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Analysis of Control of Building Construction Project Implementation in West Papua Province

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ABSTRACT

The implementation of development projects in West Papua Province often experiences time extensions due to various factors, including technical issues, human resources, socio-cultural aspects, and material logistics. Additionally, construction projects in this region frequently face challenges due to the significant distance from major logistics centers. Therefore, it is necessary to analyze the influencing factors and control strategies. This study employs the Delphi method, involving construction experts in West Papua, including respondents from academia, construction specialists from service providers, and public works officials representing service users. The study distributes questionnaires to respondents to collect expert opinions, which are then processed to reach an agreement or consensus on each expert's opinion. The factors influencing project costs have scores ranging from 4.3 to 4.6, indicating that respondents strongly agree that these aspects contribute to project expenses. In terms of scheduling, the scores range from 3.9 to 4.7, showing that respondents also consider this a significant factor in project delays. Regarding quality, the average scores range from 4.2 to 4.6, demonstrating that this factor is perceived as highly influential on project quality. Based on the analysis results, the factors affecting cost control include ineffective cost supervision, price fluctuations, and execution method errors. The factors influencing time control are scope changes, financial issues, lack of supervision, and insufficient project coordination. The factor affecting quality control is the lack of on-site supervision. Strategies that can be implemented for cost, schedule, and quality control include utilizing project management software such as BIM and Microsoft Project, conducting material quality testing, implementing quality management systems, and conducting regular monitoring of project progress.

1. INTRODUCTION

The development of West Papua is one of the main priorities of the Indonesian government, especially in the welfare approach based on seven indigenous territories. Accelerating development in Papua and West Papua has several challenges, including poverty, security issues, and economic disparities between coastal and mountainous areas.

West Papua is a province of Indonesia located on the island of New Guinea or Development of West Papua, which is located in the western part of New Guinea, should prioritize development with humanity in mind, but at the same time the physical aspects of development should not be neglected. Improve licensing bureaucracy and improve health service delivery. Development in West Papua will be carried out with a transparent approach and oversight of all activities. Effective assistance and support from the central government as needed will be provided.

Currently, with the existence of the New Autonomous Region (DOB) of Papua Province, there will be new infrastructure development, especially the provincial office area. The construction of this office requires good and effective project management in order to produce the right quality, on time, at the right cost. Construction management is the process of organizing, managing, and controlling all aspects of a construction project, from planning, implementation, to maintenance and maintenance after the project is completed. The purpose of construction management is to reduce delays and costs of construction projects and reduce the risks that arise. The application of construction management varies depending on the type and scope of the project. For example, in a housing development project, construction management includes design, procurement of building materials, labor management, time management, cost management, risk management, and others. For large-scale civil engineering projects such as buildings, construction management can be more complex, including architectural design, structural design, procurement of construction materials, labor management, time management, cost management, risk management, and project management.

The implementation of development in West Papua Province often experiences extended time due to various factors, including technical, human resources, socio-cultural, and material logistics issues. The complexity of the challenges faced includes technical aspects, logistics, human resources, and local social and cultural dynamics. In addition, the

implementation of construction projects in the region is often constrained by significant distances from major logistics centers. This results in difficulties in the procurement and delivery of construction materials, especially those that must be imported from outside Papua, resulting in an extension of the overall construction time.

2.

LITERATURE REVIEW

Construction management

Planning, organizing, leading, and supervising company resources to achieve short-term goals is known as project management. In addition, project management uses a system approach and vertical and horizontal hierarchy (flow of activities) (Soeharto, 1995). According to Rani, H.A. (2016), projects are activities carried out with limited time and resources to achieve the desired end result. All project efforts are limited by budget, schedule, and quality, known as the three constraints, to achieve the end result. Planning is the first stage in project management that is critical to achieving project goals. This stage involves defining project objectives, creating a schedule, estimating costs, and determining the resources required.

Delphi method

The Delphi method is a method that harmonizes the communication process of a group so that an effective process is achieved in obtaining solutions to complex problems (Marimin, 2004). The Delphi method is expected to get opinions, consensus or qualitative problems. The expert group will usually ask a problem to each group member by circulating a questionnaire, the Delphi method is used as a group opinion filter whose participants consist of experts who have competence in their fields. (Ciptomulyo, 2001).

The Delphi method will collect the thoughts of experts who have competence in their fields by using questionnaires and additional reciprocal opinions. The Delphi technique is used as a tool in collecting data on construction implementation control strategies in West Papua that are selected and collected based on expert judgment.

Construction project control

According to Soeharto (1995), project control means supervising, investigating, making corrections, and guiding project operations toward predetermined goals. Controlling, also referred to as control, is the process of establishing results, evaluating the work, and taking corrective action if necessary. Since prior planning is required, this process can be carried out. This is because the essence of control is to compare what should happen with what has happened (Ervianto, 2002).

In practice, there are many methods and applications that can be used to control construction projects, such as Critical Chain Project Management and Root Cause Analysis to monitor project schedules and costs. In addition, applications such as Microsoft Access can assist in the control of construction projects by using variance analysis and the earned value concept, which can provide information about project implementation quickly rather than just providing information about the project schedule.

Construction project

control is very important to ensure the completion of the project efficiently, effectively, and according to plan. Construction project control includes many things, such as supervision of schedule, cost, quality, resources, and risks; implementation of occupational safety and health (OHS) control systems and preventive and corrective actions to reduce cost performance risks.

Activity on arrow (AOA)

According to Lenggogeni (2013), this method is in the form of circles and arrows. These arrows and circles represent project activities; the circles are events, and there is a node called the "J" node at the head of the arrow that connects all the activities together. In terms of terms, these are the terms used in forward and backward calculations. While dummy is an activity with zero duration that only shows the problem relationship between activities.

Ervianto (2013) states that arrows and circles form AOA. The arrows indicate activities that occur, with the node at the bottom of the arrow called node I and the node at the head of the arrow called node J. The reasons for using the arrow method are as follows: 1. Activities are part of the project, 2. Events are the most important points during the project, 3. Dummy activities are artificial activities with zero duration and show the relationship between activities.

The terms in AOA include: a. Early Start (ES): the earliest time an activity starts after the previous activity is completed. If this time is expressed in hours, then this time is the earliest hour the activity is completed, b. Late Start (LS): the latest time after the activity is completed without slowing down the completion of the project schedule, c. Early Finish (EF): the earliest time an activity can be completed if it starts at the earliest time and is completed according to its duration, d. Late Finish (LF): the latest time an activity can be started without delaying the completion of the project.

Precedence Diagramming Method (PDM)

Precedence Diagramming Method (PDM) is one of the scheduling techniques included in the Work Network Plan or Network Scheduling Technique. PDM is a more complex version of Activity on Node-AON-in contrast to AOA, which focuses on arrows. Therefore, PDM is sometimes also called Activity on Node (Callahan, 1992). The differences between Activity on Ayrow (AOA) and PDM are as follows. 1. In AOA, activities are displayed with arrows, while AON and PDM use nodes. In AOA, the shape of the node is a circle, while in AON and PDM the shape of the node is a rectangle, 3. The size of nodes in AON and PDM is larger than AOA nodes because they contain more information, 4.

Table 1 Simple PDM

Activity	Activity before
A	-
B	-
C	A, B
D	A, B

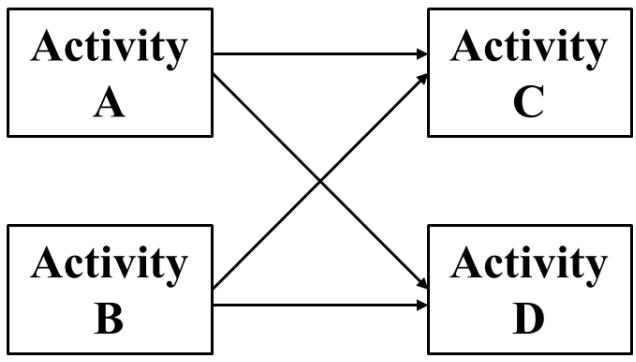

Figure 1. Simple PDM

A project scheduling method called PDM (Precedence Diagram Method) method is used to determine the critical path of the project, this method is used to analyze the relationship between activities and determine how long it takes to complete the various stages of the project. The PDM method displays project activities in the form of symbols, and the relationships between those activities are depicted with lines connecting them. This method is also used to determine the time required to complete the various stages of the project and to calculate the time remaining for each activity before the start of another activity.

***Metode project evaluation and review technic* (PERT)**

According to Schroeder in the book Project Management by Hamdan Dimyati and Kadar Nurjaman (2014: 324), namely: "The PERT method (Program evaluation and review technique) is a network-based project scheduling method that requires three time estimates for each activity. These three-time estimates can be used to calculate the chances of completing the project by the set date, as well as the normal start and end times for flap activities or events. The three-time estimates are as follows: 1. Optimistic time (a) The time of the activity if everything goes well without any bottlenecks, or delays, 2. Most probable time (m) The time of the activity that would occur if an activity is carried out under normal conditions, with acceptable delays and postponements, 3. Pessimistic time (b) The time of the activity if there are more reasonable bottlenecks or delays.

3. DISCUSSION

Delphi method

Delphi method rounds I

The Delphi method is carried out by using a questionnaire. The first round of Delphi method is carried out by selecting respondents / experts who are identified as having the ability in their fields and are stake holders involved in development in West Papua. At this stage, round I questionnaires will be distributed by distributing open questionnaires with the aim of encouraging experts to provide broad and in-depth views related to controlling the implementation of building development in West Papua. After obtaining questionnaire I data, questionnaire II will be carried out.

Table 1. Delphi method rounds I

No	Type of Respondent	Experience	Last Education
1	Service User	> 10 Years	S2 Architecture
2	Service User	> 5 Years	S1 Civil Engineering
3	Academician	> 5 Years	S1 Architecture
4	Academician	> 5 Years	S2 Civil Engineering
5	Academician	> 10 Years	S2 Civil Engineering
6	Contractor	> 5 Years	S1 Architecture
7	Contractor	> 5 Years	S2 Civil Engineering
8	Construction Supervisor/Management	> 10 Years	S2 Architecture
9	Construction Supervisor/Management	> 5 Years	S1 Civil Engineering
10	Construction Supervisor/Management	> 5 Years	S1 Architecture

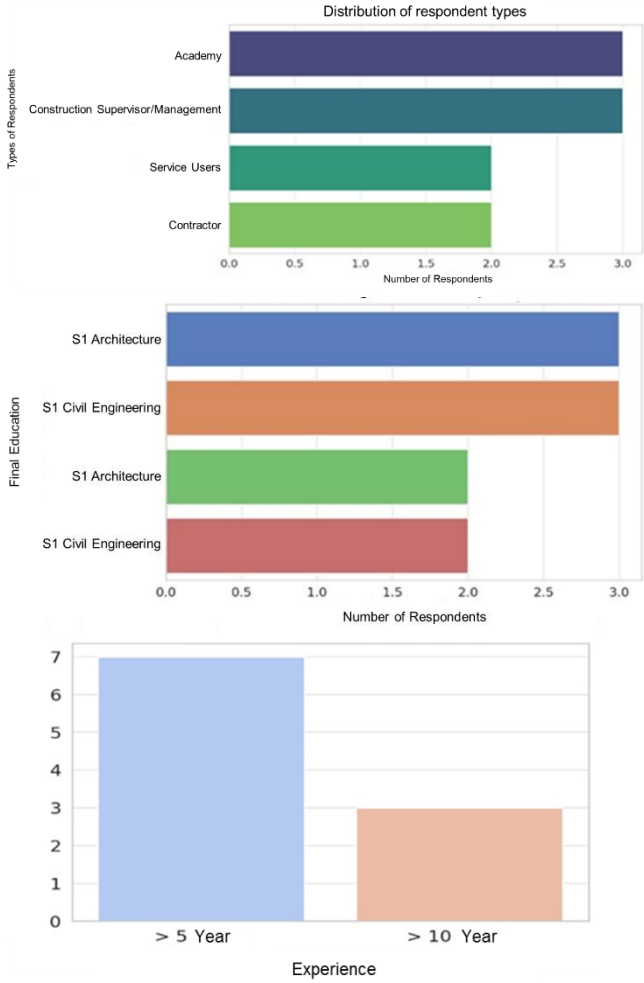

Figure 1. Delphi method rounds I

Cost Factor Analysis

Factors affecting cost in construction projects have high average scores, ranging from 4.3 to 4.6. This indicates that respondents strongly agree that these aspects contribute to project costs.

The statement with the highest mean is that ineffective cost control can result in waste and uncontrolled expenditure (4.6, SD = 0.52, Mode = 5). The low standard deviation indicates that the majority of respondents have a uniform view on this statement. In contrast, the statement with a lower, but still high, mean is that poor or inaccurate design can cause changes during construction (4.3, SD = 0.82, Mode = 5), indicating that although this factor is considered important, there is little variation in respondents' opinions. Most of the factors in this category have a mode of 5, which means the majority of respondents strongly agree with the statements. Interquartile Range (IQR) values ranged from 1 to 2, with the statement regarding cost control having the smallest IQR (1), indicating that this factor had the highest consistency of opinion among respondents.

Schedule Factor Analysis

In the schedule section, the average scores were within the range of 3.9 to 4.7, indicating that respondents also considered these factors to have a significant effect on project delays. The statement with the highest average is that changes in the scope of work, financial problems, lack of supervision, and lack of

coordination between related parties can cause delays in implementation (4.7, SD = 0.67, Mode = 5). This shows that changes and unpreparedness in the project are the main factors affecting delays. In contrast, the factor with the lowest mean in this category is that labor shortages and poor quality are the main causes of delays (3.9, SD = 0.88, Mode = 3). This suggests that there is more variation in opinion regarding this factor, with some respondents perhaps considering it a less dominant cause than other factors.

The standard deviation is highest for the first (0.88) and third (0.88) statements, indicating that there is a greater variation in opinion compared to other factors. The IQR ranges from 1.75 to 2, indicating a fairly consistent spread of data.

Quality Factor Analysis

In the quality category, the mean statements ranged from 4.2 to 4.6, indicating that these factors were seen as strongly influencing the quality of the project.

The statement with the highest mean is that lack of supervision in the field can lead to the quality of work not being achieved (4.6, SD = 0.52, Mode = 5). The low standard deviation indicates that almost all respondents had a uniform opinion on this statement. In contrast, the statement with a lower but still high mean is that inadequate quality planning can cause project quality to be difficult to achieve (4.2, SD = 0.92, Mode = 5). The highest standard deviation in this category is found in this statement (0.92), indicating that there is greater variation in opinion among respondents. Most of the factors in this category have a mode of 5, except for the factor of insufficient expertise of personnel handling contracts (mode = 4). This suggests that this factor is still debated in terms of its level of urgency compared to other factors

Control Strategy

Data analysis on the second round of control strategies was carried out by calculating the Statistical Values, namely the mean, standard deviation, Interquartile Range (IQR) and mode for each factor on each quality, time and cost variable. Cost control strategy

The cost control strategy showed high effectiveness with an average of 4.6 to 4.7, indicating that respondents rated this strategy as very important. The application of Critical Path Method (CPM) (4.7, SD = 0.48, Mode = 5) had the highest level of agreement indicating that this method was considered an effective approach to optimize project cost and time. The low standard deviation reflects the consistency of opinion among respondents.

The use of project management software such as BIM and Microsoft Project (4.6, SD = 0.52, Mode = 5) also received strong support. This suggests that digitization and automation in project management are increasingly considered as key necessities to improve cost control efficiency. The implication is that the implementation of these strategies should be integrated in project policies with wider training and implementation for maximum impact.

- Schedule Control Strategy Analysis

The strategies in the schedule section had an average score of 4.2 to 4.5, reflecting the importance of various approaches to maintain project timeliness. The approaches that received the highest support were the creation of a detailed project schedule using project management software (4.5, SD = 0.85, Mode = 5) as well as the identification of critical tasks using the Critical Path Method (CPM) (4.5, SD = 0.53, Mode = 4). However, the higher standard deviation on project schedule generation indicates some variation in respondents' opinions, possibly due to different levels of experience and access to software. The strategy of increasing working hours (overtime) (4.2, SD = 0.79, Mode = 4) received lower support than the other strategies, suggesting that it may be perceived as a temporary solution rather than a long-term approach.

Quality Control Strategy Analysis

In the quality category, the average strategies ranged from 4.3 to 4.7, with the strategy of having competent human resources (4.7, SD = 0.48, Mode = 5) as the most decisive factor. This suggests that success in quality control is highly dependent on the quality of the workforce handling the project.

The strategies of conducting material quality testing and implementing a quality management system have the same average (4.5, SD = 0.71, Mode = 5), indicating that these two approaches are also considered important in maintaining construction quality. Meanwhile, the strategy of organizing procedures for controlling plans, processes, and preparing quality reports (4.3, SD = 0.82, Mode = 5) has the highest standard deviation, reflecting the variation in the level of understanding or implementation of this strategy in the field.

Evaluation of Factors Affecting Construction Schedule

- All factors had high averages (≥3.9), indicating that respondents agreed these factors contributed to project delays.

- The factor with the highest score was “Changes in scope of work, financial problems, lack of supervision, and lack of coordination” (4.7), indicating that this aspect was considered the main cause of project delays.

- The factor with the lowest score was “Labor shortage and quality” (3.9), although it was still in the important category.

- All factors have an evaluation of “Consensus Achieved,” indicated by SD ≤ 1 and IR ≤ 2, meaning there is a high level of agreement among respondents.

- Modes range from 3 to 5, with the factors of changes in scope of work and weather conditions having a mode of 5, indicating that the majority of respondents strongly agree with the statement.

Construction

Evaluation of Factors Affecting Construction Quality

All factors have an average of ≥3.9, indicating that respondents agree these factors affect project quality, The factor with the highest score is “Changes in the scope of work, financial problems, lack of supervision, and lack of coordination” (4.7). This indicates that the managerial and administrative aspects of the project greatly affect quality, Uncontrolled changes in scope can lead to rushed work, lack of quality control, and materials and labor that do not meet specifications, The factor with the lowest score is “Labor shortage and quality” (3.9). Although it has the lowest score among other factors, it is still considered to affect the quality of the project, Poor quality of labor can lead to errors in workmanship which leads to a decrease in construction quality. All factors have a score of “Consensus Achieved”, which indicates that respondents have a high level of

agreement on the influence of these factors on project quality. combination of technological methods with stricter supervision and better communication between stakeholders.

Recommendations

Cost Control Recommendations

Based on the data and the results of data processing obtained from respondents, the authors can conclude the following Cost Control recommendations:

The most agreed main factor in influencing costs is "ineffective cost control" with the highest score (4.6). The most agreed control strategy is "Implementation of CPM" with the highest score (4.7). All factors and strategies had consensus evaluations achieved, indicating a high level of agreement between respondents. It is recommended to improve the effectiveness of cost control and apply the CPM method and project management software to optimize cost control in construction projects in West Papua.

Time Control Recommendations

Based on the data and the results of data processing obtained from respondents, the authors can conclude the Time Control recommendations as follows:

The main factors for project delays are changes in the scope of work, financial problems, lack of supervision, and poor coordination (4.7). The most agreed strategies are the use of project management software and the critical path method (CPM) (4.5). Conducting regular monitoring of project progress was also considered important (4.3) with a high level of agreement (SD 0.48). Although increasing working hours (overtime) was considered as a project duration reduction strategy, its effectiveness was not as strong as planning and monitoring-based strategies. It is recommended to improve project schedule planning in a more structured manner, use the CPM method, and conduct regular supervision and evaluation to keep the project on schedule.

Quality Control Recommendations

Based on the data and the results of data processing obtained from respondents, the authors can conclude the following Quality Control recommendations:

The main factors affecting project quality are changes in the scope of work, financial problems, lack of supervision, and poor coordination (4.7). The most effective quality control strategies are detailed project planning and critical path method (4.5). Regular supervision is also very important (4.3) with the highest level of agreement (SD 0.48). The strategy of increasing working hours (overtime) has a lower effectiveness in improving project quality, as it may risk the quality of work. It is recommended to improve supervision and coordination between related parties and ensure thorough project planning to maintain construction quality standards.

4. CONCLUSIONS

Based on the analysis conducted using the Delphi method in the research on construction project control in West Papua, several conclusions can be drawn as follows:

1. The main factors affecting cost control are ineffective cost supervision, fluctuations in material prices, and errors in implementation methods. The primary factors influencing time control are changes in the scope of work, financial issues, lack of supervision, and insufficient coordination within the project. The main factor affecting quality control is the lack of on-site supervision, which results in substandard work quality.
2. Strategies that can be implemented for controlling costs, schedules, and quality include the use of project management software such as BIM and Microsoft Project, conducting material quality testing, implementing a quality management system, and performing routine supervision of project progress.
3. Based on the analysis conducted, digital technology is more effective than conventional methods in all aspects of project control (cost, schedule, and quality). The main advantages of digital technology include increased efficiency and accuracy in planning and project control, enabling real-time monitoring and analysis, and reducing the risk of human error and delays in decision-making. However, the main challenges in implementing digital technology are the initial implementation costs and the need for workforce training, which must be considered to ensure optimal adoption.

REFERENCES

Callahan, M. (1992). Construction Project Scheduling. McGraw Hill, New York.

Dimyati, H. A., & Nurjaman, K. (2014). Manajemen Proyek (1st ed.). Pustaka Setia, Bandung.

Dipohusodo, I. (1996). Manajemen Proyek & Konstruksi. Kanisius, Yogyakarta.

Ervianto, I. (2003). Manajemen Proyek Konstruksi. ANDI Publisher, Yogyakarta.

Hajek, G. (1994). Manajemen Proyek Perekayasaan. Erlangga, Jakarta.

Husein, A. (2011). Manajemen Proyek: Perencanaan, Penjadwalan, dan Pengendalian Proyek. Andi, Yogyakarta.

Indonesia. (2022). Peraturan Pemerintah Nomor 16 Tahun 2021 tentang Peraturan Pelaksanaan Undang-Undang Nomor 28 Tahun 2002 tentang Bangunan Gedung. Jakarta: Kementerian Sekretariat Negara.

Rani, H. A. (2016). Manajemen Proyek Konstruksi. CV. Budi Utama, Yogyakarta.

Soeharto, I. (1995). Manajemen Proyek Dari Konseptual Sampai Operasional. Erlangga, Jakarta.

Soeharto, I. (1999). Manajemen Proyek (Vol. 1). Ciracas, Jakarta.

Sugiyono. (2018). Metode Penelitian Kuantitatif (1st ed.). Alfabeta, Bandung.

Widiasanti, I., & Lenggogeni. (2013). Manajemen Konstruksi (1st ed.). Remaja Rosdakarya, Bandung.

Zimmerer, T. W., & Scarborough, N. M. (2002). Pengantar Kewirausahaan dan Manajemen Bisnis Kecil. Prehalindo, Jakarta.