Analysis of the Factors Affecting Delay in Housing Projects in XYZ Group)
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Abstract—Success in completing projects on time is one of the essential goals, both for the owner and the contractor. XYZ Group, a holding of several companies in the real estate, has delayed more than 53% of housing projects. The impact of delays is time overrun, cost overrun, deviations in the quality, disputes, negative social consequences, arbitration, and idling resources. This paper studied a list of construction delay causes gathered from the literature. It starts by exploring factors causing project delays from the research and finding 48 causative factors, followed by distributing preliminary questionnaires to expert respondents to obtain 23 causes for housing project delays. The primary survey held on 55 respondents consisting of technical directors, project managers, project engineers, quality control, logistics, and project planners. Relative Importance Index (RII) calculated, and according to the highest values, the top five delay causes of housing projects are determined. Objectives of project delays from the owner and contractor are "Late issuing of approval of design documents by the owner," and "Changing government political/economic situation or policy." The cause of project delays from the owner is "Shortage of labour from the contractor," "Changes to work completed by the owner," and "Failure of the contractor to complete the work." Meanwhile, "Slow delivery of resources required by the contractor," "Changes in details by the owner," "Rework due to quality and final results by the contractor," is the cause of project delays from the contractor.

Keywords—Cause of Delay, Contractor, Housing, Owner, Project Delay.

I. INTRODUCTION

XYZ Group is a holding of several companies which have main activities in real estate services. The main activity of these companies is the construction of residential areas and public facilities in residential locations in East Java. Based on data from the engineering department, in January 2016 - September 2019, there were more than 53% of the delay in completion of housing project work. Different definitions of delay were found, and the delay is the most common, costly, complicated and risky problem encountered in construction projects. Delay is the time overrun either beyond the completion date specified in a contract or beyond the date that the parties agreed upon for delivery project. Assaf and Al-Hejji [1].

Kikwasi, Sambasivan and Soon in research on the impact of delays in construction projects in Tanzania and Malaysia, explain the impacts of delays such as time overrun, cost overrun, dispute, negative social impact, arbitration, total abandonment, litigation and idling resources [2-3]. The purpose of this study is to identify and analyze factors that are thought to cause delays in the implementation of housing projects in the XYZ Group.

Proboyo explained 45 factors causing a delay which was divided into several aspects, namely planning and scheduling, scope and work documents, organizational system, coordination and communication, preparedness/resource prepared, inspection system, control and evaluation work, and other (outside the ability of owners and contractors) [4].

Marzouk and El-Rasas focused on the causes of construction delays in the Egyptian construction industry [5]. The main objective of the research is to identify and rank the major causes of delays for engineering projects. The research was used interview and questionary survey to 33 experts in Egypt, identified 38 delay factor and classified under seven groups: owner, consultant, contractor, material, labour and equipment, project, and external.

Aziz and Abdel-Hakam in exploring delay causes of road construction projects in Egypt, identified 239 factors and determined the most significant factors [6]. It was classified under the following 15 primary classifications. Main factors of delays are owner financial problems/client finance/financial ability for the project, shortage in equipment/insufficient numbers, inadequate contractor experience (work) causing an error, shortage (availability) in construction materials, and equipment failure (breakdown).

Fallahnejad explored delay causes in Iran gas pipeline projects [7]. The researcher examined the previous 24 projects, including contract documents, correspondence, progress reports, minutes of meetings and final contractor reports regarding delays. It has identified 43 delay factors that divided into nine groups: the low ability of the contractor to provide imported material, unrealistic contract durations imposed by the client, slow delivery of material by the client, slow land expropriation due to resistance from occupants, clients' change orders, large quantities of extra work, type of project bidding and award, delays in contractor's payment by the client, obtaining permits from governmental organization, delays in suppliers and subcontractors' work, and contractor's poor cash flow management.

Hwang, Zhao, & Ng on the research in critical factors affecting schedule in public housing projects in Singapore, identified 18 causes of a delay from the questionnaire from 115 respondent consist of the contractor, consultant and owner [8]. Top five causes of delays are site development, finance by contractor, coordinating parties, planning and scheduling, contractor experience.

Sweis et al explored the causes of delay in construction projects in Jordan [9]. Data on the study variables have been
collected through a structured questionnaire from 30 construction, consultant firms and owner located in Jordan. Significant causes of delays are bad planning and scheduling, lack of finance by contractor, change order from the owner, poor of labour skill and lack of competency by an engineer.

Sambasivan and Soon in causes and effects of delays in the Malaysian construction industry, identified 28 causes of a delay from the interview and questionnaire surveys from 30 consultants, owner and contractor [3].

Primary causes are contractor’s improper planning, contractor’s poor site management, inadequate contractor experience, client’s finance and payments for completed work, problems with subcontractors, shortage in material, labour supply, equipment availability and failure, lack of communication between parties, mistakes during the construction stage.

Based on the synthesis of previous studies, 48 causes of delays were obtained and were divided into six (6) major groups and stages according to the project cycle, as shown in Table 1 that causes delay in construction project, which are used in this paper, as follows: (1) Uneffective and unrealistic project schedule by owner; (2) Incomplete identification of work by the contractor; (3) Uncontrolling sequence work planning by the owner; (4) Unrealistic duration of work by owner; (5) Owner and contractor’s improper planning; (6) Ineffective construction method by the contractor; (7) Incomplete/conflicts of design drawings details and specifications; (8) Slow in design by owner; (9) Late issuing of approval of design documents by the owner; (10) The disagreement on design between contractor and owner; (11) Slow delivery of resources required by the contractor; (12) Shortage of labour from the contractor; (13) Shortage of material for contractor; (14) Shortage in equipment/insufficient numbers by contractor; (15) Financing by contractor during construction; (16) Owner financial problems; (17) Lack of material or equipment by owner; (18) The slowness of the owner decision-making process; (19) Difficulty of coordination between various parties (contractor and subcontractor) working on the project by owner; (20) Late land handover by owner/slow site clearance; (21) Insufficient communication between the owner and contractor or other parties; (22) Accidents during construction – labor injuries – infectious disease; (23) Unlimited pending by owner; (24) Additional order by owner during construction; (25) Changes to work completed by the owner; (26) Delay by sub-contractor from the contractor; (27) The contractor does not schedule the submission of material sample; (28) Delay in request and approval material samples by owner; (29) Slow permit by owner; (30) Changes in details by the owner; (31) Changes in scope of work by owner; (32) Slowly material test by owner; (33) Failure of the contractor to complete the work; (34) Rework due to quality and final results by the contractor; (35) Slowness progress evaluation by owner; (36) Inadequate supervision and regulation work by the owner; (37) The low productivity level oflabours; (38) Poor qualification of the contractors technical staff; (39) Inefficient inspection and control of work by the owner; (40) Owner’s personal managerial skill and qualification; (41) Skill and motivation labour’s by contractor; (42) Unforeseen site conditions; (43) Restricted access at site; (44) Act of God (Fire, flood, storm, earthquake); (45) Labour demonstration; (46) Riot, plague, war; (47) Vandalism by third party; (48) Changing government political/economic situation or policy [3-9].

This research aimed to identify the most important cause of delay that affects housing projects in XYZ Group, from owner and contractor perspective based on Relative Importance Index (RII) analysis.

### Table 1.

| S/N | Stage       | Category group item                                                                 | Related cause ID | cause | Total number of causes |
|-----|-------------|-------------------------------------------------------------------------------------|------------------|-------|------------------------|
| 01  | Planning    | Planning and scheduling related cause group                                        | 01:06            | 6     |                        |
| 02  | Procurement | Scope and work documents (contract) related cause group                              | 07:10            | 4     |                        |
| 03  | Construction Control | Organizational system, coordination and communication related cause group         | 11:17            | 7     |                        |
| 04  | Monitoring  | Inspection system, control and evaluation work related cause group                 | 18:31            | 14    |                        |
| 05  | External    | Other (outside the ability of owners and contractors) related cause group           | 32:41            | 10    |                        |
| 06  | External    | Other (outside the ability of owners and contractors) related cause group           | 42:48            | 7     |                        |

II. RESEARCH METHODS

The methodology of this paper is listed as the following items: (1) Gathering the causes: The thoroughness of the literature review gathers several of 48 causes; (2) Defining the causes into groups: Different numbers of groups were found in the literature review, and it was found that for a particular cause, it can be placed in research in a group different from the other research; (3) The questionnaire survey: For the 48 different delay factors were identified. The questionnaires were developed into two major: Preliminary survey and main survey; (4) Distribute a preliminary survey and interview with six experts; (5) Distribute the primary survey, to get significant factors that cause delays in housing project XYZ Group. A 55 respondent that consist of technical directors, project managers, project engineers, quality control, logistics, and project planners. A five-point Likert scale ranging from 1 (not important) to 5 (extremely important) was used to categorize the importance of causes; (6) Take an instrument test: validity and reliability test; (7) Data are gathered and computing by using a RII, taking in view of owner and contractors. Agreement on the ranking of the importance of the causes of delay between the parties is analyzed.

III. RESULT AND DISCUSSION

A. The Preliminary Survey

The preliminary survey is held to eliminate the irrelevant causal factor found in the literature, which indicated never
happened and caused delays in the XYZ Group, involved six experts with working experience is more than 15 years in XYZ Group. Expert data can be seen on Table 2. From 48 causal factor that found, 27 factors eliminated dan adding two elements (Table 3). It can be seen in Table 3.

### B. The Main Survey

A number of 55 respondents (technical directors, project managers, project engineers, quality control, logistics, and project planners) were distributed and valid responses valid responses were obtained. The collected data were analyzed through Relative Importance Index (RII) method. The analysis included ranking the different causes according to the relative importance indices. The analysis revealed the most contributing factors causing delays.

The causes of delay in housing projects will be looked at from different perspectives. Respondents profiles are included in the following Table 4 about the professionalism. The owner and contractor’s data are shown in Table 5 and Table 6.

### C. Validity Test

Validity test conducts to assess the validity of the questionnaire variables represented the measuring function of research. It using Pearson Product Moment Correlation 2-tailed, significant factor 5%, rtable: 0.2656.

Each factor that causes a delay in the primary survey calculated by Eq. 1.

$$ r = \frac{n \sum XY - \sum X \sum Y}{\sqrt{(n \sum X^2 - (\sum X)^2) (n \sum Y^2 - (\sum Y)^2)}} $$  \hspace{1cm} (1)

Where $r$ is Pearson Correlation; $n$ is the total number of respondents; $X$ is Independent Variable (score for each question); $Y$ is the Dependent Variable (total score for every question). The result of validity test can be seen on Table 7. Value of Pearson Correlation each factor computed an question). The result of validity test can be seen on Table 7. Value of Pearson Correlation less than rtable, this factor becomes not valid and will be eliminated from this research.

Validity test eliminates two invalid factors (X13 and X23) because Pearson Correlation/r less than rtable. There are 21 delay factors for this research (Table 7).

### D. Reliability Test

Reliability test using a Cronbach-alpha method. Twenty-one factors from validity test, compute using Eq. 2 and result of reliability test can be seen on Table 8.

$$ r = \left( \frac{n}{n-1} \right) \left( 1 - \frac{\sum r_i^2}{\sigma_i^2} \right) $$  \hspace{1cm} (2)

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### Table 2. Preliminary survey expert data

| ID   | Position           | Last Education       |
|------|--------------------|----------------------|
| Expert 1 | Technical Director | Bachelor Engineering |
| Expert 2 | Project Managers 1 | Bachelor Engineering |
| Expert 3 | Project Managers 2 | Bachelor Engineering |
| Expert 4 | Project Managers 3 | Bachelor Engineering |
| Expert 5 | Project Managers 4 | Bachelor Engineering |
| Expert 6 | Project Planner    | Master Engineering   |

### Table 3. Result of preliminary survey

| ID Indicator | Description                                      |
|--------------|--------------------------------------------------|
| X1           | Owner and contractor’s improper planning          |
| X2           | Slow in design by owner                          |
| X3           | Late issuing of approval of design documents by the owner |
| X4           | The disagreement between working drawings between contractor and owner |
| X5           | Slow delivery of resources required by the contractor |
| X6           | Shortage of labour from the contractor            |
| X7           | Shortage of material for contractor               |
| X8           | The slowness of the owner decision-making process |
| X9           | Changes to work completed by the owner            |
| X10          | Delay by sub-contractor from the contractor       |
| X11          | The contractor does not schedule the submission of sample material |
| X12          | Delay in request and approval material samples by owner |
| X13          | Slow permit by owner                             |
| X14          | Changes in details by the owner                  |
| X15          | Failure of the contractor to complete the work    |
| X16          | Rework due to quality and final results by the contractor |
| X17          | Inadequate supervision and regulation work by the owner |
| X18          | The low productivity level of labours             |
| X19          | Inefficient inspection and control of work by the owner |
| X20          | Unforeseen site conditions                       |
| X21          | Changing government political/economic situation or policy |
| X22          | Religious holiday                                |
| X23          | Rice planting season                             |

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### Table 4. Profession of respondent

| S/N | Profession of respondents | Number of respondents | Percentage (%) |
|-----|----------------------------|------------------------|----------------|
| 1   | Owners                     | 25                     | 46             |
| 2   | Contractors                | 30                     | 54             |
| Total |                           | 55                     | 100            |

### Table 5. Owner respondent data

| S/N | Category                  | Number of respondents | Percentage (%) |
|-----|----------------------------|------------------------|----------------|
| 1   | Age                        |                        |                |
|     | ≤ 30 years old             | 4                      | 16,00          |
|     | 31 – 45 years old          | 17                     | 68,00          |
|     | ≥ 46 years old             | 4                      | 16,00          |
|     | Senior high school/ below  | 11                     | 44,00          |
| 2   | Last Education             |                        |                |
|     | Diploma/Bachelor degree    | 12                     | 48,00          |
|     | Master/ Doctorate degree   | 2                      | 8,00           |
|     | ≤ 5 years                  | 5                      | 20,00          |
| 3   | Years of Experience        |                        |                |
|     | 6 - 10 years               | 10                     | 40,00          |
|     | 11-20 years                | 9                      | 36,00          |
|     | ≥ 21 years                 | 1                      | 4,00           |

### Table 6. Contractor respondent data

| S/N | Category                  | Number of respondents | Percentage (%) |
|-----|----------------------------|------------------------|----------------|
| 1   | Age                        |                        |                |
|     | ≤ 30 years old             | 3                      | 10,00          |
|     | 31 – 45 years old          | 15                     | 50,00          |
|     | ≥ 46 years old             | 12                     | 40,00          |
|     | Senior high school/ below  | 17                     | 56,67          |
| 2   | Last Education             |                        |                |
|     | Diploma/Bachelor degree    | 13                     | 43,33          |
|     | Master/ Doctorate degree   | 0                      | 0,00           |
|     | ≤ 5 years                  | 3                      | 10,00          |
| 3   | Years of Experience        |                        |                |
|     | 6 - 10 years               | 10                     | 33,33          |
|     | 11-20 years                | 11                     | 36,67          |
|     | ≥ 21 years                 | 6                      | 20,00          |
As seen in Table 10, there are differences between the owner and the contractor regarding the most influence the cause of the delay. From the owner, the most crucial cause is filled by variable X6, namely "Shortage of labour from the contractor" with the calculated RII (Relative Importance Index) value of 0.704. Whereas from the contractor, it was the X5, "Slow delivery of resources required by the contractor," with a calculated RII (Relative Importance Index) of 0.673.

As seen in Table 10, there are differences in perceptions between the owner and the contractor regarding the delay in housing projects in XYZ Group based on the results of RII calculations. From the owner's point of view, an essential cause is filled by variable X9, namely "Changes to work completed by the contractor," with a calculated RII (Relative Importance Index) value of 0.704. Whereas from the contractor's point of view, it was found that the variable X8, namely "Changes in details by the owner," was the most crucial cause with the calculated RII (Relative Importance Index) value of 0.664.
Chang
Slow delivery of resources required by the contractor,
work." The cause of project delays from the contractor is
owner," and "Failure of the contractor to complete the
owner has significant factors for delays.
approval of design documents by the owner," and "Changing
delays from the owner and contractor are "Late issuing of
factors causing delays in housing projects in the XYZ Group,
Based on the results of the RII analysis found eight dominant
calculated RII value amounting to 0.640 from the contractor
to
to contractor based on the results of RII calculations, according
to The low productivity
Inadequate supervision
and regulation work by
and final results by the
contractor Rework due to quality
Failure of the contractor to complete the work
X15: Failure of the contractor to complete the work
X16: Changes in details by the owner
X17: Inadequate supervision
X18: Changes in details by the owner
X19: Inefficient inspection
X20: Unforeseen conditions
X21: Changing government political/economic situation or policy
X22: Religious holiday

Table 11. Result of RII on construction stage

| Cause                                              | Owner RII | Owner Rank | Contractor RII | Contractor Rank |
|----------------------------------------------------|-----------|------------|----------------|-----------------|
| Delay group: organizational system, coordination and communication The slowness of the owner decision-making process | 0.616 | 4          | 0.620          | 3               |
| X8                                                 | 0.616     | 4          | 0.620          | 3               |
| X9 Changes to work completed by the owner           | 0.672     | 1          | 0.653          | 2               |
| Delay by sub-contractor from the contractor         | 0.656     | 3          | 0.620          | 3               |
| X10 from the contractor                             | 0.656     | 3          | 0.620          | 3               |
| X11 The contractor does not schedule the submission of sample material | 0.544 | 6          | 0.600          | 6               |
| Delay in request and approval of material samples by owner | 0.608 | 5          | 0.607          | 5               |
| X12 Changes in details by the owner                 | 0.664     | 2          | 0.660          | 1               |
| X14                                                 | 0.664     | 2          | 0.660          | 1               |

Table 12. Result of RII on control and monitoring stage

| Cause                                              | Owner RII | Owner Rank | Contractor RII | Contractor Rank |
|----------------------------------------------------|-----------|------------|----------------|-----------------|
| Delay group: inspection system, control and evaluation work related cause group |          |            |                |                 |
| X15 Failure of the contractor to complete the work Rework due to quality and final results by the contractor | 0.744 | 1          | 0.580          | 5               |
| X16 Inadequate supervision and regulation work by the owner | 0.728 | 2          | 0.627          | 1               |
| X17 The low productivity level of labours Inefficient inspection and control of work by the owner | 0.568 | 5          | 0.613          | 2               |
| X18                                                 | 0.632     | 3          | 0.593          | 3               |
| X19                                                 | 0.616     | 4          | 0.593          | 3               |

There is a common perception between the owner and the contractor based on the results of RII calculations, according to Table 13. The essential cause is variable X21, "Changing government political/economic situation or policy" with a calculated RII value of 0.712 from the owner's side and a calculated RII value amounting to 0.640 from the contractor. Based on the results of the RII analysis found eight dominant factors causing delays in housing projects in the XYZ Group, both from the perspective of the owner and from the contractor. All these factors are presented in Table 14.

IV. CONCLUSIONS

Based on analysis of RII, identified eight significant factors cause of delays in XYZ Group. The cause of project delays from the owner and contractor are "Late issuing of approval of design documents by the owner," and "Changing government political/economic situation or policy." The owner has significant factors for delays. It is "Shortage of labour from the contractor," "Changes to work completed by the owner," and "Failure of the contractor to complete the work." The cause of project delays from the contractor is "Slow delivery of resources required by the contractor," "Changes in details by the owner," "Rework due to quality and final results by the contractor."

Table 13. Result of RII on external stage

| Cause                                              | Owner RII | Owner Rank | Contractor RII | Contractor Rank |
|----------------------------------------------------|-----------|------------|----------------|-----------------|
| Delay group: other (outside the ability of owners and contractors) related cause group |          |            |                |                 |
| X20 Unforeseen conditions                           | 0.640     | 2          | 0.633          | 2               |
| Changing government political/economic situation or policy | 0.712 | 1          | 0.640          | 1               |
| X22 Religious holiday                              | 0.600     | 3          | 0.620          | 3               |

Table 14. Result of RII analysis

| Stage                                              | Owner | Contractor |
|----------------------------------------------------|-------|------------|
| A. Planning Scope and work documents (contract)     |       |            |
| X3: Late issuing of approval of design documents by the owner, RII: Rank 1 |       |            |
| B. Procurement RII: Rank 2                         |       |            |
| X6: Shortage of labor from the contractor, RII: Rank 1 |       |            |
| Organizational system, coordination and communication |       |            |
| X9: Changes to work completed by the owner, RII: Rank 1 |       |            |
| C. Construction RII: Rank 2                        |       |            |
| X14: Changes in details by the owner, RII: Rank 1   |       |            |
| Inspection system, control and evaluation work     |       |            |
| X15: Failure of the contractor to complete the work, RII: Rank 1 |       |            |
| D. Control and Monitoring RII: Rank 2               |       |            |
| X16: Rework due to quality and final results by the contractor, RII: Rank 1 |       |            |
| E. External Other (outside the ability of owners and contractors) |       |            |
| X21: Changing government political/economic situation or policy, RII: Rank 1 |       |            |

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