Enhancing Project Delivery and Resource Optimization: Analysis of Project Management Group Processes and Knowledge Areas at X-Camp PT XL Axiata Tbk

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Abstract. The IoT market's rapid growth in Indonesia offers opportunities for market leadership. X-Camp PT XL Axiata Tbk., Southeast Asia's first IoT open lab linked to GSMA's Mobile IoT Open Lab Alliance, has potential in this trend. To boost effectiveness and efficiency, enhancing project management in product development is essential. This research identifies reasons for project delays and budget issues at X-Camp, suggesting improvements. Utilizing Project Management Process Group and Knowledge Areas Analysis, data collection included observation, interviews, historical data analysis. Thematic analysis highlighted critical knowledge areas. Root cause analysis uncovered issues like undefined scope and limited skills. The study informs X-Camp's project management, enhancing operations. Proposed improvements and plans address root causes, facilitating change.

Keywords: Internet of Things, Product Development, Performances, Project, Project Management

1 Introduction

1.1 Background

A project, as defined by the Project Management Institute, is a temporary endeavor aimed at achieving a unique expected outcome. It possesses a distinct start and end, and successful completion hinges on meeting objectives or addressing infeasibility, lack of necessity, or client requests [1]. To manage projects effectively, PMI emphasizes the application of knowledge, skills, tools, and techniques, encompassing initiation, planning, execution, monitoring and controlling, and closing stages. [1] Effectiveness and efficiency are key goals – effectiveness entails producing a desired result, while efficiency involves achieving desired results without wasting resources. [2]

The Internet of Things (IoT) is rapidly reshaping various industries, including Indonesia's, by extending network connectivity and computing capabilities to everyday objects.[3] The nation's IoT sector is set to integrate a multitude of sensors across sectors, propelling market growth to an estimated value of Rp 444 trillion by 2022, with potential for Rp 1,620 trillion in the next five years.[3] Within this landscape, X-Camp PT XL Axiata Tbk., Indonesia's pioneering IoT

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open laboratory, emerges as a pivotal player.[4] Backed by PT XL Axiata Tbk.'s resources and brand strength, X-Camp's strategic programs, including the Incubation Program, Enterprise Engagement, and IoT Academy, position it at the forefront of IoT innovation in Indonesia.[4]

However, in the face of Indonesia's burgeoning IoT landscape, effective and efficient project management is crucial.[2] Given X-Camp's role, refining project management processes becomes paramount. By optimizing project management strategies, X-Camp can ensure the timely and cost-effective delivery of IoT solutions, solidifying its status as a market leader and contributing to the growth and sustainability of the IoT industry.

1.2 Problem Statement

An initial analysis was conducted on X-Camp XL Axiata's weekly reports and annual budget planning, uncovering instances of project delays. X-Camp uses a Gantt chart within Microsoft Excel to track project progress, which includes project specifics, task details, responsible parties, task status (categorized as "On Track," "Dragged" for delays, "Critical" for significant delays, and "Hold" for postponed tasks), and associated deadlines.

In several of X-Camp's projects, notable delays were observed: Plan 4 Site (PoC) experienced a 48% delay within a 3-month period (March to May 2023), PT ETA's (Visual Inspection/QC) Development faced a 58% delay over 5 months (January to May 2023), and the 5G Automation Logistic Drone project encountered a 54% delay with an 8% critical delay over a 4-month span (January to April 2023).

Table 1. X-Camp's Budget vs. Actuals Analysis in 2021

2021 - Budget vs. Actuals Analysis

Initiative	Objective	Scope of Work	CAPEX Planned	Actual Usage	CAPEX Actual Usage	CAPEX Difference (Actual - Planned)	CAPEX Difference (%)
Commercial Use Case Development	The program aimed to address requests coming from client for potential commercial use-case development.	The program aimed to address requests coming from client for potential commercial use-case development.	Rp338,424,000	Vaccine Temperature Monitor Development	Rp36,000,000	-Rp184,424,000	-54.49%
				Fridge Monitoring Product Sample	Rp50,000,000		
				Smart Energy Meter Development	Rp68,000,000		
Internal Product Catalogue	To complement our portfolio and build flexibility/agility in delivering customized solutions for potential engagements in the future, it is necessary to have a solid product catalogue as our underlying product foundation.	- 20 Prototyping - 12 Product Sample - Field PoC	Rp286,729,734	Internal Prototyping - MBKM Project	Rp52,000,000	-Rp158,729,734	-55.36%
				Internal Prototyping - 5G IoT Component	Rp76,000,000		
External Co-development program	As a result of our active ecosystem building activities, we have a network of startups and developers who might have commercial leads in their own commercial pipeline	2 Co-development project	Rp70,505,000	IoT Product Sample - XLFL IMDP 2021	Rp221,000,000	Rp150,495,000	213.45%
Total Proposed Budget (IDR)			**Rp695,658,734**		**Rp503,000,000**	**-Rp192,658,734**	**-27.69%**

Table 2. X-Camp's Budget vs. Actuals Analysis in 2022

2022 - Budget vs. Actuals Analysis								
Initiative	**Objective**	**# of unit**	**CAPEX Planned**	**Actual # of unit**	**Actual Usage**	**CAPEX Actual Usage**	**CAPEX Difference (Actual - Planned)**	**CAPEX Difference (%)**
Commercial - Use Case	Ready to Sell IoT Product	10	Rp472,007,120	2	XL Home Installation - Xcamp	Rp1,000,000	-Rp116,007,120	-24.58%
					Site Monitoring Development	Rp55,000,000		
					Workstation for X-Camp AI/ML Processing	Rp300,000,000		
Internal Product Catalogue	XLFL IMDP 2022 IoT Use Case Prototyping	18	Rp251,997,166	16	IoT Product Sample - XLFL IMDP 2022	Rp262,000,000	Rp10,002,834	3.97%
Internal Use Case Dev	To Help Internal Needs to Reduce OPEX with IoT Solutions	2	Rp134,995,892	1	GCP - Xcamp	Rp30,000,000	-Rp29,995,892	-22.22%
					IoT Lab Tools, Equipment & Component	Rp75,000,000		
External Co Dev - Use Case	Agriculture - IPB; Manufacture - Poltek Astra; Industri - UGM	1	Rp199,999,822	1	Co-Development of 5G AI Use Cases	Rp48,000,000	-Rp151,999,822	-76.00%
Total Cost (IDR)		31	**Rp1,059,000,000**	20		**Rp771,000,000**	**-Rp288,000,000**	**-27.20%**

The provided figures illustrate X-Camp's budget planning and capital expenditure for 2021 and 2022, with a -27% difference between planned and actual expenses. In 2022, achieving only 64.52% of goals and incomplete OPEX activities highlight suboptimal budget use. These findings emphasize the need for improved project management to enhance X-Camp's product development efficiency and effectiveness.

1.3 Research Questions

To define the research objectives below, the study needs to address these key questions:

1. What's causing project delays at X-Camp?
2. What's leading to inefficient budget usage at X-Camp?
3. How can we suggest practical improvements to fix these problems?

1.4 Research Objective

The objectives of this research are:

1. To ascertain the root causes of project delays at X-Camp.
2. To identify the factors responsible for the suboptimal utilization of budgets at X-Camp.
3. To put forward viable recommendations aimed at addressing the identified issues within X-Camp's projects.

1.5 Scope and Limitation

This study delves into X-Camp's product development process, focusing on issues identified and analyzed from 2021 to 2022, along with problems and delays in project management activities during Q1 and Q2 of 2023. The goal is to comprehensively analyze project management practices within X-Camp's product development, prioritizing critical knowledge areas defined by the Project Management Institute (PMI). The study acknowledges limitations, with findings tailored to X-Camp and specific timeframes, and focuses on selected knowledge areas most pertinent to their projects. Data accuracy and completeness, as well as contextual factors, will impact the study's conclusions, relying on X-Camp's data from 2020 to 2022.

2 Theoretical Foundation

2.1 Project

A project is a temporary endeavor with a defined beginning and end, aiming to achieve a unique outcome.[1] This outcome could be a tangible or intangible product, service, or result. Despite potential repetitive actions, each project retains its individuality due to distinct circumstances, stakeholders, resources, and multifunctional aspects.

2.2 Project Management

Project management could be defined as:

"Project management is the art of creating the illusion that any outcome is the result of a series of predetermined, deliberate acts when, in fact, it was dumb luck." [5]

The goal of project management is to efficiently utilize the resources at hand to achieve desired outcomes by coordinating work both horizontally and vertically within an organization. This is done to increase the effectiveness and efficiency of a project. Project management involves a set of procedures that can be categorized into five different groups:

2.3 Project Management Process Group and Knowledge Area Mapping

PMI outlines five essential Project Management Process Groups applicable to all projects, regardless of industry.[1] These groups—Initiating, Planning, Executing, Monitoring and Controlling, and Closing—interact dynamically within and between them. These interaction, involve inputs and outputs, fostering continuity and progress. Notably, Process Groups aren't synonymous with project phases, as they can be carried out within a single phase or across multiple phases. The Initiating Process Group secures project authorization, the Planning Group refines objectives and strategies, the Executing Group fulfills project work, the Monitoring and Controlling Group tracks and adapts project progress, and the Closing Group formally concludes the project. This framework ensures efficient project management and successful outcomes.

2.4 Generic Product Development Process

The process of product development follows a methodical series of stages to convert concepts into products that can be brought to market, including planning, concept development, system-level design, detail design, testing and refinement, and production ramp-up. This process emphasizes understanding market needs, generating concepts, designing components, and testing prototypes to ensure functionality and customer satisfaction. Each organization's unique approach highlights the diversity in how these phases are executed.[6]

2.5 Cause and Effect Diagram

The cause-and-effect diagram, also known as the fishbone diagram, was devised by Ishikawa Kaoru and is a fundamental quality tool for structured problem-solving.[7] It involves identifying major cause categories branching from a central problem statement, generating possible causes for each category, and further probing "Why does this happen?" to uncover sub-causes, helping to understand causal relationships and address problems effectively.[8]

2.6 Critical Path Method

The Critical Path Method (CPM) is a mathematical algorithm crucial for scheduling project activities in various domains, offering a structured approach to identify and manage dependencies.[9] By constructing a project model including activity durations and dependencies, project managers determine the critical path – the sequence of essential activities that must be completed on time for timely project completion. This method aids in setting start and end times, estimating project completion, and calculating slack and float time.[10] CPM involves components like ES, EF, LS, LF, T, and S, and employs forward and backward passes to determine critical activities and network flexibility.

3 Methodology

3.1 Problem Identification

The first stage of this research entails an evaluation of the current state of project management, specifically in the area of scheduling, at X-Camp PT XL Axiata Tbk. The researcher will commence by recognizing and defining the problem of project delays and inefficient budget utilization in past projects, and setting appropriate research questions and goals. To achieve this, the researcher will collect data on project management and the impact of delays on the company's finances and product development quality. This information will be obtained through interviews, on-site observations, and the collection of historical data.

3.2 Data Collection

3.2.1 Primary Data

This data is unique and directly collected for the specific research at hand, utilizing techniques like on-site observations, interviews, and the company's historical records.

3.2.1.1 Observation

The researcher employed active observation as a data collection method, closely observing and recording behaviors, interactions, and activities of project participants at X-Camp to gain deep insights into project management practices, challenges, and dynamics. This approach provided qualitative data that complemented interviews and document analysis, revealing implicit knowledge and enhancing understanding of project execution, team collaboration, and decision-making. The researcher's immersion in the project context uncovered valuable insights into implementation details, bottlenecks, and factors affecting project outcomes, contributing to comprehensive findings and conclusions.

3.2.1.2 Interview

The research involves conducting interviews with internal human resources at X-Camp as a primary data collection method. Interviews are chosen for their capacity to yield detailed insights despite a small participant count. By engaging in one-on-one interviews, either face-to-face or online, the researcher aims to delve into participants' experiences and perspectives, uncovering root causes of project delays, proposing improvements, and enhancing future projects. A semi-structured interview format is employed for a balanced approach, offering

consistency while allowing exploration of specific topics and individual viewpoints. This fosters an open environment and enables the collection of valuable qualitative data to uncover project delay causes, suggest effective enhancements, and gain insights for similar projects ahead.

3.2.2 Secondary Data

The research utilizes academic articles, textbooks, case studies, industry reports, and regulations related to project management and IoT product development. These sources validate issues in X-Camp's project management and support suggested improvements.

3.2.2.1 Historical Data

This research involves gathering historical data on project scheduling, actualization, and financial planning to identify time delays and budget utilization. The data scope spans from January 2020 to December 2022 in line with X-Camp's available information, considering annual planning and evaluation cycles.

3.3 Data Processing

Using NVivo analysis, deductive coding will categorize interview data into Project Management Processes and Knowledge Areas, focusing on critical Knowledge Areas that affect project delays and budget usage. A root cause analysis via a fishbone diagram will explore underlying factors, guiding impactful recommendations from theories and frameworks. An implementation plan will be crafted for practical application, aiming to improve project delivery and budget optimization at X-Camp.

3.4 Conclusion and Recommendation

In the Conclusion, vital data analysis findings will spotlight key knowledge areas impacting X-Camp's project delays and budget use, emphasizing root causes. In Recommendations, tangible resources such as finance, technology, and human capital, along with intangible resources like culture and communication, will be identified for implementing changes and ensuring successful project management practices. This comprehensive approach aims to facilitate effective implementation of the proposed improvements.

4 Data Analysis

4.1 Business Situational Analysis

4.1.1 Interview Coding

The researcher utilized NVivo, a qualitative data analysis software, employing deductive coding aligned with the Project Management Process Group and Knowledge Area framework to analyze interview data. The structured approach involved hierarchical nodes corresponding to major project phases, Knowledge Areas, and individual Processes. This method enhanced consistency, reliability, and validity, facilitating systematic analysis of data related to project management principles and identifying areas for improvement at X-Camp.

4.1.2 Interview Results

Fig. 1. *Hierarcy Chart of Codes*

The interview analysis aimed to uncover factors behind project delays and budget inefficiencies, employing hierarchical coding for data organization. Key areas were illuminated, with Project Schedule Management in the Planning Group having the highest code references (73). Notably, processes like Plan Schedule Management, Define Activities, and Estimate Activity Durations received significant attention. The Executing and Monitoring/Controlling Groups, specifically the Control Schedule process, garnered 38 references. Recurring issues were identified within the Planning and Executing, Monitoring, and Controlling Groups, encompassing challenges in estimation, external factors, resource competence, and risk management. These findings serve as a basis for addressing root causes and enhancing project management at X-Camp.

4.2 Root Causes Analysis

In the Root Causes Analysis section, a thorough examination of project delays and suboptimal budget utilization was conducted using cause-and-effect diagrams. The cause and effect diagram visually represented factors influencing these issues, with Knowledge Areas identified as causes. For project delays (Figure 1), key factors included undefined scopes, limited project management skills, inadequate planning tools, external dependencies, inadequate change management, and reactive risk management. For suboptimal budget utilization (Figure 2), root causes encompassed undefined scopes, ineffective budget planning and estimation, external dependencies, insufficient cost monitoring on partners, and inadequate resource allocation and competence within X-Camp's internal resources. Each identified root cause was linked to specific Knowledge Areas and Process Groups, offering a comprehensive understanding of contributing factors.

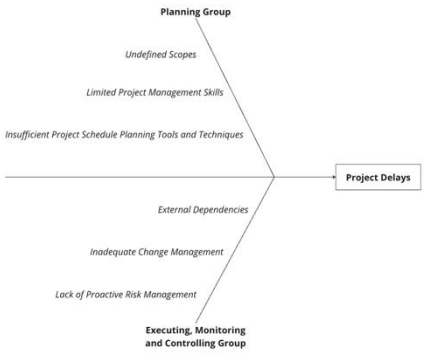

Fig. 2. *Cause-and-Effect Diagram of Project Delays*

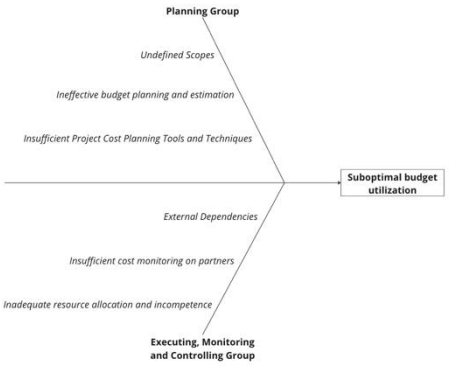

Fig. 3. *Cause-and-Effect Diagram of Suboptimal Budget Utilization*

4.3 Proposed Improvement

To address the core issues of project delays and suboptimal budget utilization at X-Camp, a comprehensive set of proposed improvements has been devised. Each of these improvements targets specific root causes, with the aim of fortifying project management practices and enhancing overall project outcomes.

Utilize Critical Path Method (CPM): Transitioning from conventional Gantt charts to CPM enables X-Camp to visualize complex project dependencies, accurately estimate activity durations, and identify critical tasks. This adaptable approach enhances project flexibility and resilience.

Enhance Project Management Competencies: Elevating project management skills through targeted training equips X-Camp's team with leadership, communication, and problem-solving abilities. A culture of knowledge sharing nurtures ongoing improvement, supported by mentorship.

Clearly Define Project Scopes: Establishing precise project scope statements ensures alignment among stakeholders, minimizes ambiguity, and curbs scope creep. This collaborative approach safeguards project clarity.

Implement Robust Risk Management: A comprehensive risk management strategy addresses external dependencies, risk mitigation, change control, and stakeholder engagement. It enhances project stability, minimizes disruptions, and bolsters effective decision-making.

5 Conclusion and Recommendation

5.1. Conclusion

This study aimed to tackle project delays and suboptimal budget utilization at X-Camp. Using project management analysis, data was collected from interviews, observations, and records, highlighting critical issues in project schedule management. Root causes were identified, leading to proposed solutions like adopting the Critical Path Method, enhancing skills, clarifying scope, and implementing robust risk management. These recommendations aim to improve project efficiency, mitigate issues, and elevate overall performance.

5.2. Recommendation

For successful implementation of the suggested improvements, consider the following factors. People Factor; Maximize resources like project management interns through education and training alongside permanent staff to bolster capabilities without new hires. Outsourcing experts can enhance internal knowledge. Technology Factor; Leverage XL Axiata's infrastructure, adopting tools from departments like Microsoft Project to enhance the critical path method and scheduling. By enacting these improvements, X-Camp can refine project management, target root causes, and ensure sustained success through evolving practices.

By considering these elements and enacting the proposed improvements, X-Camp can refine project management. Adapting resources and integrating appropriate tools will target identified root causes, fostering improved project outcomes. A continuous evaluation process will ensure evolving project management practices for sustained success.

References

[1] Project Management Institute. A Guide to the Project Management Body of Knowledge (PMBOK Guide). 6th ed. Project Management Institute; 2017.
[2] Encyclopædia Britannica Inc. How to Use Effective and Efficient. 2023;
[3] Telkom Indonesia. Teknologi IoT di Indonesia. 2022;
[4] X-Camp PT XL Axiata Tbk. X-CAMP Rumah IoT Indonesia. 2018;
[5] Kerzner H. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. 10th Edition. New Jersey: John Wiley & Sons, Inc.; 2009.
[6] Ulrich KT, Eppinger SD. Product Design and Development. 6th ed. New York: McGraw-Hill Education; 2016.
[7] IONOS. Fishbone diagram | The cause-effect diagram explained. 2020;
[8] American Society for Quality. What is a Fishbone Diagram? Ishikawa Cause & Effect Diagram. 2023;
[9] Jesse J, Magallon D. Critical Path Method. 2009;
[10] Zakia, Febrianti D. The Critical Path Method in Construction Project Rescheduling. IOP Conf Ser Earth Environ Sci 2021;832(1):012009.