

Establishment of Magnetic Levitation for Flood Prevention in Jakarta with Project Management Approach

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Abstract

DKI Jakarta is one of the urban areas that has always experienced an increase in population every year. This results in an increase in the development of the plains of Jakarta and the increase in groundwater use. As a result, groundwater is decreasing and the Jakarta area is getting lower. This is exacerbated by rising sea levels due to global warming. In the future, it is very likely that areas near the waters will be inundated. By looking at the problem, researchers discouraged the project by building a reclamation that applied the working principle of magnet levitation as a place of refuge and increased the number of dwellings in the Jakarta area. In addition, it can also increase Jakarta's regional income and development can be carried out according to what the government wants. With the magnet levitation, the region will be free from flood threats and reduce groundwater use which is one of the threats to flooding for Jakarta. This project is a long-term project that can benefit the population and government of Jakarta. In addition to income from investors, this project can also increase the potential of Jakarta. Various kinds of things can be built in this area, including supporting facilities that can be supplied to the Jakarta area such as logistic storage and so on. The total needed in this development is IDR 695,580,112,442. This project is planned to start on September 3rd, 2018 and finish on November 5th, 2024 before adding contingency reserve.

Keywords

Flood Prevention, Jakarta, Magnetic Levitation, Project Management, Reclamation

1. Introduction

Hoping to have a better life is normal, one way that can be done is through urbanization. In 2014 it was found that there were 54% of the world's population living in urban areas, even according to United Nations (PBB) estimates it would increase to 66% by 2050, 90% of which were concentrated in the Asian and African continents (Widyaningrum, 2018). In Indonesia, one of the urban areas is DKI Jakarta. According to world population data, Jakarta ranks 9th most populous city in the world in 2015 (Malik, 2017). It can be seen from the increasing density of Jakarta which can be seen in Figure 1.

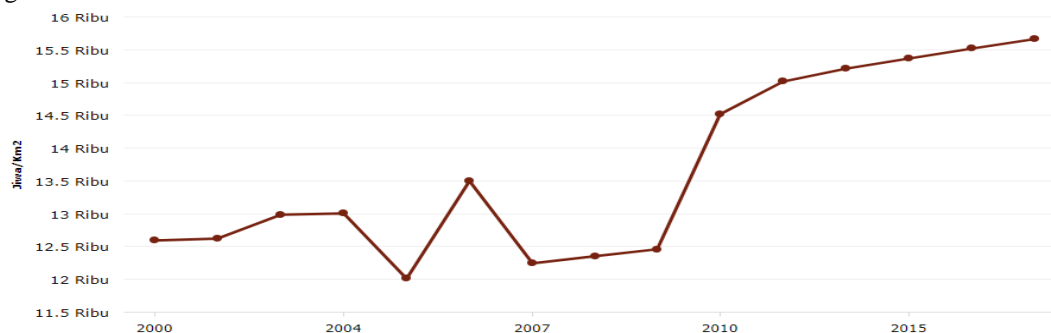


Figure 1. DKI Jakarta population density (2000-2017)

This increasing number affects the use of Jakarta's land area to be used as a residential area. In addition, the potential of this urban area also attracts investors to participate in building a company in the form of dwellings and companies. As a result, the land used as water catchment decreases every year. This is in line with reduced groundwater resulting from the exploitation of Jakarta residents. This resulted in a decrease in Jakarta's land surface to lower Jakarta's position on the sea. This condition is exacerbated by the tendency of rising sea levels due to global warming. This land subsidence and rising sea water is very likely to flood the Jakarta area which borders the waters in the future, as has happened in the city of Semarang, Central Java. The condition of Jakarta in 2018 can be seen in Figure 2.



Figure 2. Condition in Jakarta 2018

Our project focuses on the construction of reclamation in the Jakarta area as a solution to the problem. Construction of buildings in the territorial waters can serve as a residence for Jakarta residents which is expected to continue to increase and as a refuge for Jakarta residents living in the vicinity of the waters. Not only that, revenue for Jakarta will also increase by offering the project to investors. Unemployment can decrease due to the large number of workers needed in the construction of reclamation. This area can later be used as the development of Jakarta in accordance with the general interest to be achieved. Potential water drainage in Seribu Island area can also be done. This project is called “Magnetic Levitation (MagLev) for Flood Prevention in the Capital of Jakarta – MagLev Establishment on Jakarta Bay Reclamation”. The rough model and working mechanism of MagLev can be seen in Figure 3.



Figure 3. MagLev Working Mechanism & Rough Model of Maglev in Building

This development applies the principle of magnetism or magnetic levitation, which is a repulsive force on a magnet which can later cause a floating effect or a floating state in a building. In addition there is an electromagnetic embedded in the bottom of the house which is coated with a steel safety frame and water repellent coating, this electromagnetic coil is used as a generator of electromotive force. TX coils and RX coils are used as wireless chargers to meet the electricity needs of buildings when there is a flood. By applying this principle, buildings in the reclamation area will be free from the threat of flooding which can occur at any time.

The background within this project master plan is to build reclamation by applying the working principle of magnet levitation in urban areas in Indonesia, specifically in DKI Jakarta. This is expected to serve as a solution to the increasing population density of Jakarta as well as a new place for residents who have a place near the waters so that it has the potential to be flooded. This will reduce losses due to disruption of activities that can occur. In addition, it can also increase the income of the Jakarta administration and can be used for public purposes that support the prosperity of Jakarta residents. This development can be carried out from 2018-2024 which is supported by

infrastructure development in Indonesia. There shall be built many roads, ports, residential buildings, and investor companies as well as businesses desired by the government. Which directly shall increase income and prosperity in Jakarta and improve the deliverables of this project toward completion, and magnify the advantages given upon project completion.

2. Research Methods

In this research, the construction of MagLev in Jakarta will use a project management approach. With the preparation of good project management, it can be estimated the time and cost needed to run the project, so as to minimize cost losses due to possible project lags (Institute, 2008). This research will explain the project scope, time estimation, cost estimation, stakeholder analysis, project impact and risk analysis that might arise in the development of MagLev in Jakarta.

Scope of the project is carried out using the Work Breakdown Structure (WBS). WBS is a grouping of work elements shown in graphical form to organize and divide the overall scope of a work project (Rev, 2003). In determining WBS, researchers conducted a Focus Group Discussion (FGD) with several project managers who were experienced with construction projects. It is hoped that the resulting WBS can cover the entire project in detail. In addition, to clarify the scope of the statement, this study uses the SMART method which consists of Specific, Measurable, Agreed upon, Realistic and Time bounded.

In project scheduling, researchers use the Critical Path Method to determine the duration of the project and determine the project's critical path. According to Dimiyati and Nurjaman (2014), the Critical Path Method (CPM) is a critical path method that uses a network with a linear time-cost balance. The CPM technique is carried out by arranging a network that is identified in the direction of activities and using simple time estimates for each activity that shows the implementation period

Stakeholder analysis is carried out using a grid model in which all stakeholders provide an assessment of 2 variables, namely power and interest. Retrieval of power and interest data is done by direct interviews with stakeholders. With stakeholder analysis, researchers can find priority stakeholders so that an appropriate approach to these stakeholders can be carried out which ultimately influences the success of the project.

3. Results and Discussion

3.1 Scope Statement and Project Scope

The scope of this project is more focused on the infrastructures establishment. The steps includes the preliminary surveys, Contractors Selections, Pre-Earth Works, Earth Works, Electronic and Communication Establishment, Building Constructions, Legal and Administrative, Information and Security system establishment. The following is explained by the SMART method.

- Specific: Located in Jakarta Bay Reclamation, Indonesia. Using Magnetic Levitation technology. Make the building float above the magnet.
- Measurable: Reasource in the form of magnet and electricity. Eliminate flood losses.
- Agreed Upon: Stakeholders consist of Jakarta Netizen, PemProv DKI Jakarta, Ministry of Marine Affairs and Fisheries (Stakeholders are fully showed in Table 3).
- Realistic: Only requires funds of Rp 695,580,112,442 and now there are 167 companies that have supported, and it is possible to increase if it added with the application MagLev technology in Jakarta bay reclamation.
- Time: Start on September 3rd, 2018 and finish on November 5th, 2024 before adding contingency reserve.

Natural factors and unexpected factors can occur unexpectedly so as to enable the occurrence of a time that has little effect because development is intended for growth long-term but it but need to be done immediately.

Project activities and sub activities are defined using Work Breakdown Structure (WBS) that can be seen in Figure 4. Level 1 of WBS is the MagLev Establishment on Jakarta Bay Reclamation, followed by level 2 WBS are the activities that will occur in the project execution. The WBS level 3 are the sub activities of level 2 WBS.

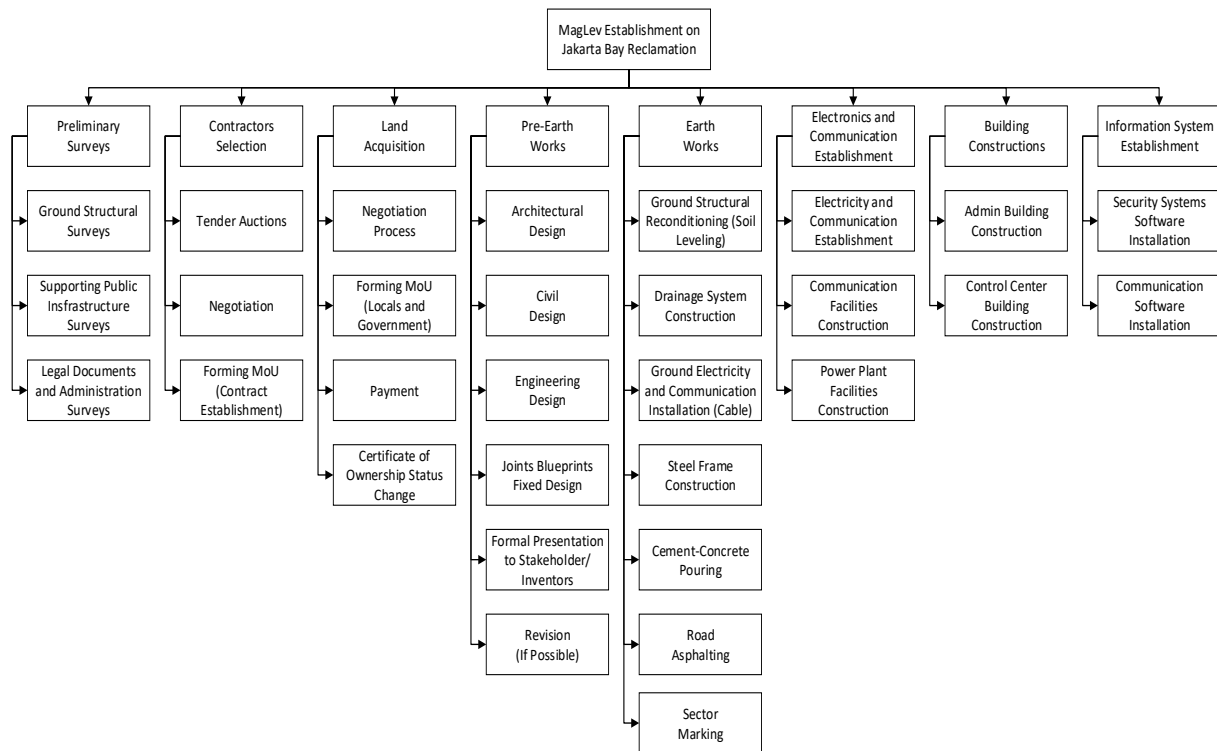


Figure 4. Work Breakdown Structure of MagLev Establishment

3.2 Project Time

Critical path is the crucial part of the project that determines the project completion time. Since the time management is sensitive in the critical path, time will be spent to complete the project. Table 1 letters represents each activities and sub activities within the project, to ease the understanding of Critical path in Network Diagram. This is obtained by analyzing the project deliverables dependencies and duration by drawing the precedence diagram of this project. The critical path diagram is shown in the Figure 5.

Table 1. Network Diagram Letter Index

Letter	Task Name	Duration(day)
A	Ground Structural Surveys	5
B	Supporting Public Infrastructure Surveys	7
C	Legal Documents and Administration Surveys	4
D	Tender Auctions	15
E	Negotiation	20
F	Forming MoU (Contract Establishment)	9
G	Negotiation Process	2
H	Forming MoU (Locals and Government)	2
I	Payment	2
J	Certificate of Ownership Status Change	3
K	Architectural Design	120
L	Civil Design	120
M	Engineering Design	120

Letter	Task Name	Duration(day)
N	Joints Blueprints Fixed Design	60
O	Formal Presentation to Stakeholder/ Inventors	14
P	Revision	21
Q	Ground Structural Reconditioning (Soil Leveling)	50
R	Drainage System Construction	50
S	Ground Electricity and Communication Installation (Cable)	50
T	Steel Frame Construction	50
U	Cement-Concrete Pouring	50
V	Road Asphaltting	50
W	Sector Making	50
X	Electricity and Communication Establishment	40
Y	Communication Facilities Construction	40
Z	Power Plant Facilities Construction	40
AA	Admin Building Construction	30
AB	Control Center Building Construction	30
AC	Security Systems Software Installation	15
AD	Communication Software Installation	15

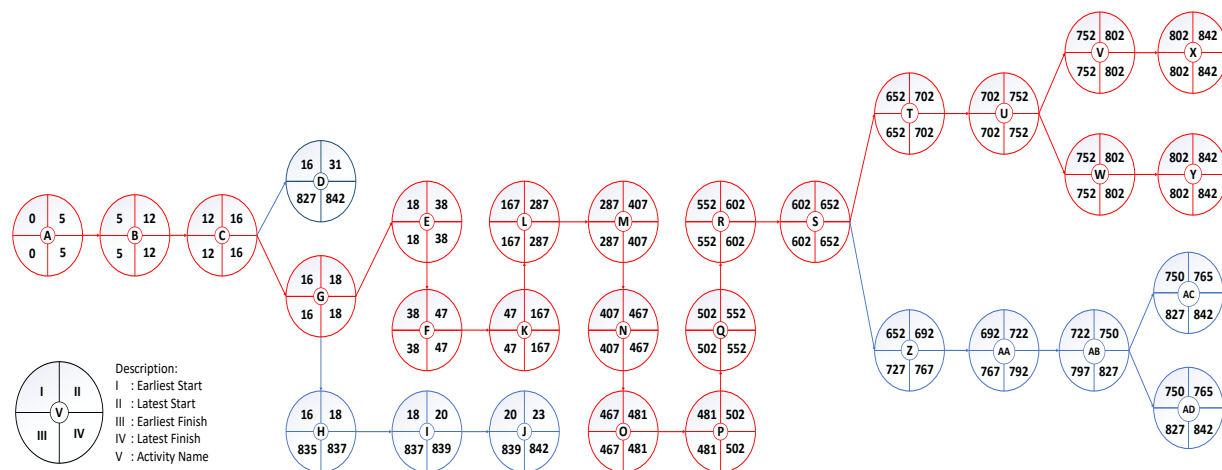


Figure 5. Critical Path Network Diagram

Based on Figure 6, the critical path is colored red, and the earliest finish of MagLev establishment project is 827 days while the latest is 842 days. This project is planned to start on September 3rd, 2018 and finish on November 5th, 2024 before adding contingency reserve by using the critical path

3.3 Master Budgets

Initial cost planned by the project team is worth of Rp. 695,580,112,442 will be spent on the whole activities and wages. This large amount of investment might come from Indonesian Government and potential investors. The cost mentioned could be different in the future due to fluctuation of rupiah. Table 2 shows the expenses that will occur during project execution.

Table 2. Master Budget of MagLev Establishment

No.	Activities	Days		Cost	Percentage	Cumulative Cost
1	Preliminary Surveys	14	Rp	253,010,230	0.04%	Rp 253,010,230
2	Contractors Selection	42	Rp	132,500,252	0.02%	Rp 385,510,482
3	Land Acquisition	8	Rp	45,900,150	0.01%	Rp 431,410,632
4	Pre-Earth Works	450	Rp	4,563,950,400	0.66%	Rp 4,995,361,032
5	Earth Works	406	Rp	563,143,200,450	80.96%	Rp 568,138,561,482
6	Electronics and Communication Establishment	320	Rp	9,101,930,200	1.31%	Rp 577,240,491,682
7	Building Constructions	295	Rp	117,708,001,560	16.92%	Rp 694,948,493,242
8	Information System Establishment	85	Rp	631,619,200	0.09%	Rp 695,580,112,442
Total					100.00%	Rp 695,580,112,442

3.4 Stakeholder Analysis

A stakeholder is a party that has an interest in a company, and can either affect or be affected by the business. Table 3 shows the identified stakeholders based on their levels of power and interest for use on the power/interest chart as part of the stakeholder analysis. Figure 6 shows the grid model for the MagLev establishment on Jakarta Bay Reclamation stakeholders. Each letter represents stakeholders in accordance with the key in the chart above.

Table 3. Stakeholder Registers of MagLev Establishment

ID	Stakeholder	Description	Power	Interest	Engagement Phase
A	Investor	People or company who invest money on the project	10	10	Whole Project Phase
B	Pemprov DKI Jakarta	Main Authority Owner	9	9	Whole Project Phase
C	Developer Agency	Authority owner for the development	9	10	Whole Project Phase
D	Coordinating Minister for Maritime Affairs and Resources	Highest institution authorized for maritime and resources in Indonesia	8	10	Whole Project Phase
E	Transportation Department of Jakarta	Authority owner for transportation routes in Jakarta	7	3	Whole Project Phase
F	Ministry of Marine Affairs and Fisheries	Highest institution authorized for marine affairs and fisheries issues in Indonesia	6	7	Whole Project Phase
G	Ministry of Labors	Highest institution authorized for labor issues in Indonesia	6	4	Whole Project Phase
H	Public Works Services	Authority owner for the distribution of water	3	7	Whole Project Phase
I	Ministry of Environment and Forestry	Highest institution authorized for environmental impacts, waste, and pollution issues in Indonesia	6	6	Whole Project Phase
J	Ministry of Finance	Highest institution authorized for financial growth in Indonesia	4	5	Whole Project Phase
K	PT. PLN	Institution responsible for electricity in Indonesia	4	8	Whole Project Phase
L	Jakarta Citizens	Society who lives in Jakarta and the main customers	10	9	Whole Project Phase
M	Contractors	Entities responsible for the whole construction site	7	7	Legal, Procurement, Construction, Report

ID	Stakeholder	Description	Power	Interest	Engagement Phase
N	Architect	Person or Entity who responsible for the architectural design of facility	7	8	Legal, Procurement, Construction, Report
O	Engineers	People responsible for particular technical activities	8	7	Procurement, Construction
P	Workers	People who are directly working for the facilities and construction	5	7	Procurement, Construction
Q	Suppliers	Entities who supply the materials and tools needed	7	9	Legal, Procurement, Construction, Report
R	Customs	Institution responsible for handling the tax and customs from overseas	8	9	Legal, Procurement, Report
S	Regional Police Stations	Available to provide extra security	9	8	Whole Project Phase
T	Nearby Hospitals	Available in case of emergency	3	6	Whole Project Phase
U	Nearby Firefighter Stations	Available in case of fire	4	4	Whole Project Phase
V	Indonesia III PT. Persero Port	Nearby port as material distribution channel	5	9	Procurement, Construction
W	Fisherman	Counter Party	6	9	Whole Project Phase
X	Local Insurance Agency	Institution responsible for labor insurances	3	4	Whole Project Phase
Y	Journalist	Person who responsible for the publication	4	3	Whole Project Phase
Z	Notary	Third party responsible in all legal assessments	8	4	Legal

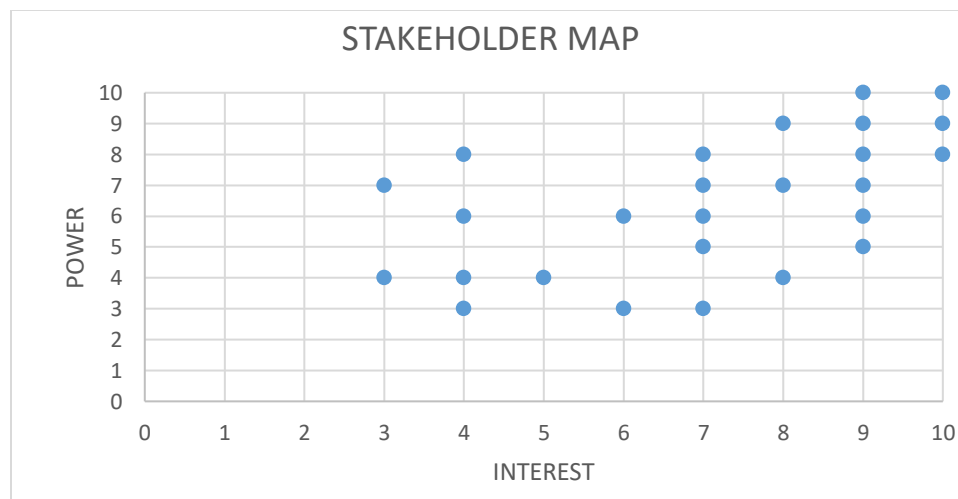


Figure 6. Stakeholder map

Based on the stakeholder map, it can be seen that the highest stakeholder priority is the investor. This is because investors are very helpful in terms of funding so that the project can be run and completed. Then followed by the Developer Agency, DKI Jakarta Provincial Government and so on. When the power and interest are above 5, then the stakeholders are closely managing the project, when the power is above 5 but the interest is lower than 5, then the stakeholders are satisfied. Also, when the power is less than 5 and the interest is more than 5, then the stakeholders are being well informed, the last is when the power and interest are less than 5 then, the stakeholders are merely monitoring the project.

3.5 Risk Analysis

As an organization we have our own perspectives about risks and how we manage these risks. The result of risk management we have done, can be seen that there are three possible risks that have the highest rank which are:

- I. As we need extensive land to build MagLev Establishment on Jakarta Bay Reclamation, the possibility to have conflict with land owner is very high. This stage is critical to project completion, otherwise the project shall have a huge delay or even failed. In our opinion, this risk can be mitigated by providing good social communication between government and local
- II. Project delivery is very crucial to project completion. Once the delivery is not proper with schedule it may affect to other project activity. This risk can be mitigated by rescheduling and/ or take overtime for certain work
- III. Budget become one of constraint in project development, failed meeting budget estimation may effect on project delay. Backup investor may become one of mitigating solution to overcome exceeded budget.

3.6 Project Impact

MagLev Establishment on Jakarta Bay Reclamation shall impact toward 4 parties within its reach shall be massive. According to their perspectives, this impact can also be called as multiplier effect which shall definitely magnify the advantages delivered upon project completion. The 4 parties that shall be affected are:

a. Toward People

Upon MagLev Establishment on Jakarta Bay Reclamation, it is expected to provide a place of residence for the people of Jakarta who do not have a place to live without worrying about being affected by floods. In addition, this development can also reduce unemployment rates, according to Ahok (2017), this reclamation can absorb a workforce of 1 million people.

On the negative side, fishermen object because they will cause shellfish, fish, and marine biota in the Jakarta Bay to experience a decline in population. However, the fishing area is actually far from the Jakarta bay reclamation area. The reclaimed island was built about 1 to 3 kilometers from the mainland. While the fishing area is located at 7-10 miles (or 11-16 km) from the mainland of Jakarta.

b. Toward Company

Deputy Chairperson of the Indonesian Employers' Association (Apindo), Suryadi Sasmita explained in the construction of the project there were 167 companies participating in the development of the Jakarta Bay reclamation. With the magnetic levitation project, it is very possible for other companies to join in because there is no fear of the failure of reclamation projects such as floods or sinking of reclaimed islands due to rising sea levels, which in the end these companies will need labor from local area so that it is beneficial for the people of Jakarta.

c. Toward Local Government

Basically, DKI Jakarta Provincial Government gets 3 benefits from the developer of Jakarta's north coast strategic area, namely obligations, land contributions, and additional contributions. From the obligation, the developer is obliged to provide basic infrastructure and facilities for each island, inter-island connecting infrastructure, and dredging sedimentation of lateral and vertical canals around the reclamation island. In addition, from the contribution of land, the developer must submit 5 percent of the total land area of HPL. In addition, through additional contributions, DKI Provincial Government is still asking for an additional contribution of 15 percent from the land that is part of the developer.

d. Toward Nation

In the islands resulting from the reclamation, there will be a place for business, recreation and settlement. Economic activities in this new region are not only from residents and residents who work there, but also from tourists who come. According to Suryadi (2016) the island resulting from reclamation with a flood problem that is resolved, will later make the north coast of Jakarta a world-class region. No less competing with the Marina Bay Sands waterfront area in Singapore.

4. Conclusions

Based on the discussion above, it can be seen that the construction of MagLev in Jakarta for flood prevention can take place as soon as 827 days and the longest is 842. It is planned to begin on September 3rd, 2018 and finish on November 5th, 2024. The total cost required is Rp. 695,580,112,442. The most prioritized stakeholder is the Investor, followed by the Developer Agency, DKI Jakarta Provincial Government and so on. This project will have an influence on 4 parts, namely the community, companies, local government, and the Indonesian state.

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Biography

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