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Operational Improvement in Infrastructure Department Contract Service Performance in Coal Mining Company

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ABSTRACT

Infrastructure is defined as the physical facilities that provide the primary support for carrying out an organizational business process. Infrastructure includes all technical aspects and facilities required to keep an organization's operations or business processes running smoothly. Infrastructure facilities are considered to all facilities related to an office building, road, water treatment plant, water distribution, airport, building and office, drainage, reservoir, bunding, retaining wall, bridge, sewerage treatment plant, power distribution, power plant, telecommunication, fuel facilities, fuel distribution, housing, port and jetty, and other facilities that support the operational activities of an organization's business process. PT. Kaltim Prima Coal considers the service level in maintenance activities that are related to the compliance performance in quality service, lead time, and work completion performance. These are some of the performance indicators used to measure the Infrastructure Department's agreement for contract maintenance. An operational strategy improvement in infrastructure department contract service maintenance is expected to improve the service level, shorten the lead time and increase customer satisfaction in order to meet the performance indicators. Six-Sigma – DMAIC (Define-Measure-Analyze-Improve-Control) approach is implemented to overcome the service level compliance problem in infrastructure operational maintenance service. Six Sigma has proven to be effective in reducing quality defects, eliminating variation, and significantly increasing the organization performance. The major issue will be investigated using fish bone

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analysis to determine the root cause and optimize the operational maintenance activities and increase the service level performance from 84 percent average to 100 percent.

Keywords:
Contract Service, DMAIC, Fishbone Diagram, Infrastructure, Lead Time, Service Level, Six-Sigma

JEL Classification: M00, M10, M19

INTRODUCTION

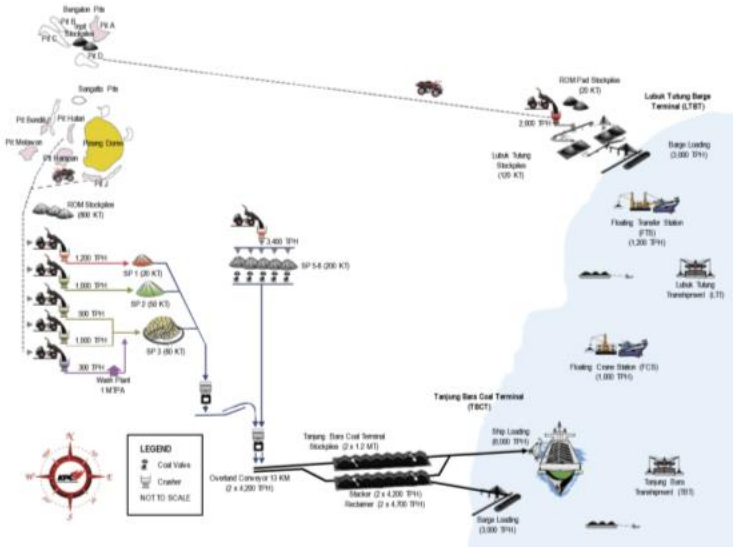
Background

PT Kaltim Prima Coal (KPC) is a coal mining company that operates one of the world's largest open-pit mines, with a total coal production capacity of 70 million tonnes per year (PT Kaltim Prima Coal, 2021). PT. Kaltim Prima Coal is located in the Sangata, Kutai Timur, East Kalimantan region of Indonesia. It's about 300 kilometers north of Balikpapan. The concession area of KPC is approximately 90,938 hectares and is divided into two mining operation areas, Sangatta and Bengalon.

Figure 1. Borneo Island Map – PT. Kaltim Prima Coal Location

PT. Kaltim Prima Coal – coal chain activities are including pre-mining process, operational mining, and post-mining, coal processing, coal conveying through the use of overland conveyor, coal terminal process, and operation infrastructure.

Figure 2. PT. Kaltim Prima Coal – Coal Chain (Source: Internal Company)



As described in the company sustainable report (PT Kaltim Prima Coal, 2019), many facilities are proposed to support the coal convey target through infrastructures such as over land conveyor, coal terminal Stockpile, western over land conveyor, coal crusher, power station, barge loading facility, ship loader, and many more. Infrastructure facilities and plants in non-mining areas are operated by the Coal Processing and Handling Division. Infrastructure department as part of Coal Processing and Handling Division is responsible to support all infrastructure facilities in non-mining operations and carries an active role to ensure the long-term viability of all facilities in order to support the company's operational performance. The facilities are including all office buildings, workshops, warehouses, airports, camps and housing, public service buildings, and other supporting facilities.

A well-managed and well-maintained infrastructure facility can assist a company's economic activity as well as the operational of production flows for goods and services. It can also help the supply chain and distribution of products and services fulfill the end-customer service level. A good infrastructure system in an organization's business process can improve a company's operating performance (Jacob and Chase, 2011). The maintenance activities are carried out by contractor as the resource's owner, providing management, supervision, skilled workers, staff, labor, offices, workshops, warehousing, vehicles, plant, equipment, tools, consumables, safety equipment, protective clothing, administration services, and everything else needed to complete the work orders which are stated in contract agreement.

The Provision building maintenance contract service is a maintenance contracts under the infrastructure department to provide service for all infrastructure maintenance activities including manpower, material, tools, and equipment to support the infrastructure operational and maintenance activity. The purpose of this contract is to complete all incoming minor to medium work from the user or building custodian that is comply with the company's requirements and specifications. The company is engaged a medium-level local contractor with the intent of developing the local contractor as part of the company's local community empowerment and development.

In order to increase company's profit and growth, every company definitely needs an effective strategy, which according to Larasati et al. (2018), must be in accordance with the current condition of the company. PT. Kaltim Prima Coal performs quality control on

a regular schedule and apply the contractor performance indicator to ensure that the contractor's work performance meets the company's objective in time, quality, and cost. The work performance shall comply with company specifications and requirements in technical, safety, and environmental regulations. Contractors must apply and implement the safety system and procedures to ensure the service is completed safely. The goal of this research is to improve the service level performance of the infrastructure department in accordance with the company vision of delivering optimum performance to all stakeholders in order to prevent operational activity disruptions in the coal supply chain caused by infrastructure facility breakdown.

Problem Statement

Infrastructure department set the service level compliance as one of the contractor performance indicators of contractor performance. The service level and achieve good performance in order to meet contract service levels. The contractor's performance is monitored on a regular basis through weekly and monthly reports, the Contractor Performance Indicator, the Contract Penalty, and the Contractor Performance Evaluation (per 6 month). In order to meet the Company Standard & Specification, the Infrastructure Department also conducts quality control time, quality, and cost by daily monitoring and daily work supervising. The Contractor sends a monthly report to evaluate the service level compliance per month. One of the contract's Contractor Performance Indicators is that the contractor must meet the 90 percent minimum requirement of work order completion per month. However, according to the contractor performance report, the service level achievement in the building maintenance contract is still below the required level. Building & Facilities Contract Maintenance Performance for year 2020 can be seen on the Table 1

Table 1. Building & Facilities Contract Maintenance Performance in 2020[1]

Work Request Status	Jan'20	Feb'20	Mar'20	Apr'20	May'20	Jun'20	Jul'20	Aug'20	Sep'20	Oct'20	Nov'20	Dec'20	Jan'21	Average Percentage
Work Request Incoming	237	222	222	223	168	257	211	239	236	204	254	267	179	
Completed	232	219	214	217	162	239	182	100	194	145	173	164	108	
Work Request Completed	98%	99%	96%	97%	96%	93%	86%	78%	82%	71%	68%	61%	60%	84%
Work Request In progress	2%	1%	4%	3%	4%	7%	14%	22%	18%	29%	32%	39%	40%	16%

According to the table, the performance of contract maintenance is still below the 90 percent requirement of service level and continues declining from September 2020 to January 2021. Currently building maintenance contract performance is unable to meet the service level target. The contractor could only achieve the service level 65 percent up to 86 percent maximum from the required 90 percent minimum target. The performance also tends to decrease month after month which lead to the increasing number of backlogs every month and long queuing waiting times for customers. These circumstances automatically impact to the Infrastructure Department's performance. According to the company's Enterprise Asset Management (EAM) – Ellipse database, the average lead time for each work order is 103 days from 38 days of target. The lead time is calculated from the time the work order is issued until the work is declared complete and the Job Sheet Summary has been verified and approved by the

[1] Source: Monthly Report - Building Maintenance Contract Service.

Superintendent of Building and Facilities. So, it is critical that the infrastructure department improve and achieve 100 percent service level performance.

Research Question
The research question of this research study is why the service level of contract maintenance is still below the 90percent minimum target of work compliance.

Research Objective
The main objective of this research is to increase the service level performance of maintenance contract from average 84 percent to 100 percent in operational workflow - Infrastructure Department contract maintenance.

LITERATURE REVIEW

In performance management, service level and lead time service has become two main aspects which is influence performance management. Service level and lead time has become a crucial factor in business process performance.

- Service level is defined as a measure (expressed as a percentage) of meeting demand through inventory in time to meet the customer's requested delivery time and quantity.
- Lead time is defined as the total time that elapses between an order's placement and its receipt. Lead time is including the time spent on order transmittal, processing, order preparation, and transit. Reduce lead time has emerged as an important competitive advantage in determining an organization performance. (Byrne, et al.,2016).

Service level was generally familiar and become an important indicator of quality in the retail industry. The most contribution factor in supply chain process, which is considered to be a two-stage supply chain with one supplier and one retailer, is product availability. Insufficient product availability in retail has also been identified as a typical problem example of low quality (Fleisch and Thiesse, 2007). Many previous studies have discussed the significance of service level management in a wide range of research areas, such as retail industries, manufacturing industries, and multimedia service providers – Teixeira et al. (2012); service strategies in manufacturing – Löfberg et al. (2010); and service level agreements – Beaumont (2006). Firms have generally tend to have large inventories in order to maintain desired service levels, which has resulted in extra costs. Poor service levels can lead to customer and sales loss, whereas excess inventory leads to extra costs due to handling big inventories (Hübner et al., 2013). Salam, Panahhifar, and Byrne (2016) performed research on the use of simulation to provide better insights into resolving the conflict between inventory and service level, explained and demonstrated the relationship between inventory level and customer service level to reduce inventory holding costs to make the managerial decision-making process more efficient and effective. Park and Hong (2014) was discussed an optimization mathematical model to determine the optimal guaranteed service time, optimal service level, and optimal capacity to maximize the overall supply chain's expected profit.

Ali et al. (2020) investigated a methodology for oil and gas companies to keep their production plants productive while investing with minimum investment in carrying maintenance, repair, and operating (MRO) inventory planning to help the exploration and production companies in improving production. Although the service levels have been widely discussed in the many literatures, the relationship between performance management and service levels in a service organization – mining industries is still under represented. Currently there still few study that discussed the how to improve the service level in service organization in mining industry. The purpose of this study is to

improve the service level in infrastructure service maintenance in the mining industry by further investigating the relationship between service level and lead time, which has never been studied before.

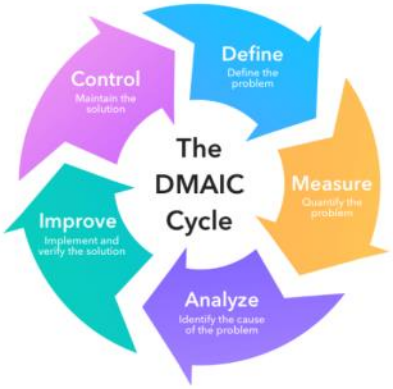
Six Sigma Methodology

Six-Sigma methodology is a business continuous improvement strategy that focuses on systematically identifying ways of reducing time, eliminate defects, and reduce variation in business processes. The initial idea behind Six- Sigma methodology is significantly to improve the company's processes lead by identifying and eliminating defects while somehow improving product quality increases customer loyalty. Six sigma methodologies as business improvement have been successfully implemented in a widely range of manufacturing industries.

Figure 3. The goal of Six-Sigma methodology

Six- Sigma Methodology was developed in the 1980s by Bill Smith, a Motorola quality engineer whose goal was to improve the way quality and measurement systems worked in order to eliminate errors. Motorola systems tolerated error rates that resulted in excessive scrap, rework, redundant testing, and, in many cases, customer dissatisfaction. When variation is eliminated, the process results can be precisely predicted – every time, according to the Six Sigma methodology. Process errors are eliminated by designing the system so that these precisely predictable results fall within the zone of acceptable performance from the customer's perspective. Six Sigma methodology in further development is currently implemented not only in manufacturing companies but also in service provider companies to improve the company's performance. Six-Sigma is structured around a five-phase performance model known as Define-Measure-Analyze-Improve-Control (DMAIC). A successful business process adheres to the Six- Sigma DMAIC methodology, which consists of five distinct stages: define, measure, analyze, improve, and control, which can be accomplished using a variety of tools. (Figure 4).

Figure 4. Six- Sigma Framework



Six sigma approaches are currently being used in the service industry to improve service quality and customer satisfaction by reducing variation in processes and eliminating non-value-added processes. (Kwak and Anbari, 2004). Antony, Antony, and Kumar (2007) report the first study implementation six sigma approach in service organization. The benefits of six sigma have been proving in service organizations such as banking, healthcare or hospital, financial service, insurance, transportation, logistic company, and recruitment consultancy. Even though six-sigma framework has been proven in many manufacturing organizations, many service organization industries frequently facing difficulties in calculating the quality measurement and still not confident with the benefit and the implementation of six sigma approach in service organization. Besides, the improvement strategy using six sigma methodology within infrastructure maintenance service in mining company has never been discussed in previous study. This study is aims to prove that six sigma methodology is can be used in infrastructure service maintenance in mining industry. The methodology is implemented to improve the effectiveness and efficiency in time, quality and costs within the organization business process. Service level in work completion the and lead time are used to measure the organization performance. The service level performance as problems issue in infrastructure maintenance service in PT. Kaltim Prima Coal solved using six sigma's problem-solving tools, in which are process mapping, cause and effect analysis, pareto analysis, and control charts.

The standard approach to Six Sigma - DMAIC methodology developed by General Electric, can be describing briefly as follows (Jacobs and Chase, 2011; Aized, 2012):

1. Define (D)
   The goals of the improvement activity and the desired performance are defined in this phase, which aims to improve the service level and customer expectations. The main objective of the Define phase is to complete the analysis of how the current process and outcomes fail to meet the needs of their customers. The main activities during the define phase are formulates the process, identify customers and their priorities, and define the project goals
2. Measure (M)
   This phase includes measuring the existing system or the current performance of the service to determine what is actually occurring and to ensure that the analysis and solution are based on actual performance. During the measurement phase, a problem and problem space with the greatest impact on the organization are identified through more in-depth analysis, and an improvement target is established. The main activities during the measure phase are determine how to measure the process performance and identify probable causes of the problem.

3. Analyze (A)
   The main activities during the analyze phase are to identify and analyze the root causes in order to identify ways to close the gap between the system's or process's current performance and the desired goal. The analysis is conducted using the measured data to determine the sources of the variation that is causing the problem. The range of potential causes of a problem of existing process conditions is narrowed during the analyze phase.
4. Improve (I)
   During this phase, the potential changes to the business process are designed, and the problem solution is determined in order to reduce or eliminate variation. The sole purpose of the improve phase is to demonstrate how to solve the problem using facts and data. An organization will make changes to a process to eliminate defects, waste, and unnecessary costs associated with the customer need identified during the define phase. Solution matrices that link brainstormed solution alternatives to customer needs and the project purpose, as well as methods for implementing desired solutions, will be tools and strategies for the improve phase. During the improve phase, the solution is piloted, the plans are made for full scale implementation.
   The main activities during the Improve phase are:
   a. Identify means to remove the causes.
   b. Improve the process by designing alternative solutions.
   c. Modify the process to stay within an acceptable range.
5. Control (C)
   The next step is to control the new system the implementation of the improvements to monitor the supporting systems process to ensure that the business solution is fully implemented. It also aids in determining whether the performance improvement is sustained or begins to decrease.
   The main activities during the Control phase are:
   a. Determine how to maintain the improvement.
   b. Put tools in place to control and monitor the improved process.
   c. Use solutions to standardize integrate solutions in daily operations.

Figure. 5 illustrates the Six Sigma DMAIC Methodology (Iskandar, 2019) shall be implemented in the company business process, scrutinize the detail breakdown and root cause of the problems.

Figure 4. Six Sigma - DMAIC Methodology

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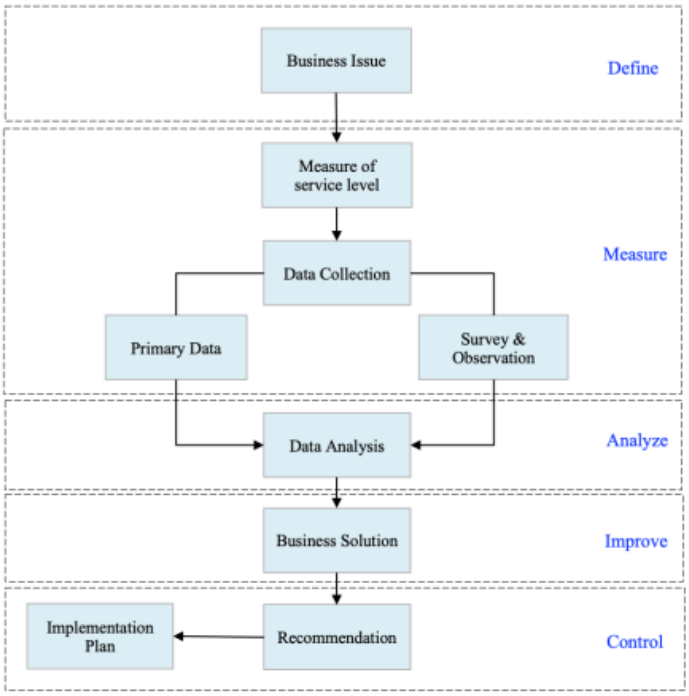
RESEARCH METHOD

Research methodology is a way to systematically solve the research problem and it refers to the behavior and instruments used in selecting and constructing research technique. The methodology of business solution for Infrastructure building contract maintenance is starting from identified business issue, service level measurement, collecting data, data analysis, find the business solution, and determine recommendation and implementation plan for contract maintenance business. Business issue identification obtained from the existing performance of building contract maintenance which are almost constantly below the service level and tend to be decrease every month. Service level measurement of existing building maintenance contractor performance is gathered from contractor monthly report data base and company ellipse data base in order to know the gap between the actual service level achievement and the target plan.

Data collection is gathered through primary data and secondary data which is purpose to explore any issue in all process and to analyze the root cause of service level problems. Primary data is gathered through conducting interview, survey and observation method with employees involved in contract maintenance process to explore the business issue and to find the constraint on the business process workflow. The purpose of interview is to know exactly how the existing operational maintenance activities running and what problem is occurred in it. Based on survey and data interview, author started to make list what the problem in each department. While the observation method is purpose to gather what is currently happening in the business process and eliminated the waste. Secondary data is gathered through Company data base Enterprise Asset Management (EAM) – Ellipse database, contractor's monthly report, and other company data documents. Six Sigma Methodology is used for this thesis to determine the strategy improvement of the business issue. The detail of research methodology can be seen in the following figure 2.5.

Figure 5. Research Methodology



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RESULTS

Analysis of Business Situation

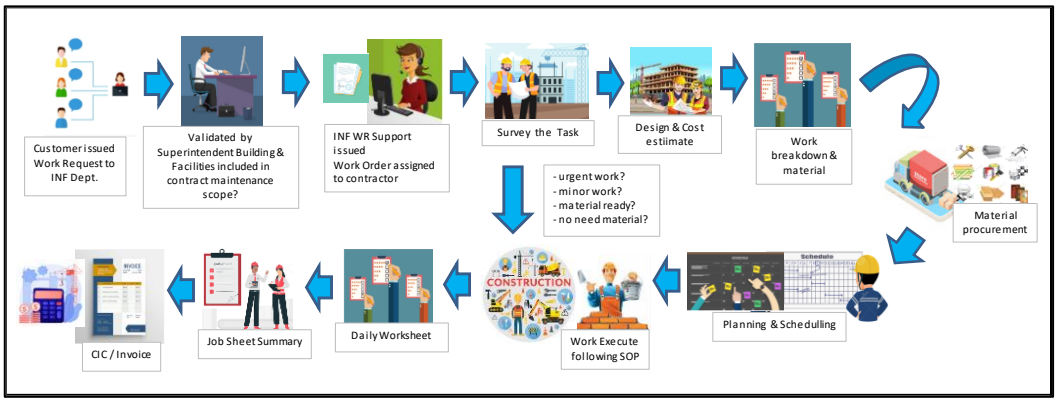
The current business process of infrastructure contract maintenance begins with the issuance of a work request. Work requests for maintenance and repair services are created by all departments and divisions in the non-mining area as the end customer and sent to infrastructure department via Infrastructure Work Request Support (INF WR Support) as a help desk. The incoming work request is then validated by the superintendent of buildings and facilities to ensure that the task is including within the scope of the contract. After validation, Infrastructure WR Support issues the incoming work request as a work order and sends it to the nominated contractor for the umbrella contract. After receiving the work order, the contractor supervisor is being scheduled to survey the work task to identified the materials and manpower required. If the work task is a high priority work with material available or minor repair work with no material required, the contractor scheduler directly assigns a crew to carry out and complete the work order. Otherwise, if the work task is a normal priority job tasks, contractor superintendent estimates the bill of quantity, material and resources needed after surveying the task.

Bill of Quantity is sent to the infrastructure engineer for validation and approval. Once the Bill of Quantity has been approved, the contractor will begin the material procurement process. before After the material has been delivered on site, the contractor scheduler will plan the resources required to complete the work task (material, manpower, equipment, mobilization and demobilization, permit, etc.) and schedule the work execution.

Infrastructure Engineer or Company Representative performs quality control, monitoring, and supervising the work task activity to ensure that the work meets the agreed quantity and Company quality specifications, both technical and safety requirements. The work is handed over to user or building custodian in the form of a daily work sheet approval after the work is completed. Daily worksheet is reporting the actual all material, manpower, and resource usage. From daily work sheet, the contractor then submits a job sheet summary which is breakdown the detail of cost spent of the work task to infrastructure department to be validated and approved by company's supervisor, superintendent, and manager. Job sheet summary document is attached with photo of the work, actual resources spent, and the approved daily work sheet, any required drawings. The breakdown list of manpower, material, and equipment spent for the job task in the job sheet summary is then resulting in the actual cost to be invoice (CIC) by company cost control. A work order is registered as completed when the job sheet summary has been approved.

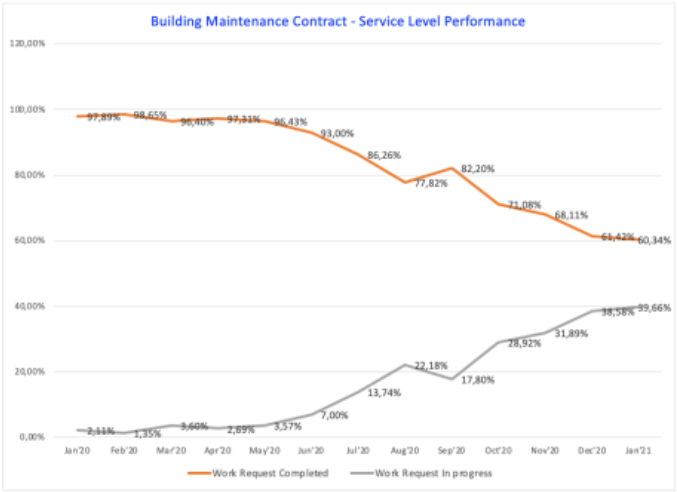
Figure 7 illustrate the overall business process workflow in building contract maintenance workflow.

Figure 6. Infrastructure contract maintenance workflow



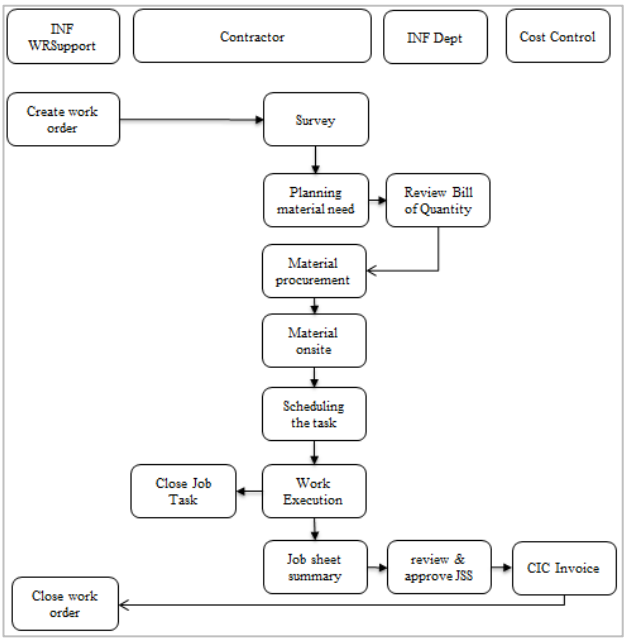
Contractor's work completion performance has been unable to meet the service level since february 2021, and tend to keep decreasing month by month. Every month, the backlog of unfinished business keeps increasing. Because of this condition, the queuing time for work order execution is quite long. (See Figure 8)

Figure 7. Building Maintenance Contract – Performance year 2021



A process diagram is required to further describe the longest lead time, measure the performance of the maintenance contract, and determine the problem statement. Process diagrams are intended to provide a much more detailed view of the process by including items like value-added time, delay, distance, storage, and so on.

Figure 8. Process Diagram



The lead time duration in every single work task in process diagram further detail by time function mapping tools to define the longest lead time in organization business process in order to find the business issue. Time-function mapping, also known as process mapping, is a tool process in a flow diagram that includes time on the horizontal axis. The nodes represent the activities, and the arrows represent the flow direction, with time represented on the horizontal axis. This type of analysis enables users to identify and eliminate waste, such as unnecessary steps, duplication, and delays. The power of time-function mapping is that it adds rigor and a time element. (See Figure 10)

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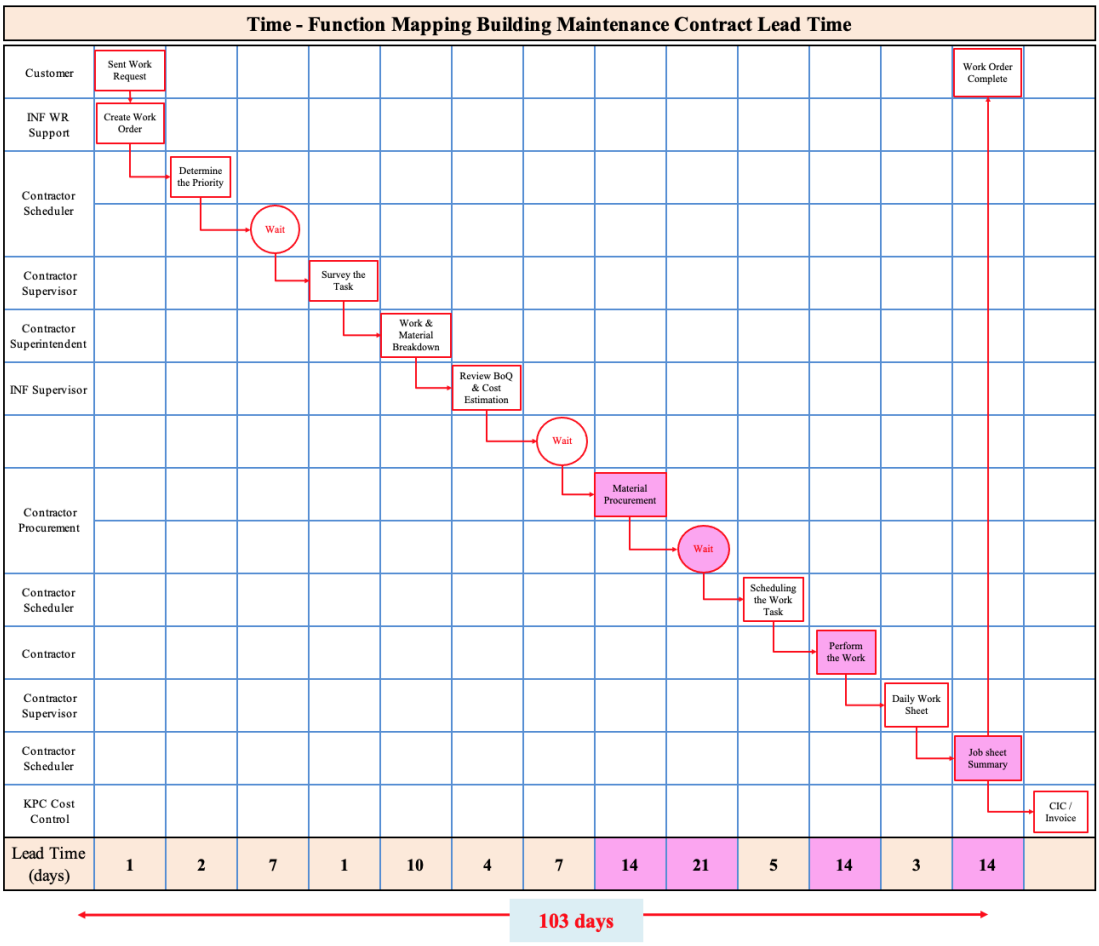
Figure 9. Time - function mapping of contract maintenance



According to time function mapping result, the longest lead time in contract maintenance is:

- Material availability (total 35 days)
- Long duration time to complete the work task (average 14 days)
- Job Sheet Summary submission (average 14 days)

The highest three of lead time

Table 2. Business issue

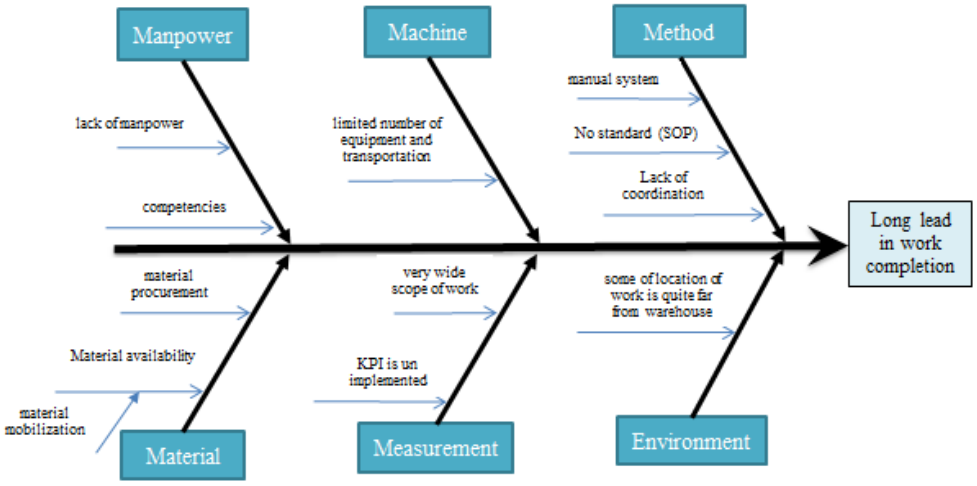
No	Existing Performance	Business Issue
1	Material availability is need long time to be delivered on site.	The contractor lacks of system for identifying and forecasting the usage of fast-moving material.
2	The average of percentage total of work execution continues to fall short below of the service level target. The duration or lead time to complete the overall work task is long (103 days).	Lack of manpower quantity, incompetence of manpower, limited system and facilities, and a lack of coordination among all parties involved in the work task. The contractor has no data on the actual completion date of the work. The contractor has no standard for determining the job task target completion schedule plan.

No	Existing Performance	Business Issue
3	The job sheet summary submission for invoice purpose after the work task is work performed are usually need very long time to submit.	Lack of manpower competencies. Daily work sheet is not fill in the same day when the work task is complete.

Cause and effect analysis – fish bone diagram is used as part of analyze tool in six sigma - DMAIC framework to analyze further the root cause of business issue.

Fish Bone Analysis
Fishbone analysis will be utilized to determine the root cause of the business issue that cause the service level performance to fall short of expectations target.

Figure 10. Fishbone diagram of contract maintenance business issue (Susanto, 2019 with some modifications)



DISCUSSION

The improvement using DMAIC - Six Sigma Methodology shall be in line with the organization goal. The possible changes to the business process are purpose to find the solution of the problem statement. Some of major challenge in previous study in service industry is to analyze the service level performance and determine the solution since the problem issue and problem solution is intangible and need to quantify. This study shall be quantifying the root cause of the business process based n risk to find the business issue that highest priority to be solved.

The top three root cause shall be analyzed by group discussion and meeting with department management to find which has the highest big impact and implication to the service level performance. The improvement is defined by quantifying the root cause using FMEA (Failure Mode and Effect Analysis) process method to assess the risk associated with the identified failure modes, effects and causes, and prioritize issues for corrective action. The objective of FMEA method is to improve the design of the manufacturing or business process and to identify failures mode and degree of severity, occurrence and detectability of each problem to improve quality of process. The outputs of FMEA are list of potential failures modes in the process, list of critical characteristics and significant characteristic, and list of recommended actions to eliminate the causes of failure mode.

The steps in implementing FMEA method are listed in the following below (Widjaja, H, 2017):

a. Identify the potential failures and effects mode
b. Determine severity of the possible failures
c. Determine the occurrence of the failures
d. Determine the detectability of the failures
e. Determine RPN (Risk Priority Number) from calculation value of Severity (S), Occurrence (O), Detectability (D) where as RPN *: S x O x D*
f. Determine the action plan shall be implemented to reduce Occurrence and Detectability of the failures.

All root causes have been identified in fishbone diagram shall be quantified based on Severity, Occurrence and Detection which can be seen in Table 3.1. The quantified based of business issue is determined from focus discussion group with management of internal infrastructure department. The discussion decision is considering the relation of problem issue to the major importance to the business process, both in terms of cost, quality and customer satisfaction.

The rating scale (Likert scale) is used within the focus discussion group to obtain the top three highest score of problem solution that should be solve as high priority Natasha, et.al (2020) on the previous study, collect the data through the questionnaire combined demographic questions and Likert scale questions that offering respondents the possibility to choose and rank among several options or the possibility to grade on a “strongly agree” to “strongly disagree” scale. This study applied the Likert scale 1 to 5 in severity, occurrence, and detection parameter.

Table 3. Scale and Parameter of Severity, Occurrence, and Detection

Severity		**Occurrence**		**Detection**	
Scale	Parameter	Scale	Parameter	Scale	Parameter
1	No Effect	1	Very Low - (Rare)	1	Certain Detectability
2	Minor	2	Low - (Unlikely)	2	High Detectability
3	Moderate	3	Moderate - (Possible)	3	Moderate Detectability
4	High	4	High - (Likely)	4	Low Detectability
5	Very High	5	Very High - (Almost Certain)	5	No Detectability

From pareto chart can be gathered the top priority of business solution of infrastructure department maintenance service as shown in table 5 below:

Table 4. Proposed business solution

Variables	Problems/ Business Issues	Problems/ Business Issues	Proposed Business Solution
Man	Lack of manpower	Currently contractor workforce is only 47 person to perform overall work order and has no engineer	Additional manpower of crew field from 9 crew become 12 crew , in order to fasten the lead time in finishing the work and to reduce the queuing time in work execution..
Man	Competencies	The contractor competencies is considered still below the the company expectation. It can be seen from the long lead time to complete the work. Scheduler/ Planner not perform the as it job desk	Provide training and performance evaluation to contractor manpower. Provide SOP for building maintenance activities work task. Involved in contractor recruitment process to ensure the manpower matches with the required qualifications
Material	Material Availability	Material is frequently still un available to perform the work. Material procurement has become the long lead the in contract maintenance workflow	Accelerate the procurement process Calculate the material safety stock to forecasting the fast moving material for ready stock buffer material.

Three (3) priority recommendations are derived from the highest score in pareto chart result. The propose solution to solve the business issue shall clearly be connected to the strategic objectives of the company business process which are:

a) Lack of manpower

The average number of incoming work requests per month is 107. The average number of work orders completed by a contractor per month is only 80. The resources should then be increased in order to meet the target plan of work order completion. From the target plan of 5 days, the average duration of work execution performing for each work order is 14 days. To carry out each work order, the contractor only provides nine crew members for each responsible area, each of which consists of one carpenter and one helper. Based of capacity resources planning, the contractor shall provide 12 crew of manpower to reduce the long lead time and long queuing time in work execution.

b) Competencies

Competence is defined as cross-functional integration and capacity coordination as a set of skills and knowledge in strategic business units (Javidan in Ljungquist, 2007). Addinna, Prasetyo, and Rufaidah (2018) mentioned that it refers to the company inherent quality that will ultimately produce sustainable profits. Contractor personnel must be trained to improve their competencies and capabilities. Competent manpower can help to speed up the completion of a job task and reduce the amount of outstanding work. Training needs analysis and developing Standard Operating Procedures in work tasks may also assist manpower in carrying out the work to the specified quality and time schedule. Standard Operation Procedure can help to reduce work deviation and rework.

c) Material availability

To expedite work execution, the contractor shall calculate and forecast the fast-moving material usage to be ready stock in a safety quantity to minimize inventory costs and ensure the material required is ready. The online development material database will make it easier for the contractor to forecast material requirements. Contractor shall have partnership with supplier must collaborate to expedite the procurement process, speed up, and ensure the material order is prioritized.

CONCLUSION

From this study, it can be clearly seen that the use of six sigma methodology was able to provide service level performance improvement in in infrastructure maintenance in mining industry service organization through DMAIC tools. Six sigma methodologies have been widely proven in business strategy improvement to improve the service level reduce time, variation and eliminate defect to achieve the service level performance target in business performance which is in line with organization objective.

The improvement shall include the additional number of manpower, develop the competencies, develop material database to monitor material stock, material demand, and forecast the material need. The business strategy improvement shall bring impact to the contract maintenance performance which is the following:

a. The service level performance of building maintenance contract shall increase be from average 84 percent to 100 percent.
b. Developing and providing online material database system for identifying and forecasting material required to perform the work order the job sheet shall be accelerate the material procurement from currently 28 days become 16 days.
c. By additional manpower, competencies development, and provide online system material database, directly fill the daily worksheet in the same day after performing the work task, the duration of work execution duration shall be improved from average 14 days in to 7 days.

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REFERENCES

Addinna D., Prasetyo A.R., Popy Rufaidah. (2018). Building Business Advantage Through Core Competency: case study PT. Japfa Comfeed Indonesia, Tbk, *International Journal of Applied Business & International Management,* Vol.3, no.1, pp 15-25.

Aized, T. (2012). *Total Quality Management and Six Sigma*. Rijeka, Croatia: InTech. (ISBN 978-953-51-0688-3).

Ali; U., Salah; B., Naeem, K., Khan, A.S., Khan, R., Pruncu, C.I., Abas, M., & Khan, S. (2020). Improved MRO Inventory Management System in Oil and Gas Company: Increased Service Level and Reduced Average Inventory Investment. *Sustainability,* vol. 12 no. 19, 8027. MDPI AG. http://dx.doi.org/10.3390/su12198027

Antony, J., Antony, F.J., & Kumar, M. (2007). Six sigma in service organizations: benefits, challenges and difficulties, common myths, empirical observations and success factors. *Int J Qual Reliab Manag*, Vol. 24 No. 3, pp 294-311, http://dx.doi.org/10.1108/02656710710730889

Beaumont, N. (2006). Service level agreements: an essential aspect of outsourcing. *The Service Industries Journal*, vol. 26 no 4, pp. 381-395

Fleisch, E., & Thiesse, F. (2007). On the Management Implication of Ubiquitous Computing: An IS Perspective. *ECIS Proceedings*. 71, pp. 1929-1940, http://aisel.aisnet.org/ecis2007/71.

Hübner, A.H., Kuhn, H., & Sternbeck, M.G. (2013). Demand and supply chain planning in grocery retail: an operations planning framework, *International Journal of Retail & Distribution Management,* vol. 41, no. 7, pp. 512-530.

Ishikawa Diagram. (2020, March, 1). In *Wikipedia.* https://en.wikipedia.org/wiki/Ishikawa_diagram.

Iskandar, A.R. (2019). *Adoption of Six Sigma – DMAIC Methodology to Optimize Service Level at PT. Ultra Prima Corrugator* (Master's thesis, Institute Technology of Bandung, Bandung, Indonesia). Retrieved from https://fp-jkt.sbm.itb.ac.id/pdf/viewer.php?code=dnbec6i6V-0.

Jacobs, F.R. and Chase, R.B. (2011). *Operation and Supply Chain Management* (13th ed.). McGraw-Hill.

Kwak, Y.H., & Anbari, F. (2004). Success factors in managing Six Sigma projects. In *Project management institute research conference*. London, UK, July 11-14.

Larasati, N., Shinta, A.G., Mahendra, D., Sanchez, V., Denisa. P., Yulza, D.F., Almutari, N.B.M.A.A. (2018) "Enhancing Business Performance of Sahid Montana Hotel Malang in Tourism Program" *International Journal of Applied Business & International Management*, vol.2, no.2, pp.3

Ljungquist, A. (2007). *Core Competency Beyond Identification: Presentation of a Model.* School ofManagement and Economics, Vaxjo University, Vaxjo, Sweden.

Löfberg, N., Witell, L., & Gustafsson, A. (2010). Service strategies in a supply chain, *Journal of Service Management*, Vol. 21 No. 4, pp. 427-440

Natasha, P., Kee, D.M.H., Zulaikha, N., Aisyah, S.H., Nagaraju, S., Rai, A., Pandey, R. (2020). Factors Affecting the Quality Service: A Case Study of SOCAR*, Advances in Global Economics and Business Journal (AGEBJ),* Vol. 1 No. 1, pp.50-60

Park, S.;& Hong, K. (2014). Optimal Guaranteed Service Time and Service Level Decision with Time and Service Level Sensitive Demand. *Mathematical Problems in Engineering,* pp. 1-7, https://doi.org/10.1155/2014/694712

PT. Kaltim Prima Coal. (2019). *Sustainability Report*. Sangatta East Kalimantan. Indonesia: PT. Kaltim Prima Coal. Retrieved March 1, 2021, from https://kpc.co.id/sustainability-report/

PT. Kaltim Prima Coal. (2020). Kaltim Prima Coal's Enterprise Asset Management (EAM). Ellipse Historial Database (Unpublished).

PT. Kaltim Prima Coal. (2021). Company Overview. Retrieved February 26, 2021, from https://kpc.co.id/company-overview.

Salam, A., Panahifar, F., & Byrne, P.J. (2016). Retail supply chain service levels: the role of inventory storage. *Journal of Enterprise Information Management, vol.29, no.* 6, pp. 887-902, https://doi.org/10.1108/JEIM-01-2015-0008

Susanto, I. (2019). Analysis Fishbone (Ishikawa Diagram). Retrieved March 1, 2021, from http://cio-indo.blogspot.com/2011/11/analisis-fishbone-ishikawa-diagram.html.

Teixeira, J., Patrício, L., Nunes, N.J., Nóbrega, L., Fisk, R.P., & Constantine, L. (2012). Customerexperience modeling: from customer experience to service design, *Journal of Service management*, Vol. 23 No. 3, pp. 362-376.

Widjaja, H. (2017). FMEA (Konsep & Contoh Kasus). Retrieved May 1, 2020, from https://docplayer.info/40232986-Fmea-konsep-contoh-kasus.html