- Correia, A., Gonçalves, A., & Misra, S. (2019). Integrating the Scrum Framework and Lean Six Sigma BT - Computational Science and Its Applications – ICCSA 2019 (S. Misra, O. Gervasi, B. Murgante, E. Stankova, V. Korkhov, C. Torre, A. M. A. C. Rocha, D. Taniar, B. O. Apduhan, & E. Tarantino (eds.); pp. 136–149). Springer International Publishing.
- Cudney, E. A., & Furterer, S. L. (2012). *Design for Six Sigma in Product and Service Development*. CRC Press, 444.
- Dudek, M. B. (2011). Application of FMEA Method in Enterprise Focused on Quality. *Journal of Achievements in Materials and Manufacturing Engineering*, 45(1), 89–102.
- Edgeman, R. L., Bigio, D., & Ferleman, T. (2005). Six Sigma and Business Excellence: Strategic and Tactical Examination of IT Service Level Management at the Office of the Chief Technology Officer of Washington, DC. *Quality and Reliability Engineering International*, 21(3), 257–273. <https://doi.org/https://doi.org/10.1002/qre.635>
- Fauzi, A. A., & Suryani, T. (2019). Measuring the effects of service quality by using CARTER model towards customer satisfaction, trust and loyalty in Indonesian Islamic banking. *Journal of Islamic Marketing*, 10(1), 269–289. <https://doi.org/10.1108/JIMA-04-2017-0048>
- Ghane, K. (2014). A model and system for applying Lean Six sigma to agile software development using hybrid simulation. *2014 IEEE International Technology Management Conference*, 1–4. <https://doi.org/10.1109/ITMC.2014.6918594>
- Hambleton, L. (2008). *Treasure Chest of Six Sigma Growth Methods , Tools , and Best A Desk Reference Book for*.
- Hardianto, H., Shofi, I. M., Khairani, D., Subchi, I., Ginanto, D. E., & Hidayati, A. (2021). Integration of the Helpdesk System with Messaging Service: A Case Study Approach. *2021 9th International Conference on Cyber and IT Service Management (CITSM)*, 1–5. <https://doi.org/10.1109/CITSM52892.2021.9588843>

- Herrera, M., & Hillegersberg, J. van. (2019). Using Metamodeling to Represent Lean Six Sigma for IT Service Improvement. 2019 IEEE 21st Conference on Business Informatics (CBI), 01, 241–248. <https://doi.org/10.1109/CBI.2019.00034>
- ITGI. (2003). Board Briefing on IT Governance. In IT Governance Institute.
- Jankowski, J. (2013). Successful Implementation of Six Sigma to Schedule Student Staffing for Circulation Service Desks. *Journal of Access Services*, 10(4), 197–216. <https://doi.org/10.1080/15367967.2013.830930>
- Justitia, A., Zaman, B., & Putra, D. K. (2021). Evaluating the quality of a help-desk complaint management service using six-sigma and COBIT 5 framework. *AIP Conference Proceedings*, 2329(1), 50009. <https://doi.org/10.1063/5.0042166>
- Li, S.-H., Wu, C.-C., Yen, D. C., & Lee, M.-C. (2011). Improving the efficiency of IT help-desk service by Six Sigma management methodology (DMAIC) – a case study of C company. *Production Planning & Control*, 22(7), 612–627. <https://doi.org/10.1080/09537287.2010.503321>
- Long, P., Kovach, J., & Ding, D. (2011). A design for Six Sigma case Study : Creating an IT change management system for a mid-size accounting firm. *African Journals OnLine (AJOL)*, 3(7), 56–72.
- Magodi, A. Y., Daniyan, I. A., & Mpofo, K. (2022). APPLICATION OF LEAN SIX SIGMA TO A SMALL ENTERPRISE IN THE GAUTENG PROVINCE: A CASE STUDY. *The South African Journal of Industrial Engineering*, 33(1), 190–204. <https://doi.org/10.7166/33-1-2504>
- Menken, I. (2010). Transform and Grow Your Help Desk Into a Service Desk Within Service Operation: Service Desk, Help Desk Best Practice Within Service Operation. Emereo. <https://books.google.co.id/books?id=e0ncwAEACAAJ>
- Modi, A., & Doyle, L. (2012). Applicability of lean-sigma in IT service delivery system. In *IFAC Proceedings Volumes (IFAC-PapersOnline)* (Vol. 45, Issue 10). IFAC. <https://doi.org/10.3182/20120611-3-IE-4029.00030>
- Oktadini, N. R., & Surendro, K. (2014). SLA in cloud computing: Improving SLA's life cycle applying six sigma. 2014 International Conference on Information Technology Systems and Innovation, ICITSI 2014 - Proceedings, 279 – 283. <https://doi.org/10.1109/ICITSI.2014.7048278>
- Ong, Y., & Sfenrianto, S. (2019). Implementation of Six Sigma Concept to Improve Software Product Quality at XYZ Company. *International Journal of Recent Technology and Engineering (IJRTE)*, 8, 1971–1977. <https://doi.org/10.35940/ijrte.D6786.118419>
- Parviainen, P., Jarvinen, J., & Sandelin, T. (1997). Practical experiences of tool support in a GQM-based measurement programme. *Software Quality Journal*, 6(4), 283–294. <https://doi.org/10.1023/A:1018576422091>
- Pereira, R., & da Silva, M. (2011). A Maturity Model for Implementing ITIL V3 in Practice. 2011 IEEE 15th International Enterprise Distributed Object Computing Conference Workshops, 259–268. <https://doi.org/10.1109/EDOCW.2011.30>
- Pillai, A. K. R., Pundir, A. K., & Ganapathy, L. (2014). Improving Information Technology Infrastructure Library Service Delivery Using an Integrated Lean Six Sigma Framework: A Case Study in a Software Application Support Scenario. *Journal of Software Engineering and Applications*, 07(06), 483–497. <https://doi.org/10.4236/jsea.2014.76045>
- Probst, J., & Case, G. (2013). Integrating Six Sigma and ITIL® for continual service improvement. The Stationery Office and Pink Elephant, July, 1–20. http://itsm.ucdavis.edu/sites/default/files/files/page/Integrating_Six_Sigma_ITIL_CSI_White_Paper_v1_0.pdf

- Quiroz Flores, J. C., Daza-Moran, F., Ramírez-Alva, A., & Collao-Diaz, M. (2022). IMPROVING SERVICE LEVEL PERFORMANCE BY IMPLEMENTING LEAN SIX SIGMA IN SMES OF THE GAMING PERIPHERALS INDUSTRY IN PERU: A CASE STUDY. *The South African Journal of Industrial Engineering*, 168–183.
- Radhakrishnan, R. (2011). Applying Six Sigma Concepts, Techniques and Method for Service Management: Business and IT Service Management (BSM & ITSM) (A. Coskun (ed.); p. Ch. 6). IntechOpen. <https://doi.org/10.5772/17222>
- Ratnawati, S., Huda, M. Q., & Sopiana, F. (2021). Evaluation of IT Service Operation for Public Service Using ITIL Version 3 and PDCA CYCLE. 2021 9th International Conference on Cyber and IT Service Management (CITSM), 1–5. <https://doi.org/10.1109/CITSM52892.2021.9589017>
- Shamsi, M. A., & Alam, A. (2018). Exploring Lean Six Sigma implementation barriers in Information Technology industry. *International Journal of Lean Six Sigma*, 9(4), 523–542. <https://doi.org/10.1108/IJLSS-06-2017-0054>
- Sihombing, J., Maslim, V., & Pardamean, B. (2011). Business Process Improvement Using Six Sigma with the DMAIC Methodology Approach (PT PMI Polyclinic External Areas).
- Singh, M., Rathi, R., & Kaswan, M. S. (2023). Overview of Lean Six Sigma 4.0 for Operational Excellence (pp. 1–4). <https://doi.org/10.1201/9781003381600-1>
- Sukmana, H. T., Andayani, Y. R., & Oh, L.-K. (2021). INCREASING SLA PERFORMANCE BY USING SERVICE DESK SIMULATION LEARNING TOOL BASED ON ITIL. *Journal of Technology*, 36(4), 243 – 252. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85123935283&partnerID=40&md5=51e3bf8c0698baf8dc891620e7dabe4a>
- Tonini, A. C., Spinola, M. D. M., & Laurindo, F. J. B. (2006). Six Sigma and Software Development Process: DMAIC Improvements. 2006 Technology Management for the Global Future - PICMET 2006 Conference, 6, 2815–2823. <https://doi.org/10.1109/PICMET.2006.296875>
- Van Bon, J. (2007). Foundations of IT Service Management based on ITIL V3. *ITIL Library*, 1, 234. <http://books.google.pt/books?id=PKNFiXLk5bIC>
- Van Bon, J. (2017). IT Service Management Forum (2006). Van Haren Publishing, Zaltbommel, 11–148.
- Wong, W., Lee, C., & Tshai, K. Y. (2012). Six Sigma in IT processes, IT services and IT products - A fact or a fad? Six Sigma beyond manufacturing in IT processes, IT services and IT products. In *Proceedings - 2012 IEEE 12th International Conference on Computer and Information Technology, CIT 2012*. <https://doi.org/10.1109/CIT.2012.115>
- Wong, W. Y., Yu, S. W., & Chean, S. L. (2019). Pre-Decision Criteria for Successful Information Technology Project Implementation: Six Sigma Practices and Approach. 2019 IEEE 7th Conference on Systems, Process and Control (ICSPC), 178–183. <https://doi.org/10.1109/ICSPC47137.2019.9067995>
- Xu, Y., Zhang, F., & Ye, X. (2013). Case Study on the Lean Six Sigma Management for Information Technology Service Management Project of G Commercial Bank. *Technology and Investment*, 04(02), 76–84. <https://doi.org/10.4236/ti.2013.42009>
- Yadav, N., Shankar, R., & Singh, S. P. (2020). Impact of Industry4.0/ICTs, Lean Six Sigma and quality management systems on organisational performance. *The TQM Journal*, 32(4), 815–835. <https://doi.org/10.1108/TQM-10-2019-0251>
- Yoon, K.-S. (2010). A Case Study on Implementation of ITSM using 6 Sigma Technique Focused on Service Desk.pdf.