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ANALYSIS OF CAUSES DELAYS IN THE ROYAL RUNGKUT SURABAYA HOSPITAL PROJECT USING FTA METHOD

Handika Setiawan[1] dan Michella Beatrix[2]

[1]Jurusan Teknik Sipil, Universitas 17 Agustus 1945 Surabaya, Jl. Semolowaru No 45, Menur Pumpungan, Kec Sukolilo, Kota Surabaya
[2] Jurusan Teknik Sipil, Universitas 17 Agustus 1945 Surabaya, Jl. Semolowaru No 45, Menur Pumpungan, Kec Sukolilo, Kota Surabaya
Email: handikasetiawam3@gmail.com

ABSTRACT

Hospitals are one of the most strategic parts of the health field. This is none other than because a quality hospital is a service to create a healthy Indonesian society, in terms of physical and mental. Therefore, the construction of the Hospital building which is included in the development of this development is needed by the Royal Surabaya Hospital. But in reality, the development of development has been delayed since December 6, 2021, which can be seen through the S curve. In this study, researchers used a questionnaire that was distributed to respondents, namely the construction staff of the Royal Extension Hospital Surabaya to obtain data, then the data was processed using the fault tree analysis method to find out what caused the delay in the project. The results of this study found that the cause of the delay was caused by the owner's late payment to the contractor or related parties, the owner's delay in approving and making changes to the design, lack of supervision of the design, damage and effectiveness of the use of heavy equipment, and lack of construction materials. It can be concluded that the cause of the occurrence of delays is due to 4 factors.

Keywords: Delays, Fault Tree Analysis, Project

ABSTRAK

Rumah sakit adalah salah satu bagian paling strategis dari bidang kesehatan. Hal ini tidak lain karena rumah sakit yang berkualitas merupakan layanan untuk menciptakan masyarakat Indonesia yang sehat, dari segi fisik dan mental. Rumah sakit sebagai fasilitas kesehatan merupakan bagian dari sumber daya manusia yang sangat diperlukan dalam mendukung pelaksanaan upaya kesehatan. Oleh karena itu pembangunan gedung Rumah Sakit yang termasuk dalam pengembangan pembangunan ini sangat dibutuhkan oleh Rumah Sakit Royal Surabaya, dimana hal ini merupakan salah satu solusi untuk meningkatkan upaya mewujudkan pelayanan yang lebih baik secara optimal bagi masyarakat sehingga Rumah Sakit Royal Surabaya berharap pembangunan ini tercapai sesuai dengan yang diharapkan sesuai dengan waktu yang telah ditetapkan dan sesuai standar Pembangunan Gedung Rumah Sakit yang telah ditentukan. Tetapi dalam kenyataannya pengembangan pembangunan mengalami keterlambatan sejak tanggal 6 Desember 2021, yang bisa dilihat melalui kurva S. Tujuan pada penelitian kali ini untuk mengetahui faktor apa saja yang mempengaruhi keterlambatan pada proyek pembangunan Rumah Sakit Royal Extension, Rungkut, Surabaya. Pada penelitian ini peneliti menggunakan kuisioner yang disebar kepada responden yaitu staff pembangunan Rumah Sakit Royal Extension Surabaya untuk mendapatkan data, lalu data diolah dengan metode *fault tree analysis* agar mengetahui apa penyebab keterlambatan proyek tersebut. Hasil dari penelitian ini didapat bahwa penyebab keterlambatan disebabkan dari terlambatnya owner dalam melakukan pembayaran pada kontraktor atau pihak terkait, keterlambatan owner dalam menyetujui dan melakukan perubahan terhadap desain, kurangnya pengawasan terhadap desain, kerusakan dan efektifitas penggunaan alat berat, dan kekurangan bahan konstruksi. Dapat disimpulkan bahwa penyebab terjadinya keterlambatan disebabkan 4 faktor.

Kata kunci: Fault Tree Analysis, Keterlambatan, Proyek

1. INTRODUCTION

Hospitals are one of the most strategic parts of the health sector. This is none other than because quality hospitals are services that aim to create a healthy Indonesian society, both physically and spiritually. Hospitals as health facilities are part of human resources and are indispensable in supporting the

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implementation of health work. The implementation of hospital health services has very complex characteristics and organizational structures. Different types of health workers and their scientific devices influence each other. Medical technology is developing rapidly, health workers must follow suit in order to provide quality services, and hospital problems are becoming increasingly complex.(Keumala & Zanzibar, 2020)

The success of a hospital in achieving service targets does not only depend on the hard work of hospital health workers, but is also greatly influenced by the work and positive contributions of other relevant agencies. Therefore, the Royal Surabaya Hospital urgently needs the construction of the Hospital building which is included in the development of the development for follow the established time and schedule. The standards for the construction of the hospital building, as expected to achieve such development. The research was conducted at the Royal Surabaya Hospital project in JL. Rungkut Industri I no 1, Kendangsari, Surabaya. Royal Surabaya Hospital was built in 2010 and inaugurated on June 19, 2012. Due to the lack of capacity to meet the needs of patients, the Royal Surabaya Hospital is currently undergoing expansion construction. It is this building widening work that is the subject of this research. The project has been delayed since December 6, 2021, due to various factors affecting the performance of project implementation. Evidence of late projects is shown through an S curve diagram that is below the normal line of the beginning of planning.

This journal helps in terms of data processing at the time of discussion. Delay risk analysis using fault tree analysis method (Case study: suncity sidoarjo apartment project). The purpose of this study is to find out the risks that can affect project delays in apartment suncity. From this study get the probability of the project apartment suncity sidoarjo due to all variables is 0.5580.(Sukmana, 2021)

This journal helps when working on SPSS, because the steps are already contained in the journal and its meaning. This journal discusses the validity and reliability used to analyze questionnaires that have been distributed.(Janna, 2020)

For reference the delay this journal is very helpful, the discussion is about critical review comparing factors leading to construction delays in developed and developing countries. No less than 8 sets of causal factors used to analyze the entire case study are owner / client, consultant, contractor, material, equipment and manpower. Based on a review of previous studies, the study took the 5 highest causal factors, then combined them into a tabular format and ranked them according to country classification. Findings indicate that contractor-related factors are the leading cause of construction delays.(Chandra & Putra, 2016)

For reference the contents of the quitioner use this journal, with the results of research that has been done to identify the factors that cause delays in the implementation of irrigation projects at the Sumatra V River Regional Hall in West Sumatra, it can be taken several conclusions that the dominant factors causing delays in the implementation of irrigation projects at the Sumatra V River Regional Hall in West Sumatra are grouped into three factors, among others: a) Material / Material Factors, these include increased material prices, delays in delivery of materials by suppliers, inaccuracies in order time. b) Labor factors, including slow labor supply, less labor productivity, and low labor experience. c) Environmental factors, including slow place permits by the Local Government, problems with the surrounding environment, and weather conditions.(Khaidir, 2018)

The first source that made researchers take the fault tree analysis method was a thesis entitled analysis of the causes of delays in the construction of the animal cage building project of Unair C Surabaya Faculty of Medicine using the fault tree analysis method.(Da Costa, 2019)

2. LITERATURE REVIEW

Project

Project description is a complicated activity with qualities that cannot be duplicated, a restricted time frame, and standards that have been established from the start in order to generate a result. Because of the constraints of completing a project, a project organization is required to manage the resources required to complete synchronous tasks in order to meet the project's objectives. Project management is also required to guarantee that the task is executed efficiently, on schedule, and to the specified standard of quality.(Basuki, 2019)

Delays

Delays are defined as increasing the time beyond the agreed-upon settlement date in a contract or surpassing the completion date of a project that has been approved by all parties concerned. Others indicated that delays in construction project work pertain to rising expenses caused by longer work hours, higher labor prices, and higher building material costs. Meanwhile, project delays are frequently a cause of disagreements and demands between project owners and contractors, thus it will be highly costly in terms of both owners and contractors. In terms of contractors, the contract will impose penalty penalties; also, contractors will incur additional overhead expenses while the project is still running. Meanwhile, in terms of project owners, project delays will bring the impact of reduced revenue due to delays in the operation of their facilities.(Rosdianto et al., 2017)

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Fault Tree Analysis

Fault tree analysis (FTA) is a system security and reliability analysis method that can start from the system's possible faults and gradually find the basic event causing the faults layer by layer, thereby defining an undesired event, and then the system is analyzed in the context of its environment and operation to find all combinations of basic events that will lead to the occurrence of the predefined undesired event. It may also utilize the logic tree diagram to define the logical link between various types of faults that may arise in the system and the basic events that cause the fault to occur. The primary events leading to system failure may be identified and the likelihood of system failure can be determined using qualitative and quantitative analysis of the fault tree.(Chen et al., 2019)

3. RESEARCH METHOD

The location of this study is located in the area of jalan Rungkut Industri I no 1, Kendangsari, Surabaya. Which is where the vicinity of the hospital area borders the factories and citizen housing.

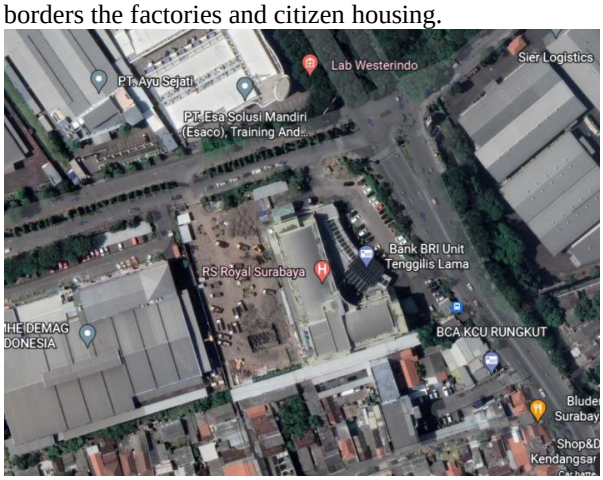

Figure 1. Project Location

The processes and stages carried out in the study are as flowchart following :

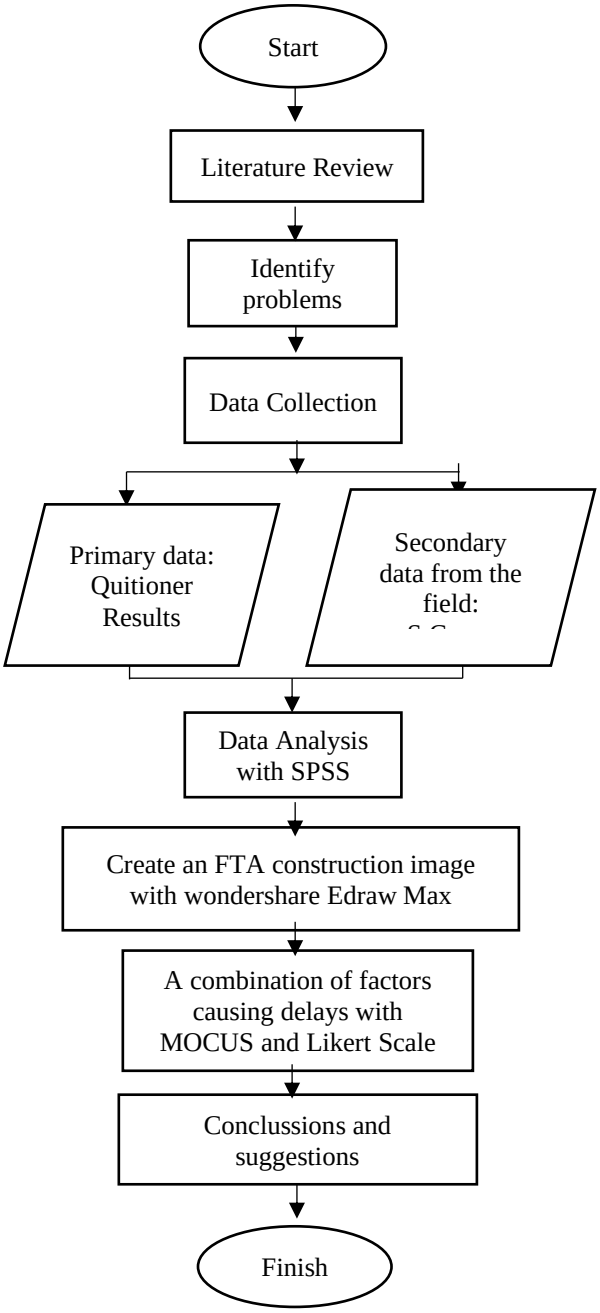

Figure 2. Flowchart Research

1. Identify problem

Identification of the problem is carried out by reading more literature and surveying directly to the project site, that way we can map out what will be discussed during the research to be carried out.

2. Data collection

The required data are primary data and secondary data. Primary data is data generated from questionnaires in the field. While the secondary data is s curve data which is used as a reference for analyzing the factors causing delay.

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3. Data processing

The validity and reliability method using SPSS software version 14, the validity method is used to analyze the validity of the questionnaire results, while the reliability method is used to analyze the consistency of the questionnaire result data.

The fault tree analysis method drawn with Wondershare Edraw Max has the following steps:

a) Identification of late work
   Identification based on S curve data obtained from the project.
b) Identify delay factors
   Identification of delay factors based on the results of field surveys and literature related to fault tree analysis.
c) Creating fault tree analysis graphics with basic logic gates such as AND gates or OR gates, top event assignments, intermediate events and basic events.

The MOCUS (Method obtain cut sets) method is a method to get a minimum of cut sets that will simplify the factors causing delays. The likert scale method is used to determine the probability that each factor has that can help solve which factor is late.

4. RESULT AND DISCUSSION

Validity test with 34 correspondents with R table 0.339. If declared valid, then the calculated R must be more than the R table, such as the following table :

Table 1. Validity Test

Code	r count	r table	Information
A1	0,662	0,339	Valid
A2	0,642	0,339	Valid
A3	0,640	0,339	Valid
A4	0,493	0,339	Valid
A5	0,515	0,339	Valid
B1	0,580	0,339	Valid
B2	0,696	0,339	Valid
B3	0,702	0,339	Valid
C1	0,747	0,339	Valid
C2	0,729	0,339	Valid
C3	0,784	0,339	Valid
C4	0,750	0,339	Valid
D1	0,715	0,339	Valid
D2	0,594	0,339	Valid
D3	0,645	0,339	Valid
D4	0,891	0,339	Valid

Reliability test with 34 correspondents with R table 0.339. If it is declared reliable, then cronbach alpha must be greater than R table, such as the following table :

Table 2. Reliability Test

Code	Cronbach's Alpha on variable X	R table	Information
A1	0,914	0,339	Reliabel
A2	0,914	0,339	Reliabel
A3	0,914	0,339	Reliabel
A4	0,918	0,339	Reliabel
A5	0,917	0,339	Reliabel
B1	0,916	0,339	Reliabel
B2	0,912	0,339	Reliabel
B3	0,912	0,339	Reliabel
C1	0,910	0,339	Reliabel
C2	0,911	0,339	Reliabel
C3	0,909	0,339	Reliabel
C4	0,910	0,339	Reliabel
D1	0,912	0,339	Reliabel
D2	0,915	0,339	Reliabel
D3	0,914	0,339	Reliabel
D4	0,908	0,339	Reliabel

In the assessment of the quitioner answers that have been obtained can be assessed using the likert scale method. As for assigning values for the answers used in the quitter shown in the table below :

Table 3. Quitioner Assesment

No	Quitioner answers	Score	Probability
1	SK (VS)	1	0,2
2	K (S)	2	0,4
3	S (A)	3	0,6
4	B (B)	4	0,8
5	SB (VB)	5	1

In the quitioner answer above using abbreviations, while the explanation of the quitioner answer is as follows:

- SK = Sangat Kecil (Very Small)
- K = Kecil (Small)
- S = Sedang (Average)
- B = Besar (Big)
- SB = Sangat Besar (Very Big)

From the quitioner data that has been arranged in the table is changed using scoring assessment and will later be used as a basis for analyzing data and becomes an important initial data for the overall analysis of data and input data to data processing.

From the results of the questionnaire, 4 intermediate events and 16 basic events were obtained as follows:

Table 4. Intermediate Event List

No	Intermediate Event
X1	Delays from the owner

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X2	Delays in Construction management
X3	Delays from contractors
X4	Delays in environmental conditions

The basic event factors obtained from surveys in the field and literature, which are equipped with questionnaire results are as follows :

Table 5. Basic Event Work From Owner

No	Work factor	SK (VS)	K (S)	S (A)	B (B)	SB (VB)	Mean Probability
A1	Late owner in making payments to contractors or related parties	3	12	11	5	3	0,56
A2	The owner's delay in approving and making and making changes to the design	3	12	12	6	1	0,54
A3	Owner's delay in preparing project land	4	20	5	3	2	0,48
A4	Lack of communication of the owner with related parties	6	12	14	2	0	0,47
A5	Owner's delay in licensing	5	17	11	1	0	0,45

An example of calculation to get the mean probability A1 is the multiplicity of quitioner answers*probability from table 3 = ((3 VS * 0,2) + (12 S * 0,4) + (11 A * 0,6) + (5 B * 0,8) + (3 VB * 1))/ 34 respondent = 0,56. Furthermore, A2-A5 uses the same way.

Table 6. Basic Event Construction Management Work

No	Work factor	SK (VS)	K (S)	S (A)	B (B)	SB (VB)	Mean Probability
B1	Lack of oversight of design	5	13	12	4	0	0,49
B2	Lack of coordination of construction management with contractors	7	15	9	3	0	0,45
B3	Lack of control over every job	7	13	11	3	0	0,46

An example of a calculation to get the mean probability B1 is the multiplicity of quitioner answers * probability from table 3 = ((5 SK * 0,2) + (13 K * 0,4) + (12 S * 0,6) + (4 B * 0,8) + (0 SB * 1))/34 respondent = 0,49. Furthermore B2-B3 uses the same way.

Table 7. Basic event work of the contractor

No	Work factors	SK	K	S	B	SB	Mean Probability
C1	Damage and effectiveness of machine use	3	14	10	6	1	0,53
C2	Planning and control carried out by the contractor did not go well.	5	13	11	4	1	0,50
C3	A production system that is not working properly	4	12	14	2	2	0,52
C4	Lack of construction materials	4	10	15	3	2	0,54

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An example of a calculation to get the mean probability C1 is the multiplicity of quitioner answers * probability from table 3 ((3 SK * 0,2) + (14 K * 0,4) + (10 S * 0,6) + (6 B * 0,8) + (1 SB * 1))/34 respondent = 0,53. Furthermore C2-C4 uses the same way.

Table 8 Basic Events of Environmental Conditions

No	Works factors	SK	K	S	B	SB	Mean Probability
D1	The occurrence of a work accident	5	16	11	2	0	0,46
D2	Problems with residents around the project	6	16	11	0	1	0,45
D3	Late work due to environmental conditions	5	17	10	1	1	0,46
D4	Soil conditions on construction projects	4	16	14	0	0	0,46

An example of a calculation to get the mean probability D1 is the multiplicity of quitioner answers * probability from table 3 ((5 SK * 0,2) + (16 K * 0,4) + (11 S * 0,6) + (2 B * 0,8) + (0 SB * 1))/34 respondent = 0,46. Furthermore D2-D4 uses the same way.

After determining the factors of the basic event and intermediate event, it is then continued by drawing a fault tree analysis graphic, as follows :

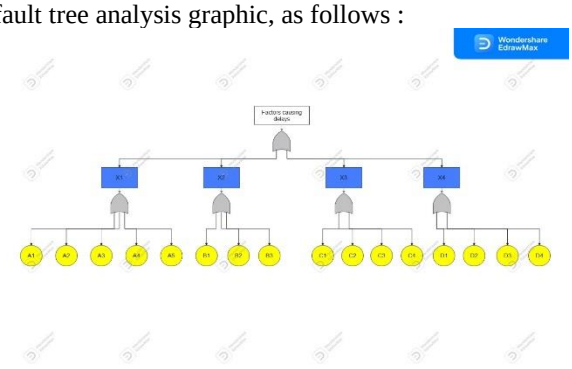

Figure 3. FTA Graph

After drawing fault tree analysis with Wondershare Edraw max, then analyzing with MOCUS (Minimal obtain cut sets), like the following table :

Table 9. MOCUS

1	2	3	Calculated	Law
Factors causing delay	x1	A1 A2 A3 A4 A5	A1+A2+A3+A4+A5= A5+A4+A3+A2+A1	Commutative Law
	X2	B1 B2 B3	B1+B2+B3=B3+B2+B1	Commutative Law
	X3	C1 C2 C3 C4	C1+C2+C3+C4= C4+C3+C2+C1	Commutative Law
	X4	D1 D2 D3 D4	D1+D2+D3+D4= D4+D3+D2+D1	Commutative Law

Description:

1. For And gate marked with (,)
2. For Or gate marked with row dressing
3. Factors causing delays in having Or gates
4. The X1 has an Or gate
5. The X2 has an Or gate
6. The X3 has an Or gate.
7. The X4 has an Or gate
8. A1+A2+A3+A4+A5 with commutative properties has the same result: A5+A4+A3+A2+A1
9. B1+B2+B3 with commutative properties has the same result, namely: B3+B2+B1
10. C1+C2+C3+C4 with commutative properties has the same result: C4+C3+C2+C1
11. D1+D2+D3+D4 with commutative properties has the same result, namely : D4+D3+D2+D1
12. So it can be concluded with the MOCUS method no changes occur in the fault tree analysis diagram. Because with MOCUS the result of the FTA produced is the same then

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used the mean analysis of the likert scale quitioner value. The probability value of A1 to A5 is taken from table 5, with a mean of 0.5 from the result of the mean probability A1 to A5 / 5. The probability value B1 to B3 is taken from table 6, with a mean of 0.47 from the result of the mean probability B1-B3 / 3. The probability value C1 through C4 is taken from table 7, with a mean of 0.52 from the result of the mean probability C1 to C4 /4. The probability value of D1 to D4 is taken from table 8, with a mean of 0.46 from the result of the mean probability D1 to D4 / 4.

Table 10. Mean Analysis

Code	N	Mean	Probability
A1	34	0,5	0,56
A2	34	0,5	0,54
A3	34	0,5	0,48
A4	34	0,5	0,47
A5	34	0,5	0,45
B1	34	0,47	0,49
B2	34	0,47	0,45
B3	34	0,47	0,46
C1	34	0,52	0,53
C2	34	0,52	0,5
C3	34	0,52	0,52
C4	34	0,52	0,54
D1	34	0,46	0,46
D2	34	0,46	0,45
D3	34	0,46	0,46
D4	34	0,46	0,46

Probability values must be greater (>) than the mean to meet the criteria. Here are basic events that meet the criteria that are factors that cause delays :

Table 11. Result Mean Analysis

Code	N	Mean	Probability
A1	34	0,5	0,56
A2	34	0,5	0,54
B1	34	0,47	0,49
C1	34	0,52	0,53
C4	34	0,52	0,54

According to the mean analysis of the likert scale obtained from the quitioner concluded the cause of the delay factor is:

1. Late owner in making payments to contractors or related parties (A1).
2. The owner's delay in approving and making and making changes to the design (A2).
3. Lack of oversight of design (B1).
4. Damage and effectiveness of machine use (C1).
5. Lack of construction materials (C4)

5. CONCLUSION

Analysis of factors causing delays in the Royal Surabaya Hospital project is caused by several things, as follows:
From the results of the Fault Tree Analysis (FTA) diagram, it found that the factors that affect the delay of the 4 jobs above are as follows:

a) Factors influenced by the owner's work:
- Late owner in making payments to contractors or related parties.(A1)
- The owner's delay in approving and making and making changes to the design.(A2)

b) Factors influenced by construction management work:
- Lack of oversight of design.(B1)

c) Factors affected by the work of the contractor:
- Damage and effectiveness of using heavy equipment.(C1)
- Lack of construction materials.(C4)

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