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ANALYSING THE CAUSES OF MANAGEMENT AND PRODUCTION DELAYS IN THE IMPLEMENTATION OF CONSTRUCTION PROJECT WORK

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ABSTRACT
This study aims to analyse the causes of delays in the implementation of construction projects caused by management (owners/consultants) and production (contractors). The research sample consists of 56 respondents who are directly involved in the implementation of construction projects (owners, consultants, contractors, field supervisors, and estimators). The quantitative data analysis technique used was descriptive analysis technique, while the qualitative data obtained by interviewing 5 construction project experts was analysed by qualitative descriptive method. To analyse the causes of delays in project implementation, an analysis technique using the Relative Importance Index (RII) formula was used with a reference value of RII> 0.710. The results showed that 1) the average RII on management factors was 0.895> 0.710. This means that management factors (owner/consultant) can cause delays in the implementation of construction projects; 2) the average RII on production factors is 0.917> 0.710. This means that production factors (contractors) can cause delays in the implementation of construction projects. This means that production factors (contractors) can cause delays in the implementation of construction projects. This research is directly useful for construction service providers and contributes to the development of Project / Construction Management science.
Keywords : *Project Delay, Construction, Management, Production.*

1. Introduction

In large-scale projects, many stakeholders will be involved, giving rise to complex relationships between stakeholders and the number of work sequences, the length of time required to complete the work, as well as several uncertainty factors in implementation that can cause unwanted deviations in project implementation. Therefore, good cooperation between the contractor and the owner in the implementation of construction projects can avoid deviations, otherwise if the owner and contractor do not cooperate well, it can result in the implementation of the project experiencing delays (Ayudhya, 2012). Delays in work will exceed the planned target time in accordance with the contract agreed upon by both parties (Desyllia et al., 2014). Project delays are caused by design changes during construction, late payments to contractors, poor planning and scheduling, poor location, management and supervision, poor incomplete and inappropriate design, inadequate contractors, inadequate work experience, contractor financial difficulties, owner financial difficulties, lack of resources and poor labour productivity and lack of skills (Zidane & Andersen, 2018; Durdyev & Hosseini, 2020; Arantes & Ferreira, 2020). Construction project delays are caused by improper planning, poor consultant performance, inefficient management, owner influence, bureaucracy, and substandard contracts.

Previous research, Gebrehiwet & Luo (2017), Mahamid et al. (2012), and Abd El-Razek et al. (2008) also concluded that delays in construction projects are caused by design documents, payments to contractors, and changes in the scope of work. Based on the results of several studies above, it can be concluded that delays in construction project work can start from the preconstruction, construction and post-construction stages and are caused by the employer and construction service provider. Delays that occur in the preconstruction stage are caused by the owner/consultant (management delays), while delays in the construction stage are caused by the contractor (production delays). Furthermore, the management and production parties cause

delays in the post-construction stage together. In the implementation of construction projects, the responsibilities of each party between the management and production parties have been regulated in Presidential Regulation No. 16 of 2018 concerning Government Procurement of Goods/Services (Presidential Regulation of the Republic of Indonesia Number 16 of 2018, concerning Government Procurement of Goods/Services, 2018). In the implementation of construction projects, the responsibilities of each party between management and production have been regulated in Presidential Regulation No. 16/2018 on Government Procurement of Goods/Services. In the implementation of construction projects, the responsibilities of each party between the management and production parties have been regulated in Presidential Regulation No. 16 of 2018 concerning Government Procurement of Goods/Services.

In Presidential Regulation No. 16 of 2018, on Public Procurement is mandated in Article 56, namely: 1) If the service provider cannot complete the work until the contract implementation period ends, but the PPK assesses that the service provider is able to complete the work, the PPK gives the service provider the opportunity to complete the work; 2) Providing an opportunity for the service provider to complete the work is stated in the contract addendum which regulates the completion of the work, the imposition of late fees to the service provider, and the extension of the implementation guarantee. Based on the article above, sanctions are only given to the service provider (production party), because it does not explain which party causes the project delay to occur, even though the delay in project work can be caused by the management (owner/consultant) and the production party (contractor). Project delays caused by management have been found by Mahamid et al. (2012) and Badawy et al. (2020). In their research that one of the causes of project delays that have a major impact is late payment from the owner. Project delays have significant consequences for the overall success of a construction project including budget, stakeholder relations, and project completion time. Project delays can result in increased labour and material costs, project overruns, reduced morale, costly lost profits, reputational damage, and legal issues. Project delays often require resources to be reused or reallocated resulting in increased labour and material costs. Project delays can cause a chain reaction of costly consequences for the organisation which includes project overruns. Additionally, project abandonment is when a company decides to no longer pursue or invest in a project. Project delays can negatively impact a company's image and tarnish its reputation in the market.

The novelty of this research is explained in the detailed identification of aspects that cause delays originating from the owner/consultant such as the absence of permits, unclear material specifications, supervision, delays in decision making by the owner, lack of communication between the consultant and contractor, design changes and specification changes. This research will fill the void of previous studies that only explain that delays are caused by the owner as the employer or project supervisor. Therefore, the success of the findings of this research can be a strong basis for the project supervisor to impose a late penalty on the owner. The purpose of this research is to identify the main factors responsible for construction project delays and contribute to knowledge in construction project management. By analysing the causes of construction project delays, this research can provide in-depth information that can help improve project management practices and propose strategies for better collaboration between stakeholders. In this study, service users are caused by management factors as the employer/owner and service providers are caused by production factors caused by contractors. Delays caused by management consist of: 1) Work start time, 2) Materials, 3) Design discussion and 4) Payment. While delays caused by production consist of 1) Labour, 2) Equipment, 3) Material, 4) Administration and 5) Work.

2. Literature Review

Delays in the completion of construction projects will hamper all parties involved in the implementation of the work, namely contractors, consultants, and project owners (Astina et al., 2012) which can extend the overall project completion duration (Gibbs et al., 2013). Doloi et al. (2012) found factors that cause delays in construction projects in India, namely site management and coordination issues; lack of commitment and communication; poor planning; unclear project scope; and non-standard contracts. Fallahnejad (2013) investigated the causes of delays

in Iran and found that the causes were the contractor's inability to provide imported materials, unrealistic contract schedules imposed by the owner, slow delivery of materials by the owner, slow land acquisition due to resistance from occupants and change orders by the owner. The causes of construction project delays in Tanzania using a questionnaire survey study, the findings showed that frequent design changes, late payments to suppliers, improper project management, lack of coordination between construction stakeholders involved in the project, and incompetent contractors are important factors in causing construction delays (Kikwasi, 2012).

According to Shebob et al. (2012), delays in construction projects in Denmark are caused by lack of resources (labour and materials); bridging work; frequent changes to the work plan; external conditions and design-related issues. Marzouk & El Rasas (2014) found that based on the owner's perspective it is caused by poor management, contractor financing, changes during construction. According to the contractor's perspective, it can be caused by owner intervention, late payment by the owner, owner's delay in making design improvements and approving design documents, suspension of work and slow decision making. According to the consultant's perspective the delay is caused by: owner order variations during construction, poor contractor labour productivity levels and unqualified labour which causes the quality of work to not meet requirements (Ezeldin & Ibrahim, 2015; Larsen et al., 2016; Tahir et al., 2019; Palikhe et al. 2019). Based on the results of research by Nugroho & Adi (2014), around 67.4% of construction projects carried out by contractors cannot be completed on time as planned due to inadequate planning and scheduling, which has an impact on licensing, additional work, delays in the supply of equipment and materials.

Gebrehiwet et al. (2017), Mahamid et al. (2012), and Abd El-Razek et al. (2008) concluded that delays in construction projects are caused by design documents, payments to contractors, and changes in the scope of work. On the other hand, Alenazi & Adamu, (2017) conducted various case studies in various countries and found several factors causing delays in construction projects. Some examples of such cases are as follows: In Malaysia, delays in construction projects are mainly related to shortages and delays in materials and equipment, as well as adverse weather conditions. In Kuwait, the three main factors for delays are design changes, financial constraints, and contractors' inexperience in construction work. In Jordan, poor planning (in terms of site conditions, unstable weather, and raw materials) was the main reason for project delays. Other factors were also highlighted such as financial problems, excessive interference from the owner, limited contractor experience, delays in decision-making, and sub-contractor issues. In Oman, the main cause of delay was related to the Client. The Client submitted several change orders and was responsible for issues related to payment progress. There were also other delay factors related to labour issues, cash flow challenges, and poor decision-making. In Nigeria, the main causes of delay were related to price volatility, poor project management, inadequate financial planning, and material unavailability.

On the other hand, Hussain et al. (2017), project time delay is an event that will have a negative impact on the socio-economic conditions of the community, which will affect sustainable life caused by poor planning and poor control. Time delays can also be caused by the influence of the surrounding environment, unpreparedness of land as a place to be used as a project location, poor project management applied and human resource errors in it. Delays are also caused by the selection of the lowest bid, the financial condition of the main contractor, delays in decision making by the developer and poor construction planning by the main contractor. Zidane & Andersen (2018) found that there are 10 factors that often occur in large construction projects in Norway. These factors are design changes during construction, contractor payment delays, poor planning and scheduling, poor site management and supervision, incomplete or inappropriate design, inadequate contractor experience/building methods and approaches, contractor financial difficulties; sponsor/owner/client financial difficulties, lack of resources, and poor labour productivity and lack of skills. In addition, according to Safapour et al. (2019), 33% of construction jobs experience rework and 20.10% of rework occurs due to poor contractor work (Liu et al., 2020). Hosseini & Durdyev (2020), Arantes & Miguel (2020) the causes of delays in construction projects are: improper planning, poor consultant performance, inefficient management, owner influence, bureaucracy, and

substandard contracts. Meanwhile, according to Reddy & Rao (2022), inadequate planning and scheduling on the part of the employer, unpaid invoices, or failure to collect payment for completed work, incompetent administration and supervision, high volume of change requests from clients. An improper scheduling plan prepared by the contractor will cause the project to supply materials late.

According to Shebob et al. (2012) and Murat & Zeynep (2021) described inadequate design, poor communication and coordination among stakeholders, lack of experience and planning by contractors, delays in material delivery and testing, external factors such as regulatory changes, unforeseen circumstances, and labour-related issues including shortages and low qualifications as the main causes of construction project delays. The strength of this study is that it provides a comprehensive list of factors that contribute to project delays. However, this study does not provide a clear methodology to identify these factors. Bordoli and Baldwin (1998) and Alkass et.al. (1995) proposed a methodology to analyse construction project delays and proposed computer-aided construction delay analysis and claim preparation as techniques to analyse project delays. However, their study did not identify specific causes of project delays. As in other developing countries, building projects in Indonesia also experience significant delays which is a problem faced by construction professionals. However, due to variations in laws, customs, and other elements, the specific reasons for project delays in Indonesia cannot be generalised to those in other countries. In this research, the emphasis on management and production adds to the existing knowledge by providing different stakeholder perspectives on the causes and impacts of project delays. There is still disagreement on the main reasons for project delays and practical methods to avoid or reduce them, even after much research on construction project delays. To fill this gap in the literature, this study offers a thorough examination of the factors that contribute to project delays as well as practical suggestions to improve stakeholder engagement.

3. Research Methods

The method used in this research is a mixed method, namely quantitative and qualitative methods (Creswell & Clark, 2017). The research sample consisted of 56 respondents who were directly involved in the implementation of construction projects (owners, consultants, contractors, field supervisors, and estimators). Respondents in this study were categorised into 5 aspects, namely: age, work experience, project management experience, position, and education. The instrument used was a questionnaire with a Likert scale related to frequency rating and impact rating with 4 scales. The rating scale based on the frequency rating of causes of delay is presented in table 1 and the rating scale based on the impact rating of project implementation time is presented in table 2.

The quantitative data analysis technique used was descriptive analysis technique, while the qualitative data obtained through interviews with 5 construction project experts was analysed by qualitative descriptive method. To test the validity of the questionnaire, a significance test was carried out with a confidence level of 95% or α = 5% (Sekaran & Bougie, 2016) and the reliability coefficient of the questionnaire was tested with the Cronbach's Alpha test (Sugiyono, 2019). After analysing the instrument trial data from 20 sample respondents, R = 0.444 was obtained, the instrument was declared valid at the 5% significance level, and the reliability coefficient was 0.962. To analyse the causes of delays in project implementation, an analysis technique using the Relative Impact Index formula was used (Sambasivan & Soon, 2007). Relative Importance Index (RII), using a reference value of RII > 0.710 and other statistical methods. RII is used to estimate the importance of statement variables and delay aspects and their impact on time using the equation (1).

$$RII = \frac{\sum_i^5 = wixi}{\sum_i^5 = 1xi} \quad (1)$$

Information:

RII : Relative Importance Index

i : Category index responges (1,2,3,4,5)

W_i : The weight associated with the value of the i-th respondent

X_i : Frequency of i-th response as a percentage of total respondents for each factor

The criteria used are based on the RII value. If the RII value > 0.710, then the delay in the construction project is significantly caused by the delay variables (no implementation permit, unclear materials, supervision, delays in owner decision making, lack of communication between consultants and contractors, design changes, and changes in specifications). Conversely, if the RII value > 0.710, it is stated that there is no delay in the construction project.

Table - Rating scale based on frequency of causes of delay

Scale evaluation	Frequency rating	Description
1	Not important	Not critical project success
2	Not too important	Less important to project success
4	Important	Critical to project success
5	Very important	Very important to success of the project

Table 2 - Rating scale based on project implementation time impact rating

Scale evaluation	Frequency rating	Description
1	Very small	Has no impact/no influence on construction implementation time
2	Small	Little impact/influence on time construction execution
4	Big	The big impact/influence on time construction execution
5	Very large	The impact/influence on the construction implementation time is very large

4. Results and Discussions

4.1 Responses Profile

Based on the descriptive analysis, the respondents' profiles were categorised into five aspects, namely: 1) Age of respondent, 2) Work experience, 3) Project management experience, 4) Position, and 5) Education. The respondent's age profile is presented in Fig. 1, the work experience profile is presented in Fig. 2, the project management experience profile is presented in Fig. 4, and the respondent's education profile is presented in Fig. 5. Based on Fig. 1, 46.43% of respondents were 30-40 years old, 35.71% of respondents were 41-50 years old, and 17.86% of respondents were 51-60 years old. Based on F Fig. 2, 19.64% of respondents have experience in construction projects for 1-4 years, 28.75% of respondents have experience in construction projects for 5-10 years, 19.64% of respondents have experience in construction projects for 11-15 years, and 32.14% of respondents have experience in construction projects for more than 15 years. Based on Fig. 3, 53.57% have experience managing building projects, 10.71% have experience managing road projects, and 35.71% have experience managing other projects. Fig. 4 shows the respondent positions of Owner as much as 17.86%, Construction Management Consultant as much as 28.57%, Implementing Contractor as much as 42.86%, Subcontractor as much as 1.79%, Field Supervisor as much as 5.36% and Quality Control as much as 3.57%. Based on Fig. 5, 3.57% of respondents have a high school education or equivalent, 5.36% have a diploma, 62.50% have a bachelor's degree, 26.79% have a master's degree, and 1.79% have a doctorate. Furthermore, Fig. 5 explains that the highest level of education of respondents is Bachelor and followed by respondents with a Master's education. This means that the research data obtained from the questionnaire can be concluded to be valid in accordance with the real conditions of the construction project.

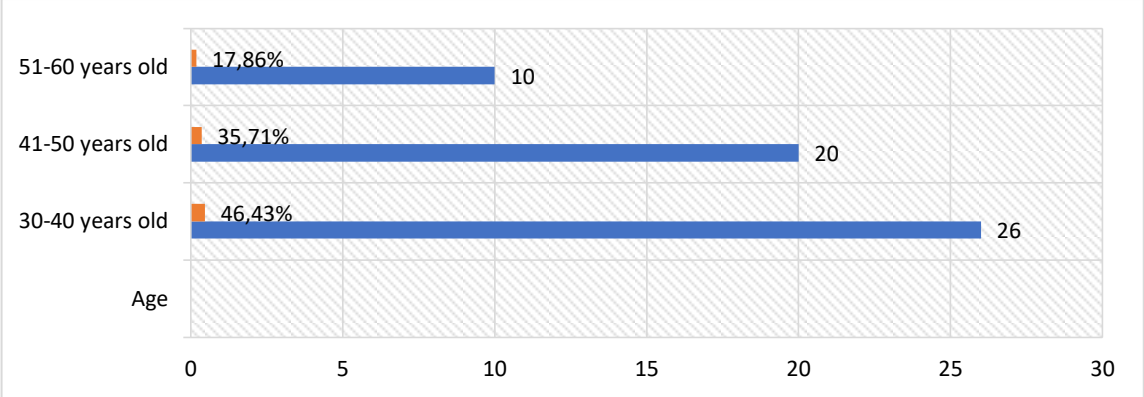

Fig. 1. Age profile of respondents

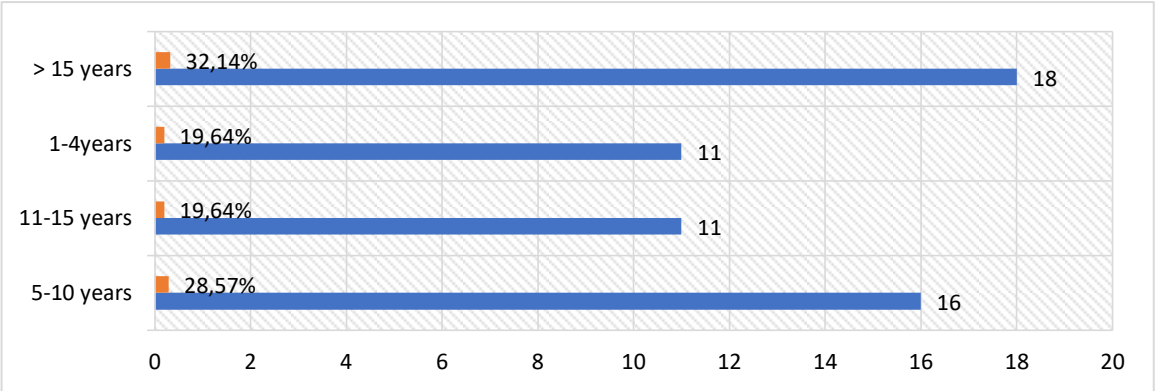

Fig. 2. Work experience profile

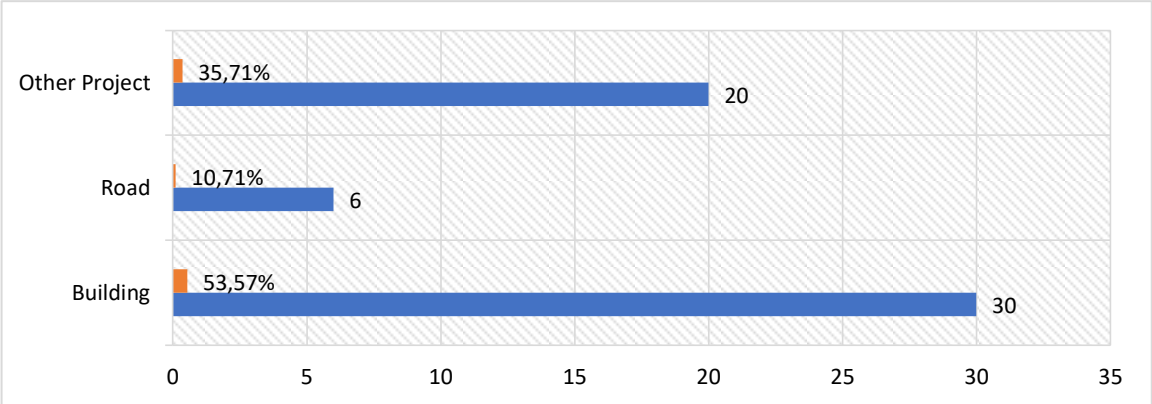

Fig. 3. Project management experience profile

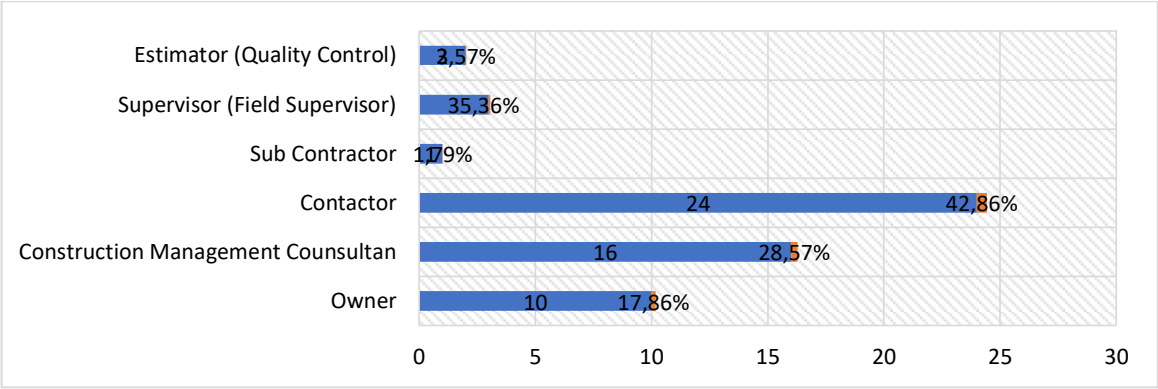

Fig. 4. Respondent's position profile

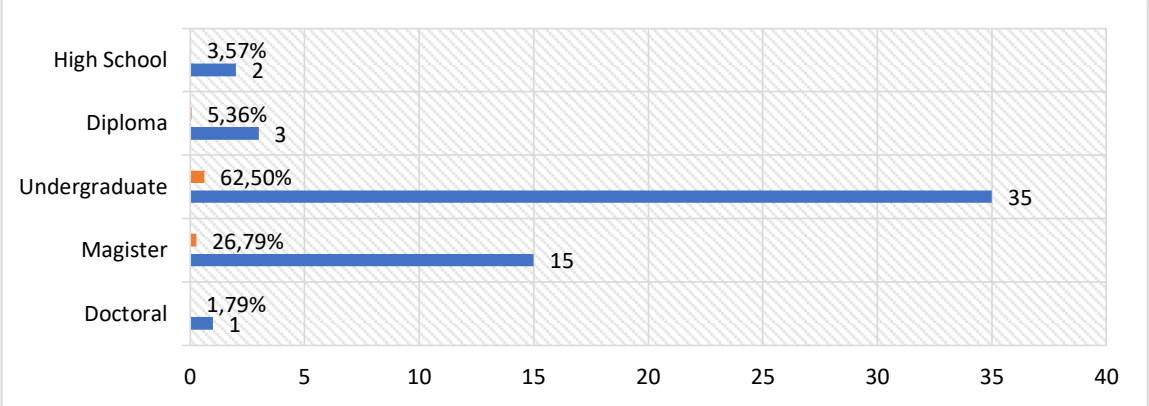

Fig. 5. Respondents' education profile

Based on Fig. 1-5, it can be concluded that the characteristics of the subjects of this study are:

a. Age factor

In this study, the age of respondents used is respondents aged over 30 years, because the age above 30 years is included in the productive working period, expectations and motivation are also high, the most respondents aged 30-40 years are 46.43%. This means that respondents who work on construction projects are at a productive age.

b. Experience factor

Experience in carrying out work is very important to be used as a measure in answering the questionnaire given which will show the tendency that the employee concerned has expertise and skills that can provide real useful information in the construction field. Work experience> 15 years is the most respondents, namely 32.14%. This means that the responses given by respondents to this research material are accurate.

c. Respondent's position

The position of the respondent in this study is very important to be a benchmark for knowing the ability to identify and analyse the questions given according to their field of work. The position of the respondent who provided the most information in this study was the managing contractor at 42.86%. This means that the responses given by the implementing contractor regarding project delays that have occurred can really describe the actual situation of the implementation of the construction project.

d. Frequently managed projects

The project most frequently managed by respondents is a building project with 53.75%. This means that the responses given by respondents regarding project delays that occur are more dominant in describing the real situation of delays in building construction projects.

e. Education

Someone who has education will have insight and accurate answers based on their level of education. The highest level of education of respondents is S1 by 62.50% and respondents with S2 education by 26.79%. This means that the respondent's educational background can be concluded to have a high academic education, so that the information data provided in this study contains high truth and can be trusted in accordance with the reality of construction project implementation.

4.2 Factors Causing Delays Caused by Management

In this study, 38 delay variables were found caused by Management which were divided into 4 categories, namely: 1) Work start time, 2) Materials, 3) Design discussions and 4) Payment. However, based on the results of interviews with 5 experts, 10 top ranking variables were used

with an RII value > 0.710 as the cause of delays for each category of delays that often occur in the field. Delays caused by management factors can be seen in Table 1.

Table 1 - Causes of Delays in Project Implementation Caused by Management Factors

Variable causes of delay by management factors		Delay indicator		RII
1.	Starting Job	X1	There is no construction implementation permit by the government due to land acquisition)	0.974
		X10	Slow decision-making from the owner regarding project problems in the field	0.924
		X11	Communication between internal & external (Consultant with owner and Contractor)	0.913
		X21	Haven't applied for work yet	0.860
2.	Material	X3	Material specifications are not clear.	0.925
		X32	There is a Change in Specifications	0.883
3.	Design Changes	X2	There is a Design Change	0.883
		X31	Recalculation due to design changes	0.875
4.	Payment	X7	Inspection, monitoring/control and evaluation of implemented projects	0.925
		X6	The procedure is too long in the payment process	0.834

Based on Table 2, research findings related to work start management factors often occur in construction work with 4 variables with the highest rank is no construction permit due to land acquisition. The findings of this study support the findings of Arifianto et al. (2017), Carlo & Rita (2021), Nugraha et al. (2022). Furthermore, the second factor is caused by delays in payments made by the owner, resulting in very slow supervision and control of work evaluation, and these findings support Hatmoko's research findings (Hatmoko et al., 2022).

4.3 Factors Causing Production Delays

In this study, 38 delay variables caused by production were found and divided into 5 categories, namely: 1) Labour, 3) Tools, 4) Materials, 4) Administration and 5) Work. However, the top 10 ranked variables were used as the causes of production-induced delays which can be seen in Table 2.

Table 2 - Causes of delays in project implementation caused by production factors

Variable causes of delay by production factors		Delay indicator		RII
1.	Labor	X30	Low labor productivity	0.910
		X25	Lack of Communication with workforce	0.906
2.	Working tool	X27	Lack of equipment in the field	0.906
		X28	Working tools do not work properly	0.901
3.	Material	X19	Late materials	0.944
		X18	Materials that do not comply with specifications	0.902
4.	Administration	X8	Improper planning schedule	0.951
		X9	Weak coordination and communication within the organization	0.902
		X12	Decision making from contractors on project problems in the field	0.901
5.	Work	X29	Construction error	0.943

Based on Table 3, the research findings related to the highest ranked production factor is the late arrival of materials to the job site with a value of 0.944. The findings of this study support the findings of Husnah (2017), Buya et al. (2022) related to the availability of materials at the job site. Furthermore, the second factor causing delays in project implementation is caused by construction errors on the project. Construction errors are caused by several factors, namely: 1) Detailed drawings that are difficult to understand and implement, 2) planning consultants do not understand the applicable detail standards and 3) unclear site drawings and views (Tristanto & Widjajakusuma, 2022).

Based on Table 2, it can be seen that the average RII on management factors is 0.895 > 0.710. This means that management factors (owner/consultant) can cause delays in the implementation of construction projects. In order, the delay indicators caused by management factors are: 1) There is no permission to carry out construction by the owner because land acquisition is still ongoing, 2) Slow decision making from the owner regarding project problems

in the field, 3) Consultant communication with the owner and contractor, 4) Not yet submitted a work request, 5) Material specifications are not clear, 6) Changes in specifications occur, 7) Design changes occur, 8) Recalculation due to design changes, 9) Inspection, monitoring, and evaluation carried out, and 10) Procedures that are too long in the payment process. The results of this study support the findings of Israngkura & Ayudhya (2012), Mahamid et al. (2012), Desylia et al. (2014), Zidane & Anderson (2018), Durdyev & Hosseini (2020), Arantes & Ferreira (2020); and Badawy et al. (2020). Furthermore, Table 3 shows that the average RII on production factors is 0.917 > 0.710. This means that production factors (contractors) can cause delays in the implementation of construction projects. In order, the indicators of delay caused by production factors are: 1) Low work productivity, 2) Lack of communication between project leaders and labour, 3) Lack of equipment in the field, 4) Work tools are not functioning properly, 5) Material delays, 6) Materials that do not meet specifications, 7) Improper schedule planning, 8) Weak coordination and communication within the organisation, 9) Decision making from contractors related to project problems in the field, and 10) Construction errors. The results of this study support the findings of Zidan & Anderson (2018).

Thus, if there is a delay in the implementation of the construction project, the responsible party is the management and production parties together, not to cause losses only to the production party.

5. Conclusion

Based on the calculation of the Relative Importance Index (RII), it is found that the cause of delays in a construction project is not only caused by the contractor (production factors), but also caused by the owner / consultant (management factors). Therefore, if there is a delay in the implementation of a construction project, the party responsible for the losses incurred is the owner / consultant and the contractor together. This finding is very useful for the Commitment Making Officer (PPK) as a consideration for decision making in the event of a delay in the implementation of a construction project and includes the results of the decision in the construction contract. In addition, the findings of this research are directly beneficial to construction service providers and contribute to the development of Project/Construction Management science.

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