

Analysis of the Project Success Factor Through Time, Cost, Labour, Health Safety Environment and Quality Aspects at PT XYZ

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Abstract:

This study aims to analyze the failure factors of PT. XYZ in 2018 – 2020 in terms of time, cost, labor, Health, Safety, and Environment (HSE), and quality based on the Success Project Factor (SPF). It includes 183 projects with the Non-Probability Sampling technique. The researcher uses fishbone and Pareto to identify problems. The results showed Schedule Performance Index (SPI) < 1 indicated the project is in the late category, the Cost Performance Index (CPI) < 1 indicated cost overrun, Safety Performance Index (SFPI) > 0 indicated the K3 target could not be reached, the Client Satisfaction Index (CSI) = 34.03, indicated that it is in the dissatisfied category, then Productivity Coefficient Plan < Realization, it meant the workforce was less productive. After the analysis of fishbone and Pareto, the data show that the highest cause was 13% due to lack of supervision, project cost aspects were 13% due to delays, HSE project aspect were 13% due to no K3 process before work begins, the quality aspect was 17% due to no training, and the labor aspect was 17% due to poor worker discipline.

Key words:

Success Project Factor, Schedule Performance, Cost Performance, Safety Performance, Productivity Coefficient, Client Satisfaction.

1. Introduction

Each project construction has a limited source of funds and project time. Therefore, a leader must be able to plan the project budget (cash flow) and project time (scheduling) to be more effective and efficient in project implementation. In this study, the researcher took the projects of PT. XYZ Oil and Gas Division and Power Generation System in 2018 – 2020. First, the researcher looked at several projects that experienced a mismatch between the planning and realization of Profit Margin at PT. XYZ Oil and Gas Division and Power Generation System for the 2018 – 2020 period. In addition, the researcher also saw a mismatch in the project time, in other words, the project could not be completed in accordance with the agreed project contract. After

knowing several projects constrained in this aspect, the researcher made the selected projects as research samples. The following are Profit Margin data of PT. XYZ Oil and Gas Division and Power Generation System for the 2018 – 2020 period:

From **Table 1**, it is explained that there are 5 projects at PT. XYZ Oil and Gas Division and Power Generation System for the 2018-2020 period which are considered not to reach the Profit Margin according to the budget plan, even suffers a minus or loss. The projects included projects G, H, and I in 2018, the AF Project in 2019 and the BA Project in 2020. As for facilitating the discussion of these projects, the researchers made the project numbers and coding as follows:

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Table 1. PM PT XYZ Oil and Gas Division and Power Generation System (Source: Data of PT. XYZ Profit and Loss (2018-2020)).

P	2018			2019			2020		
	R1	R2	S	R1	R2	S	R1	R2	S
A	30%	29%	0%	30%	30%	0%	30%	30%	0%
B	35%	35%	0%	51%	51%	0%	10%	11%	1%
G	14%	4%	-10%	18%	21%	3%	20%	20%	0%
H	16%	8%	-7%	25%	38%	13%	15%	15%	0%
I	16%	15%	-1%	21%	22%	0%	17%	16%	0%
AF	42%	42%	0%	10%	6%	-4%	29%	29%	0%
BA	25%	25%	0%	21%	21%	0%	7%	-5%	-12%

Description: R1=Planned Budget, R2=Actual Budget, S=Difference, P=Project.

Table 2. Project Number and Code (Source: Data of PT. XYZ (2018-2020)).

Project Number	Project Code
118040037	A
118040038	B
118040039	C
116020059	D
116020040	E

Projects A, B, and C are projects with a typical Detail Engineering Design (DED) which is a plan for toll road drawings for 3 tracks with different areas. Project D is an asset mapping project and the creation of an application for the distribution of assets in Indonesia using the Geographical Information System (GIS) application model. Meanwhile, the last project, project E, is the construction of an Electric Transmission Network. The 5 projects are Oil and Gas Division Projects and Power Generation Systems at PT. XYZ.

The non-optimal planning and supply capacity for project needs will result in losses for both the user or the project contractor. The problem that will arise from the contractor’s side is the decrease in the value of customer satisfaction which has an impact

on the termination of the project because it is not in accordance with the provisions of the project contract. Research on work delays has actually been done by many other researchers. *Arianie & Puspitasari (2017)* research on increasing project effectiveness and efficiency. *Arianie & Puspitasari (2017)* tried to analyze by optimizing the project schedule using PERT/CPM. The difference in the scope of this research is that it discussed the root of the problem in 5 aspects (project time, project costs, HSE, quality, and project labor). In the case of this research, the 5 projects mentioned above also experienced a mismatch between the project schedule planning and realization which resulted in the project timing being not achieved. In the calculations the researcher has calculated from the total time of the project implementation, only the effective hours of work are taken after the reduction of working hours per day and holidays.

Figure 1 indicates that projects A, B, and C experienced delays in project execution time in the sense that they were not in accordance with the project contract. The planning for the completion of projects A, B, and C is 1312 hours, but in reality they have been completed in 2648, 2944, and 2944

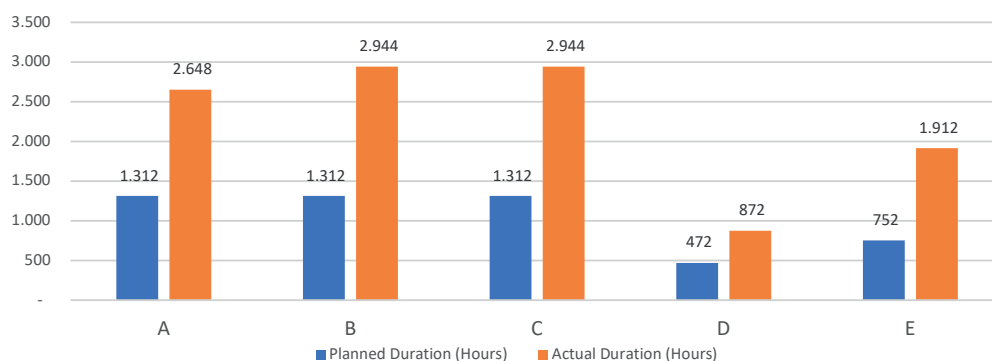


Figure 1. Project Time Planning and Realization of Project Completion of PT. XYZ (Source: Data of PT. XYZ (2018-2020)).

hours respectively. While the planning for the completion of projects D and E are 472 and 752 hours respectively, but in the implementation, they reach 872 and 1912 hours. The problem of duration had been studied by many authors. One of them is by comparing the triangular distribution and beta distribution, then the two distributions will find the optimal project completion time (Maidamisa, 2017). The difference is, in this study, the researcher tries to examine other aspects that are likely to be the factors causing the delay itself.

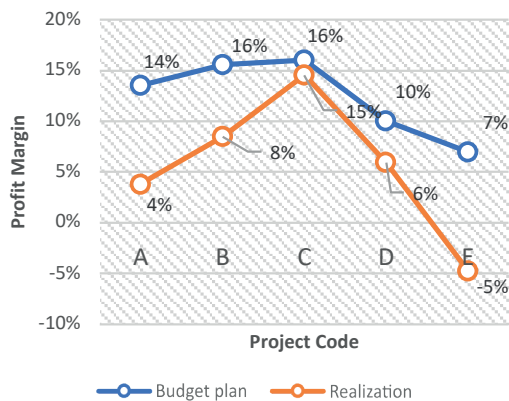


Figure 2. Sample Project of PT. XYZ Which did not reach the Target Profit Margin (Source: Data of PT. XYZ (2018-2020)).

As a result of delays in the implementation of a project, it has an impact on the swelling of the project budget costs that have been allocated. Surely, it is very influential on the target profit margin of PT. XYZ.

Consequently, the project work addendum resulted in additional project time and project costs. Of course, this resulted in the target profit margin not being in accordance with the plan as shown in Figure 2. In the Figure 2, the target that was almost achieved was only in project C where the planning was 16% but the realization only reached 15%. In project E, it actually suffered a loss where the project obtained a Profit Margin of -5%.

This discrepancy between planning and realization is certainly a minus for company management. According to Rochman & Wahyuni (2018), planning and control in construction projects are the most basic functions in realizing the success of an activity in a construction project. The success of a project cannot be separated from a series of activities that include good planning stages. According to Sutawidjaya, Nawangsari, & Djamil

(2019), project scheduling is a very important stage, involving the detailed allocation of resources in the form of people, finances, and equipment for the activities needed.

Project workforce is one of the success factors of a project, as explained in the analysis of Kamau, Jane, & John (2018). In their findings, factors related to the project workforce have a marginal influence on project success and are dominated by external environmental factors in influencing the success of construction projects. Changes in the amount or volume greatly affect the project cost plan, the amount or volume is the most basic thing in the budget plan. Figure 3 explains that the planning and realization differences are not so significant where project A, B, and C planning are 27 people and the realization is 25, 28, and 23 people, respectively. While projects D and E planning are 28 and 21 people and the realization is 26 and 19 people.

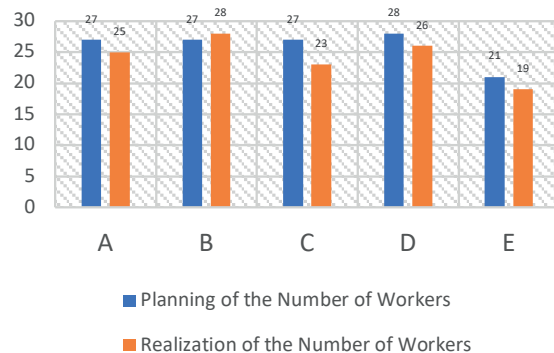


Figure 3. Project Workforce Planning and Realization Volume (Source: Data from the Customer Satisfaction Division of PT. XYZ Oil and Gas Division and Power Generation System (2018-2020))

In the face of global competition, improving the quality of services as a survey and consulting company is very important. Therefore, one way to win the competition from its competitors is to provide services in accordance with customer expectations and desires. If the quality of service enjoyed by customers turns out to be below what they expect, they will lose interest in the company's products and services. Likewise, if the opposite happens (Meiliawan, & Nugroho, 2020). Therefore, apart from the project workforce, the phenomenon of this research is also included in the IKP (Customer Satisfaction Index) graph that has been processed as follows (Figure 4).

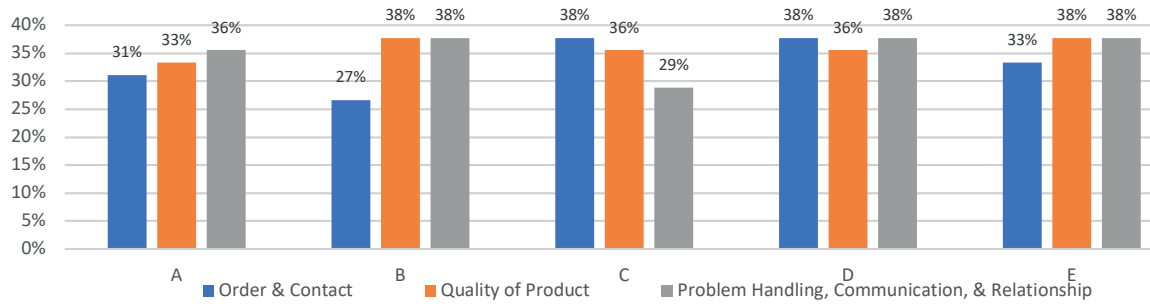


Figure 4. Order and Contact Satisfaction Level, Quality of Product, & Problem Handling, Communication, & Relationship (Source: Data from the Customer Satisfaction Division of PT. XYZ Oil and Gas Division and Power Generation System (2018-2020)).

Table 3. Differences with Previous Research.

Research (year) Title	Research differences				
	Time Aspect	Labor Aspect	Quality Aspect	HSE Aspect	Cost Aspect
Wicaksono (2016). Worker Performance Analysis on the Delay in the Fabrication Process of PT Alstom Power Esi's Coal Fired Boiler Project Work	The difference in this study is the presence of the highest frequency presentation, so the main causes are more specific to the lack of project workforce.	The indicator of the cause of the problem, the researcher focuses more on the time aspect where the cause of the delay is the lack of worker skills.	Research does not discuss product quality to project customers/users	The research does not discuss aspects of work accidents	Research does not address the cost aspect
Dharsika, Budiarta, & Yansen (2017). Analysis of the Quality of Project Managers on the Implementation of Construction Projects (Case Study: Denpasar and Badung)	The research does not discuss the project time aspect of project completion delays	The project quality aspect, according to the researcher, is caused by the poor quality of managers in this study, the main factor is the lack of supervision and discipline of workers	Aspects of project quality, according to researchers, are caused by the quality of managers while in the study the main cause is the absence of comprehensive workforce training.	The research does not discuss aspects of work accidents	Research does not address the cost aspect
Ismiyati, Sanggawuri, & Handajani (2019). Application of Risk Management in the Construction of a Log Pier Extension Project	The researcher discusses the work accident which is one of the factors for project delays. This research is for the time aspect, the main cause is the lack of project manpower and poor project scheduling	Research does not address labor aspects	Research does not discuss product quality to project customers/users	According to the researcher, the HSE aspect is more directed at a comprehensive risk management solution for work accidents. In this study, it is more directed to the causes specifically in the case of the project being studied	The researcher discusses the work accident which is one of the costs overrun factors. In this study for the time aspect the main cause is the lack of supervision and discipline of workers.
Ayano, & Teshome (2018). Factors Contributing for Delay in Government Construction Projects in Oromia, Ethiopia	The researcher mentions the main aspect of project delays due to poor integrity between project clients and project managers	Research does not address labor aspects	Research does not discuss product quality to project customers/users	The research does not discuss aspects of work accidents	Research does not address the cost aspect

Table 4. Customer Satisfaction Index (Source: Data from the Customer Satisfaction Division of PT. XYZ Oil and Gas Division and Power Generation System (2018-2020)).

No	Index Value (100%)	Criteria
1.	80% < SI ≤ 100%	Very satisfied
2.	60% < SI ≤ 80%	Satisfied
3.	40% < SI ≤ 60%	Quite satisfied
4.	20% < SI ≤ 40%	Less satisfied
5.	0% < SI ≤ 20%	Not satisfied

Description: SI= Satisfaction Index.

Figure 4 and Table 4 explain that the average customer satisfaction in each project is in the range of 20% - 40%, indicating that the Order and Contact, Quality of Product, and Problem Handling, Communication, and Relationship variables are at the Less Satisfied level and only a few percent adrift are in the Not Satisfied category. Therefore, there needs to be a significant improvement to improve the quality of PT. XYZ. According to Wang & Nagahira (2017) in their research, they conclude that there are 3 success factors in project implementation that can increase customer satisfaction including user innovation and successful new product development, degree of product market and technological novelty, R&D strategy, and user expertise. However, in this study, the process has not led to a new direction in management. This category indicates the weak level of company service, so it is necessary to have a management approach in an organization that has a focus on customers (Kathongo, 2017). From the HSE aspect, the cumulative data for PT XYZ projects for the 2018-2020 period are seen from the Fatal and Non-Fatal Accident aspects:

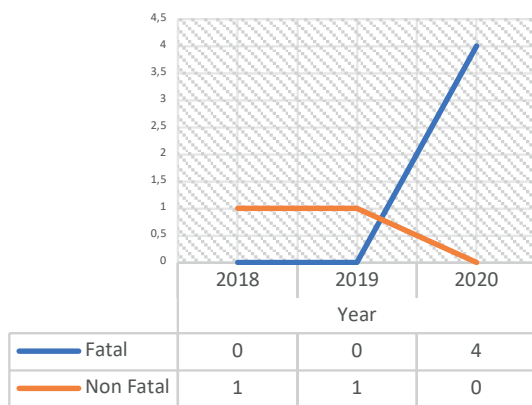


Figure 5. Event Recapitulation of Fatal and Non Fatal Accident Categories (Source: HSE K3 Data of PT. XYZ Oil and Gas Division and Power Generation System (2018-2020)).

Sutawijaya, & Nawangsari (2018) explained that the project element has a relatively higher accident rate compared to other activities. Because project activities can cause some unwanted impacts, especially on safety and work environment. Therefore, risk management has an important role in mitigating things that are not desirable in the project. Risk management in several studies has been shown to have a positive influence on project performance, one of which is in terms of Hely and Safety risk management in a project (Ogolla, Mugambi, & Obwongi, 2019). Figure 5 explains that during the project period there had been 4 fatal accidents which were caused by being infected with the Covid-19 pandemic and 2 accidents with non-fatal categories. In the Non-Fatal incident, the accident occurred because the glass was scratched during the building renovation process and the second was the incident where an employee was squeezed by SPI ASS Which while working. From these data, it has been confirmed that 1 fatal accident occurred in project A and 1 other in project D, while one non-fatal accident occurred in project C and E respectively. This becomes important to discuss as in the research of Dharma, Putera, & Parami (2017) explained that project accidents on construction works can be one of the causes of disruption of project activities.

Based on Figure 1-5, what are the factors causing the non-conformance of realization in terms of time, cost, labor, quality, and HSE? And what needs to be done to minimize the non-conformance of realization in terms of time, cost, labor, quality, and HSE? On the basis of the 5 aspects mentioned in Figure 1 - 5, the researcher is interested in conducting research with the title "Project Analysis Through Aspects of Time, Cost, Manpower, HSE, and Project Quality Viewed from the Success Project Factor (SPF) at PT XYZ".

2. Theoretical Review

Frefer, Mahmoud, Haleema, & Almamlook (2018) explained that in the analysis there are at least 2 measuring tools in measuring Success Project Factors, namely Objective Measurement and Subjective Measurement. Objective Measurement is a measuring tool factor consisting of project time (Time), project cost (Cost), health and safety (Healthy & Safety) and profit (Profitability). Meanwhile, Subjective Measurement is a measuring tool consisting of Quality, Technical Performance, Functionality, Productivity, Satisfaction, and Environmental Sustainability.

2.1. Schedule Performance Index (SPI)

In finding the Schedule Performance Index (SPI) researcher uses the formula:

$$SPI = \frac{EV}{PV} \tag{1}$$

where: EV=Earn Value; PV=Planned Value.

The SPI provisions include:

If SPI = 1 = on time project

If SPI > 1 = faster project

If SPI < 1 = late project

Source: [Frefer, Mahmoud, Haleema, & Almamlook \(2018\)](#).

2.2. Cost Performance Index (CPI)

In finding the Cost Performance Index (CPI) the researcher uses the formula:

$$CPI = \frac{BCWP}{ACWP} \tag{2}$$

where: BCWP=Budget Cost for Work Performed; ACWP=Actual Cost for Work Performed.

The SPI provisions include:

If CPI = 1 = the project cost is based on plan

If CPI > 1 = the project cost is smaller/saving

If CPI < 1 = the project cost is bigger/wasteful

Source: [Frefer, Mahmoud, Haleema, & Almamlook \(2018\)](#).

2.3. Safety Performance Index (SFPI)

In finding the Safety Performance Index (SFPI) researcher uses the formula:

$$SFPI = \frac{\text{Number of Accidents X 200.000}}{\text{Total of Working Hours in Field}} \tag{3}$$

In this case, the focus of the discussion is accidents due to activities with SFPI provisions, including:

If accident = 0 = Acceptable (target);

If accident ≥ 1 = Not Acceptable

Source: [Frefer, Mahmoud, Haleema, & Almamlook \(2018\)](#).

2.4. Project Labor Productive Coefficient

The project labor coefficient is determined to determine the number of project workers and the project time used to complete one work item with a certain volume ([Messah, Sina, & Manubulu, 2013](#)). In search. The Coefficient of Labor Productivity of the research project uses the formula:

$$\text{Productivity Coeffi.} = \frac{\text{Workers x Project Duratio}}{\text{Volume}} \tag{4}$$

Provisions for Project Workforce Include:

In looking for the project labor coefficient, the researcher looks at the comparison between the planning coefficient and the realization coefficient, the smaller the coefficient, the lower the project cost, thus showing the productivity of the project workforce.

2.5. Customer Satisfaction Index (CSI)

In finding the Customer Satisfaction Index (CSI), the researcher uses the formula:

$$CSI = \frac{\sum_{i=1}^p W_{si}}{5} \times 100 \tag{5}$$

where:

p= number of attributes of interest.

The CSI provisions include:

Table 5. CSI Value Scale.

No.	Description	Rating Scale Value
1.	Not satisfied	20%-35%
2.	Less satisfied	36%-51%
3.	Quite satisfied	52%-67%
4.	Satisfied	68%-83%
5.	Very satisfied	84%-100%

Source: [Yanova \(2015\)](#).

CSI is general enough to allow the incorporation of additional customer satisfaction areas as deemed necessary. In all cases, the sum of all weights corresponding to each area of concern in finding the customer satisfaction index starts from the Project Schedule Control Weight, Project Weight

Within Client's Budget, Work Quality Weight, Effective Communication Weight, Response Weight to Complaints, and Weights of Environmental and Safety Procedures.

2.6. Project Management

A Project involves many activities. Each activity takes time, which is interpreted as Duration. Duration is a probabilistic statistical quantity described as a unit of value. In addition to project time / project schedule aspects of project costs and scope are also aspects of project management. There are at least 3 limiting factors in a project management including scope, project time, and project costs (Lesmana, & Antika, 2019).

2.7. Fishbone Analysis

Fishbone Diagrams may also be called Cause-and-Effect Diagrams or Ishikawa Diagrams to provide a basis for identifying potential root causes for project performance problems. Tools such as Failure Mode and Effects Analysis and Fishbone Diagrams can be used to initiate and document the organized thought processes needed to separate the main cause of the discrepancy from the contributing causes (Kerzner, 2010).

According to Septiawan, & Bektı (2016) Fishbone diagrams have a structure that helps the team in a systematic way. The advantage of using a Fishbone Diagram is to help identify the root cause of problems that arise in a structured way and make research easier when identifying the location of data collection.

2.8. Pareto Diagram

The Pareto Diagram is a bar graph which is usually combined with a line chart consisting of various factors and has a relationship with variables that have been arranged based on the magnitude of the impact of the problems that arise. A Pareto Diagram, also known as a Pareto Chart, is a specific type of histogram, which is required by the repetition of events. It shows the number of defects made by type or class of identified causes (Septiawan, & Bektı, 2016).

2.9. Research Process Flow

In the analysis, this research uses qualitative methods. Qualitative methods are needed because the purpose of this study is to determine the classification of actions. The character of the problem requires qualitative methods. The flow of the analysis process in this study begins with determining the

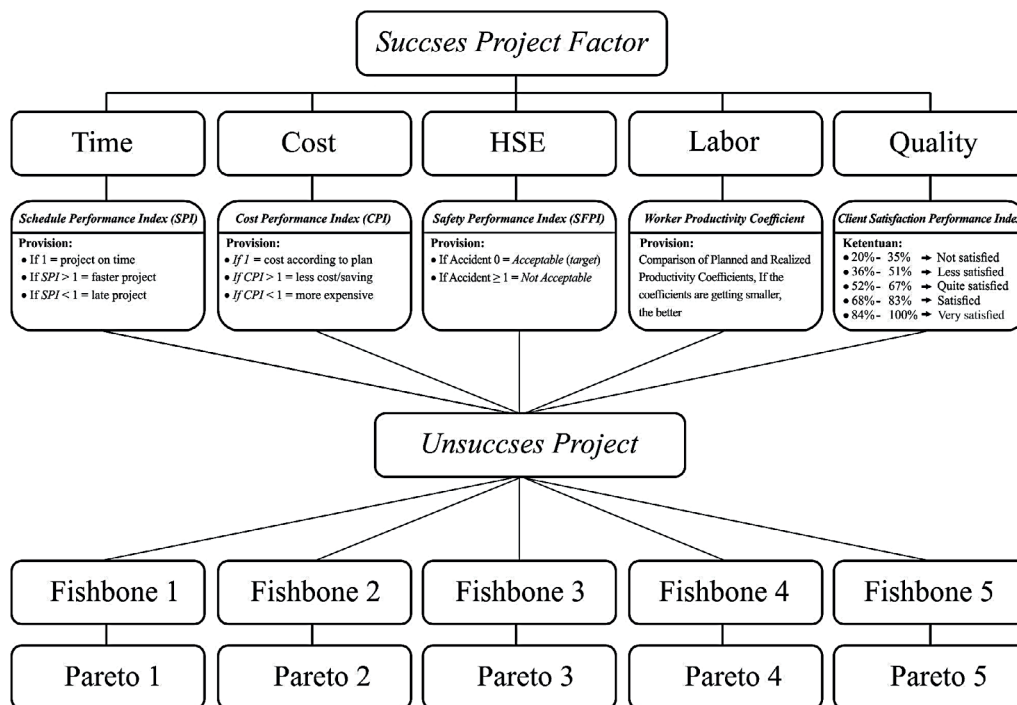


Figure 6. Research Process Flow (Source: Processed Data (2020)).

categorization of the level of project success by using the Success Project Factor (SPF) scale. In the analysis, the researcher identifies the results of project activities according to the provisions of the calculation of formulas 1-5 regarding the index of each aspect of the research.

After knowing the results of the provisions of the index, the researcher determines the categorization of each aspect whether every aspect of each project under the study is successful or not, if in the result the aspect of each project is not successful, the researcher conducts a factor analysis using Fishbone analysis of the 5 aspects of the project, consisting of Time, Cost, Labor, HSE, and Quality. After knowing the factors, the next step is to identify the main cause with pareto diagram.

3. Research Design and Methodology

In this research used mix methods. To analyze the category of project success or not (Success Project Factor) the researcher used Schedule Performance Index, Cost Performance Index, Safety Performance Index, Project Labor Productive Coefficient, and Customer Satisfaction Index. After knowing the category in the project, the researcher analysis using fishbone and Pareto methods to find the main causes of problems in each aspect and find solutions to solve the problem. The data used consists of secondary data on financial data, budget plan, Addendum, Project Workforce, IKP (Customer Satisfaction Index), and HSE as well as premier data on the 5 projects for the 2018-2020 period in the form of interviews to be conducted on employees involved in related projects

4. Finding and Discussion

4.1. Schedule Performance Index (SPI)

Earned Value (EV) can be calculated by multiplying the cumulative percentage of realization progress by the number of project time plans for the completion of a job.

The cumulative percentage of realization progress is the cumulative project achievement that has been achieved within the project period stated in the project contract. The cumulative percentage of realization progress is obtained from the final project report.

After calculating the project's effective time for 8 hours per day, it is known that the total hours between the plan and realization are quite significant, as shown in Figure 1. This is clarified by index, namely the Schedule Performance Index (SPI) which can be seen in the calculation in Table 6.

Table 6. Schedule Performance Index (SPI) (Source: Processed Data (2021)).

P	Planned		Earn		Category
	Value	WP	Value	SPI	
A	6.032	41 %	2.812	0.46	Late Project
B	7.618	31 %	2.372	0.31	Late Project
C	8.069	22 %	1.793	0.22	Late Project
D	6.121	44 %	2.704	0.44	Late Project
E	2.574	62 %	1.582	0.61	Late Project

Description: WP=Works Progress when Contract Expired; P=Project.

An example of calculating the Schedule Performance Index (SPI) in Table 6 no 1 is as follows:

$$SPI = 2.812 \text{ IDR} / 6.032 \text{ IDR} = 0.46$$

Based on Table 5, almost every project is not more than 1 in the Schedule Performance Index (SPI). Therefore, it can be concluded that if $SPI < 1$ then the project is late from the predetermined plan.

4.2. Cost Performance Index (CPI)

Cost Performance Index (CPI) serves to analyze project cost efficiency. It measures the value of the work completed compared to the actual project costs that have been incurred. The Cost Performance Index (CPI) determines how much of the project's budget has been realized and it shows how well the project is working within the project budget.

Table 7. Cost Performance Index (CPI) (Source: Processed Data (2021)).

Project	BCWP	ACWP	CPI	Category
A	2.812	5.334	0.53	Waste
B	2.372	6.920	0.34	Waste
C	1.793	7.371	0.24	Waste
D	2.704	5.441	0.50	Waste
E	1.582	2.398	0.66	Waste

An example of calculating the Cost Performance Index (CPI) in Table 6 no 1 is as follows:

$$CPI = 2.812 \text{ IDR} / 5.334 \text{ IDR} = 0.53$$

Based on Table 7, almost every project is not more than 1 in the Cost Performance Index (CPI).

Therefore, it can be concluded that if the $CPI < 1$ then the project cost is greater/wasteful than the predetermined plan.

4.3. Safety Performance Index (SFPI)

Risk management in several studies has been shown to have a positive influence on project performance, one of which is in terms of Helty and Safety risk management in a project (Ogolla, Mugambi, & Obwongi, 2019). This is very important because Safety will be able to provide a sense of security to workers and reduce the risk of inhibiting activities.

Table 8. Safety Performance Index (SFPI) (Source: Processed Data (2021)).

Project	Total of		SPFI	Category
	Number of Accidents	Working Hours		
A	1	2.648	75.53	Not Acceptable
B	0	2.944	0.00	Acceptable
C	1	2.944	67.93	Not Acceptable
D	1	872	229.36	Not Acceptable
E	1	1.912	104.60	Not Acceptable

An example of calculating the Safety Performance Index (SFPI) in Table 7 no 1 is as follows:

$$SFPI = 1 \times 200.000 / 2.648 \text{ hour} = 75.53$$

As explained in Table 8, it is explained that during the project period there have been 4 fatal accidents which were caused by being infected with the Covid-19 pandemic and there were 2 accidents with non-fatal categories. In the Non-Fatal incident, the accident occurred because the glass was scratched during the building renovation process and the second was the incident where an employee was squeezed by *SPI ASS Which* while working. From these data, it has been confirmed that 1 fatal accident occurred in project A and 1 other in project D, while one non-fatal accident occurred in project C and E respectively. In Table 7, it is explained that only project B did not have a work accident so it was included in the Acceptable (Target) category.

4.4. Project Labor Productivity Coefficient

Quantum index coefficient that shows the project time is required to work on each unit volume of work at a predetermined project time. The smaller the project labor coefficient, the more productive workers in a project are. Because the project labor coefficient is very influential on the Unit Price

Analysis (AHSP). The greater the coefficient, the more the project budget required will increase.

Table 9. Coefficient of Project Labor Productivity (Source: Processed Data (2021)).

Project	Coefficient Plan	Coefficient Realization
A	0.014	0.026
B	0.003	0.008
C	0.014	0.027
D	0.282	0.484
E	0.537	1.236

An example of calculating the Project Labor Productivity Coefficient in Table 9 Project A is as follows:

$$\text{Coefficient} = 27 \times 200.000 \times 1.312 \text{ hour} / 2.570.177 \text{ m}^2 = 0.014$$

Therefore, based on Table 8, it shows that the Realization of the Project Labor Productivity Coefficient is greater than the plan, it can be concluded that each project is less productive in carrying out work.

4.5. Client Satisfaction Index (CSI)

Based on data from the Customer Satisfaction Division of PT. XYZ, the researcher obtained questionnaire data consisting of 6-point questionnaires that are used as assessments, namely project schedule suitability, project budget suitability, quality, effective communication, response/complaint resolution, and the weight of Environmental and Safety Procedures. The calculation results of the Client Satisfaction Index (CSI) are as follows:

Table 10. Client Satisfaction Index (CSI) (Source: Processed Data (2021)).

No.	MIS	MSS	WF	WS	WT	CSI
	a	b	c	d	e=b*c	f
2	1.67	1.87	16.50	30.80		
3	1.70	1.67	16.83	28.05		
4	1.73	1.73	17.16	29.75		
5	1.67	1.60	16.50	26.40	170.14	34.03
6	1.70	1.87	16.83	31.42		
7	1.63	1.47	16.17	23.72		
Total	10.10					

Description:

- MIS = Mean Importance Score
- MSS = Mean Satisfaction Score
- WF = Weight Factors

WS=Weight Score
WT=Weighted Total

An example of calculating the Client Satisfaction Index (CSI) in table 10 Project A is as follows:

Determine the Mean Importance Score (MIS), as follows:

$$MSS = \frac{2+1+1+3+1+2+3+1+1+2+1+3+1+1+3+3+2+1+3+3+1+3+1}{1+3+1+3+1+3+1} = \frac{56}{30}$$

MSS= 1.87

Determine the Weight Factors (WF), as follows:

$$WF = \frac{1.67}{10.10} \times 100 = 16.50$$

Determine the Weight Score (WS), as follows:

$$WS = 16.50 \times 1.87 = 30.80$$

Determine the Weighted Total (WT), as follows:

$$WT = 30.80 + 28.05 + 29.75 + 26.40 + 31.42 + 23.72 = 170.14$$

Determine the Weighted Total (WT), as follows:

$$CSI = \frac{170.14}{5} \times 100\% = 34.03 \%$$

Based on data from Table 9 Client Satisfaction Index (CSI), CSI is at number 34.03 which means it is in

the Dissatisfied category according to table 4 of the CSI Value Scale.

4.6. Fishbone & Pareto Diagram Project Time Aspects

In Figure 7 Fishbone explains the factors that cause project delays. Then these factors are classified into 5 causes in terms of Man, Method, Process, Equipment, and Environment.

In the Man Factor, it was found that the cause of delays was due to frequent work delays and lack of supervision of aspects of workers in the field. This results in workers not being able to complete each activity effectively.

Method factor affects the efficiency of project execution time. In the field, it was found that the factors that caused delays are less optimal project scheduling, planner errors in interpreting planning data, and delays in determining project milestones. These factors are the cause of the delay in the completion of the project in accordance with the project time that has been determined. For example, in determining the location, where the client has not provided a clear location and coordinates in project execution such as land acquisition in building electricity transmission substations in the field.

Environmental factors affect the project completion time. If the environment is not cooperative with the project being carried out, it will certainly be an obstacle in terms of project completion time.

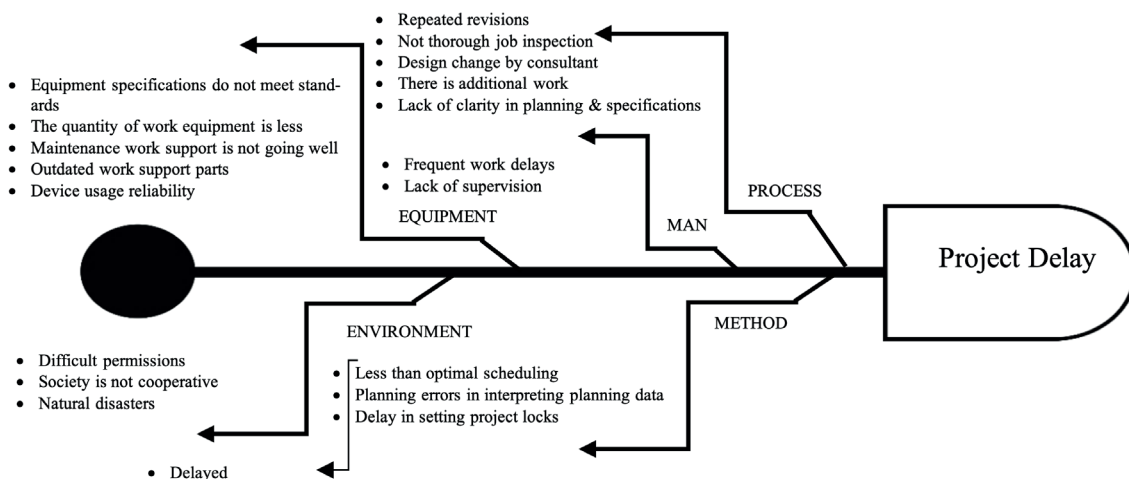


Figure 7. Fishbone Diagram of Project Time Aspects (Source: Processed Data (2021)).

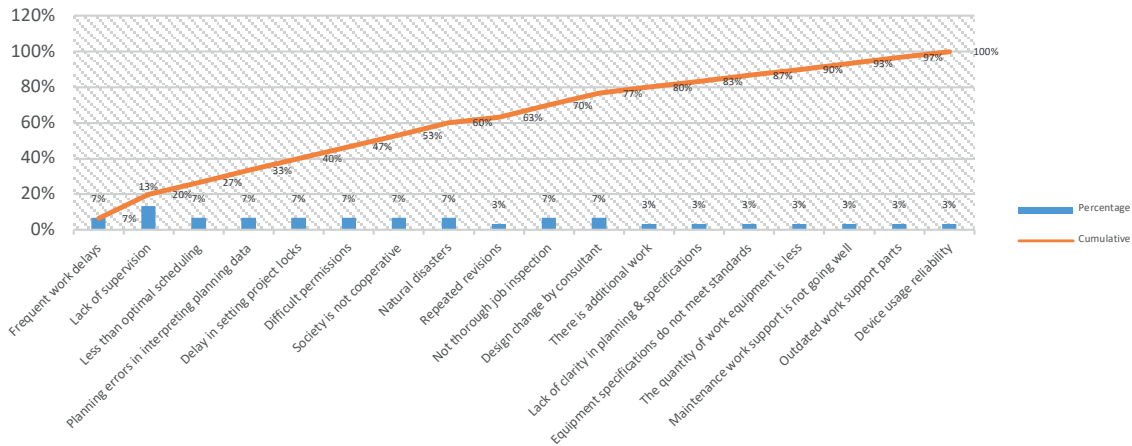


Figure 8. Graph of the Causes of the Project Time Aspect (Source: Processed Data (2021)).

Environmental factors in the time aspect of this project consist of difficult licensing, uncooperative communities, and natural disasters.

The Equipment factor affects the project completion time where the work requires qualified equipment specifications to support project needs. As for the time aspect of the project, the problem factors are that the equipment specifications do not meet the standards, the quantity of work equipment is lacking, maintenance support work does not go well, supporting parts work using, and the reliability of the use of the equipment.

The last factor in project delays is the process in project work caused by repeated revisions, less thorough work inspections, design changes by consultants, additional work, and uncertainty in planning and specifications.

Based on the fishbone diagram in Figure 7, the frequency of each category of causes of accidents is obtained. From this frequency, it will then be analyzed using Pareto analysis to obtain which category should be improved first.

From Figure 8, it can be seen that the highest cause is 13% due to lack of supervision. So in this aspect of project time, the cause of failure to reach the agreed project time is the lack of supervision for the main factor of this aspect.

4.7. Fishbone and Pareto Diagram of Project Cost Aspects

Based on the Figure 9, there are 5 factors that affect project cost overruns (Project Cost Overrun) namely Man, Method, Environment, Equipment and

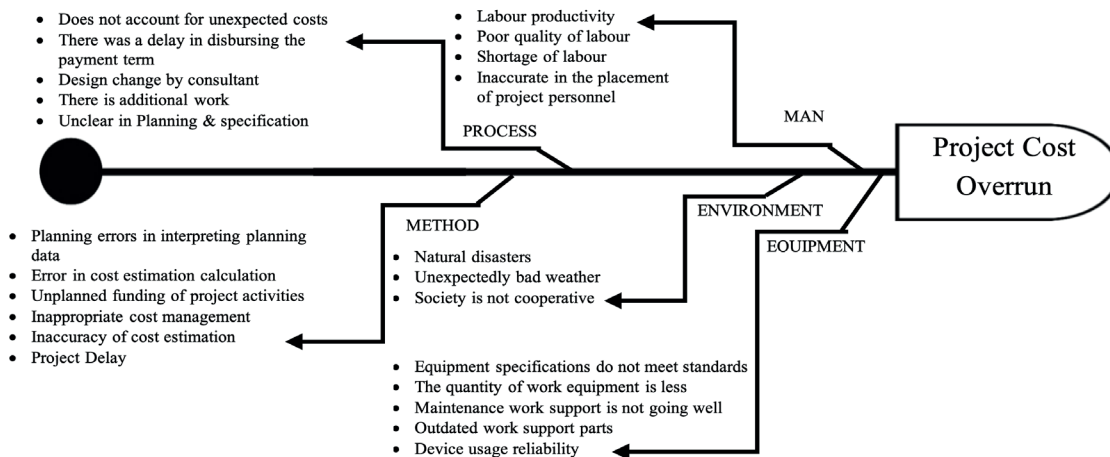


Figure 9. Fishbone Diagram of Project Cost Aspects.

Process. In the Man Factor, it was found that there were 4 sub-factors causing them, including the lack of productivity of project workers, lack of quality of project workers, lack of quantity of project workers, and inappropriate placement of project personnel

In Factor Method, there are 5 sub-factors that become obstacles from the financial side of the project, including planning errors in interpreting planning data, errors in calculating project cost estimates, funding for unplanned project activities, inappropriate project cost management, and inaccuracy of project cost estimates.

In Environmental factors, there are 3 sub-factors, the most significant factor is the lack of uncooperative communities when project work requires approval. For example, at the time of land acquisition, the agreement was very difficult to determine the selling price of land owned by the community for project work.

The Equipment factor affects the project completion time where the work requires qualified equipment specifications to support project needs. As for the time aspect of the project, the problem factors are that the equipment specifications do not meet the standards, the quantity of work equipment is lacking, maintenance support work does not go well, supporting parts work using, and the reliability of the use of the equipment.

The Process factors that become obstacles when working on this project can be seen in Figure 9. Of the 5 sub-factors, the most significant cause of cost overrun is the lack of an unexpected project cost

estimate outside the calculation of the project cost budget plan.

Based on the fishbone diagram in Figure 10, the frequency of each category of causes of accidents is obtained. From this frequency, it will then be analyzed using Pareto analysis to obtain which category should be improved first. Figure 10 is a Pareto analysis table for the case of a cost overrun project.

From Figure 10, it can be seen that the highest cause is 13% due to project delay. So that in the cost aspect of this project, the cause of the project cost overrun is project delay.

4.8. Fishbone and Pareto Diagrams HSE Aspects

The occurrence of accidents is caused by several main factors, including Man, Method, Environment, Equipment and Process and these five factors have varied sub-factors such as the Man factor, the sub-factors include limited knowledge about work safety making workers reluctant to work with tools. protective equipment and get used to what it is without personal protective equipment.

In the case of a project accident, it can be seen in Figure 11. The figure classifies into 5 sections where each section is searched for the frequency of each category causing accidents. From the results of these frequencies, it will then be analyzed using a Pareto diagram to find out which category needs to be repaired first, as shown in the Figure 12.

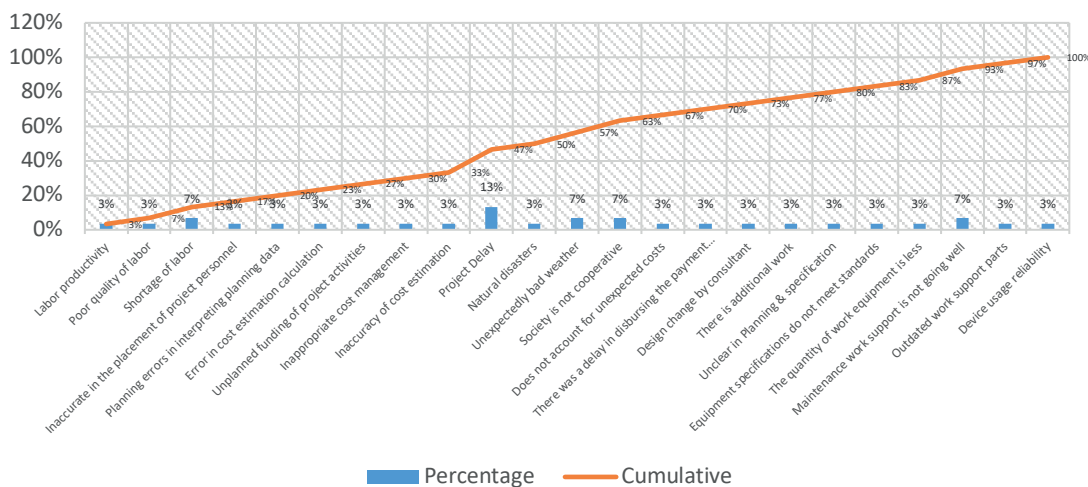


Figure 10. Graph of the Causes of Project Cost Aspects (Source: Processed Data (2021)).

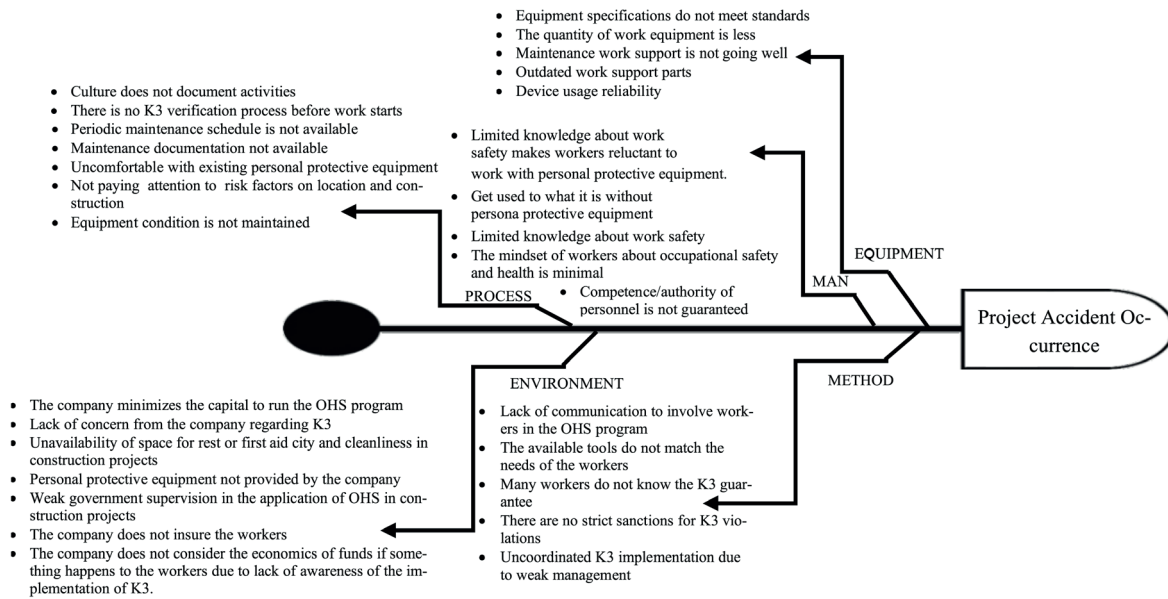


Figure 11. Fishbone Diagram of Occupational Safety Aspects (Source: Processed Data (2021)).

From Figure 12, it can be seen that the highest cause is 13% due to no K3 verification process before work begins. So in this work safety aspect, the cause of the work accident project is that there is no K3 verification process before the work begins.

4.9. Fishbone and Pareto Diagrams Quality Aspects

From the data collection and observation, it is known that there are differences in the primary and secondary

factors of the dimensions of employee service quality between the target dimensions of employee service quality and user expectations. Differences or discrepancies in the dimensions of employee quality to customers require an action that can overcome these problems. Fishbone analysis in Figure 13 is an analytical technique that uses a diagram showing the relationship between cause and effect to help identify the root cause of a problem, in the fishbone case in Figure 13, it explains the 5 causal factors in terms of Man, Method, Environment, Equipment, and Process.

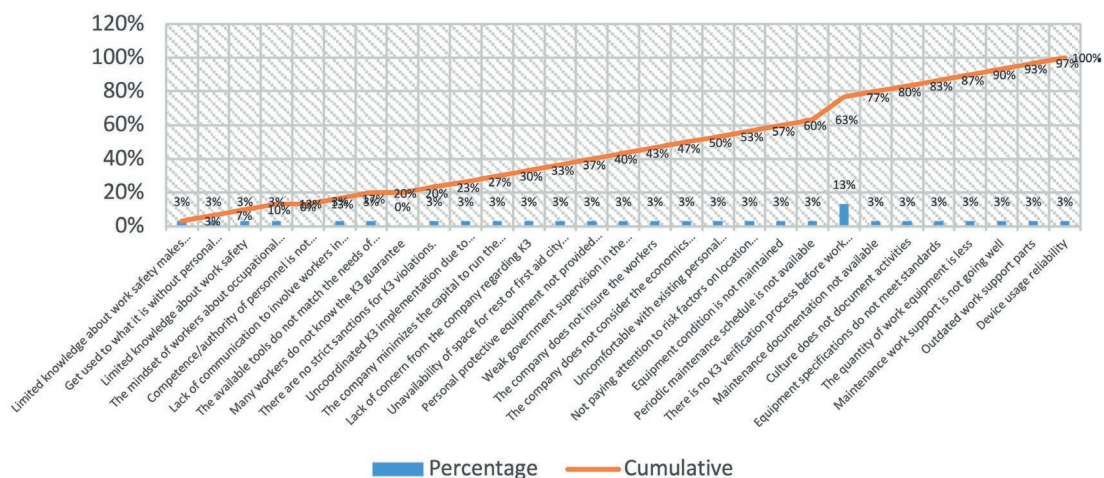


Figure 12. Graph of Causes of Safety Aspects (Source: Processed Data (2021)).

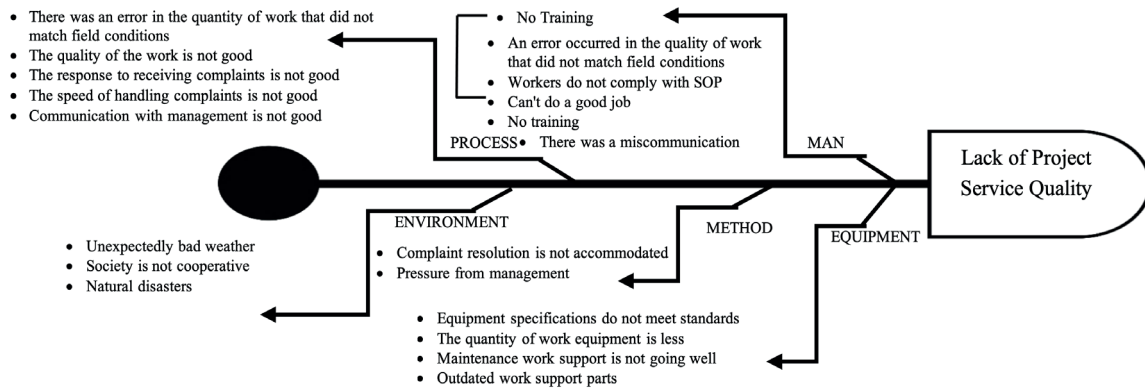


Figure 13. Quality Aspect Fishbone Diagram (Source: Processed Data (2021)).

In the case of the cause of the project accident, it can be seen in Figure 13. The figure classifies into 5 sections where each section is sought for the frequency of each category of cause of accidents. From the results of these frequencies, it will then be analyzed using a Pareto diagram to find out which category needs to be repaired first, as shown in the diagram Figure 14.

From Figure 14, it can be seen that the highest cause of 17% was due to no training. So that in this aspect of decreasing quality, it is caused by no training and further improvements need to be made in terms of SOPs and management.

4.10. Fishbone & Pareto Diagram Aspects of Project Workforce

From the results of Figure 15 on the decline in the performance of the project workforce seen in the Man, Method, Environment, Equipment, and

Process aspects, it is known that the aspects in the Figure 15. The Man aspect is caused by several causes including errors in the quality of work that do not match field conditions, Workers not complying with SOPs, Unable to carry out work properly and so on as well as other factors.

In the case of a decrease in the performance of the project workforce, it is divided into 5 parts where each section is sought for the frequency of each category of causes of accidents. From the results of these frequencies, it will then be analyzed using a Pareto diagram to find out which category needs to be repaired first, as shown in the Figure 16.

From Figure 15, it is known that the highest cause of 17% is due to the discipline of project workers is not good. While the next cause is 10% as a result of the selection process is No worker supervision. So that in the aspect of decreasing the performance of this project's workforce, the thing that needs to be improved is the problem of worker discipline.

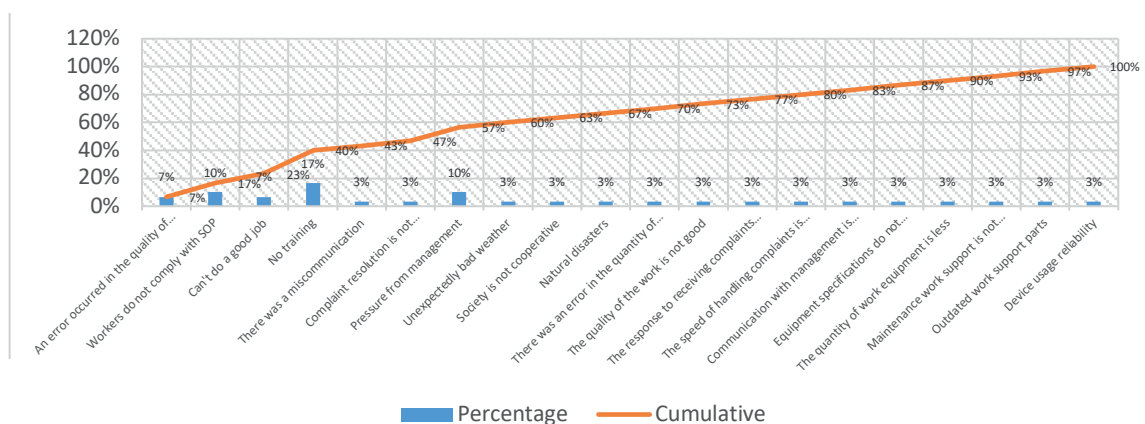


Figure 14. Graph of Causes of Quality Aspects (Source: Processed Data (2021)).

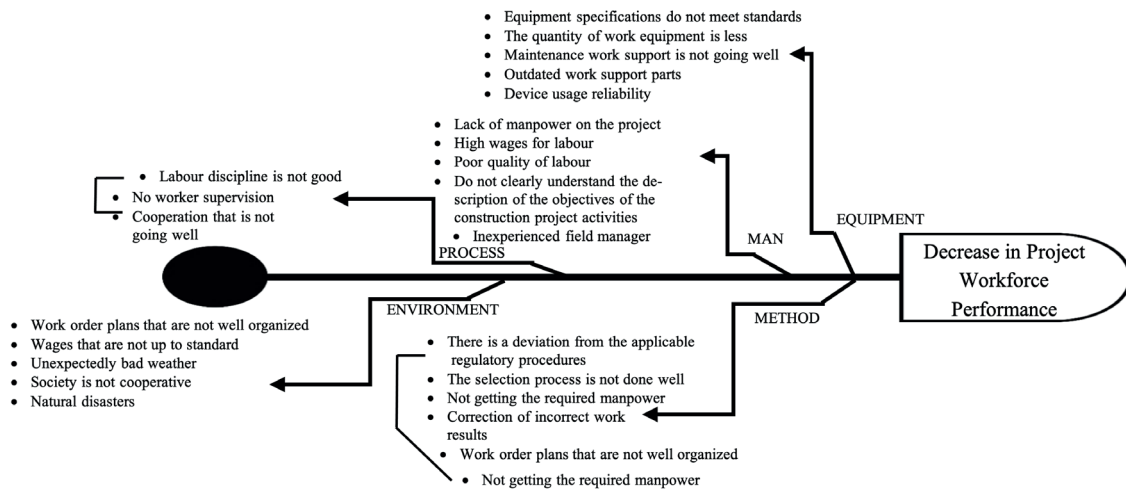


Figure 15. Fishbone Diagram of Project Workforce (Source: Processed Data (2021)).

5. Conclusion and Suggestion

5.1. Conclusion

This index becomes a reference in finding what factors are the cause of the decline in the index, from the results of the analysis using the fishbone and Pareto methods found the causal factors, among others:

1. The factors causing the discrepancy in the realization seen from the aspect of the project time of PT. XYZ from the results of the analysis using the fishbone method. The causative factors are found based on Figure 7 both in terms of process, man, environment, equipment, and method. Based on Figure 8 the most dominant factor is due to lack of supervision.

2. The factors causing the discrepancy in the realization seen from the aspect of the project cost of PT. XYZ from the results of the analysis using the fishbone method. The causative factors are found based on Figure 9 both in terms of process, man, environment, equipment, and method. Based on Figure 10 the most dominant factors are project delay.

3. The factors causing the discrepancy in the realization seen from the aspect of labor PT. XYZ from the results of the analysis using the fishbone method. The causative factors are found based on Figure 15 both in terms of process, man, environment, equipment, and method. Based on Figure 16, the most dominant factor is due to poor discipline of project workers.

4. The factors causing the discrepancy in the realization seen from the aspect of the project

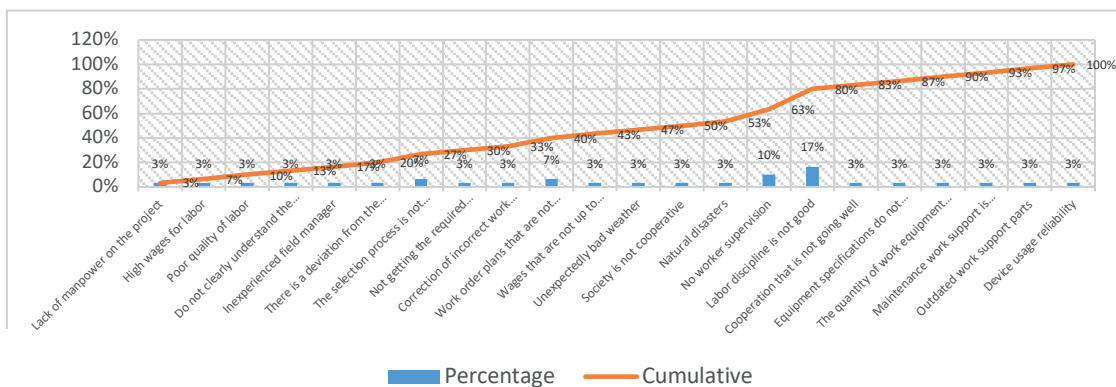


Figure 16. Graph of the Causes of Project Labor Aspects (Source: Processed Data (2021)).

- quality of PT. XYZ from the results of the analysis using the fishbone method. The causative factors are found based on **Figure 13** both in terms of process, man, environment, equipment, and method. Based on **Figure 14**, the most dominant factor is caused by no training.
5. The factors causing the non-conformance of realization seen from the HSE aspect of the PT. XYZ from the results of the analysis using the fishbone method. The causative factors are found based on **Figure 11** both in terms of process, man, environment, equipment, and method. Based on **Figure 12** the most dominant factor is caused by There is no K3 verification process before work starts.
 6. Based on **Figures 7 and 8** things that need to be done in minimizing the discrepancy in the realization seen from the aspect of PT. XYZ is to further improve the supervision of workers by building a performance monitoring system.
 7. Based on **Figures 9 and 10** things that need to be done in minimizing the discrepancy in the realization seen from the aspect of the project cost of PT. XYZ is to by increasing project scheduling where work that should be done simultaneously cannot be realized it increases the duration and affects the completion and cost of the project. If this can be overcome, the work will be more efficient so that it can reduce the rental rate for project needs and project delays can be minimized.
 8. Based on **Figures 15 and 16** things that need to be done in minimizing the discrepancy in the realization seen from the aspect of labor PT. XYZ apart from the discipline of workers must be further improved. These two causes actually intersect each other so that with the construction of a good project supervision system, it will be in line with the discipline of workers towards a significantly better direction.
 9. Based on **Figures 13 and 14** things that need to be done in minimizing the discrepancy in the realization seen from the aspect of project quality PT. XYZ is to build worker skills by holding training. With the hope that the training will improve services that will be enjoyed by customers and increase interest in the company's services.
 10. Based on **Figures 11 and 12** things that need to be done in minimizing the discrepancy in the realization seen from the HSE aspect of the PT. XYZ is to further improve the readiness process of workers before starting their work. Construction K3 standards must be further improved so as to minimize the occurrence of work accidents during project work.

5.2. Suggestion

Here are some suggestions that the author can give from the results of this study:

1. In the aspect of project time, management should tighten supervision of the Man (Human) aspect in the project work process so that there is no work process that is ineffective in utilizing project time and work delays.
2. In addition, to be more efficient in the aspect of project costs, the authors suggest the management of PT. XYZ to see more about the progress of the completion of the work so that it is as expected and pay more attention to the accuracy of project work.
3. The author's suggestion on the occupational safety aspect should be that the OHS section of the project can do a crosscheck first so that the verification process before the work can run well.
4. In terms of quality, the suggestion to be given is for project management to upgrade the skills of workers by providing trainings that support work more effectively and efficiently.
5. The next aspect is the aspect of the project workforce, the authors suggest that management should tighten supervision so that worker discipline will work well to achieve project goals in accordance with the project contract agreement.

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