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Project control using S Curve in provision of pedestal crane at PT. Medco E&P Natuna - West Belut Platform

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ABSTRACT

In the implementation of a project, three main aspects are indicators of the success of the project: cost, schedule, and quality. If the cost and time of project implementation are in accordance with the planning and quality requirements, then the project can be said to be successful. Time plays a significant role in construction management projects, where time is also a management function. With good and proper time control, obstacles to delays in project implementation can be avoided as much as possible. The purpose of this study was to determine the cause of the achievement or deviation of work between the realization in the field and the planned time schedule for the procurement of a pedestal crane unit for a new platform in the operational area of block-B-Natuna.

Keywords: Construction, Pedestal Crane, Project Management, S Curve, Time Schedule.

1. INTRODUCTION

One of the key assignments of a speculator and a temporary worker in the arrangement and execution of development work is to degree the advance of execution with respect to the arranged due dates and costs (Konior & Szóstak, 2020). The success of a construction project on time is the most important goal for both owners and contractors (Rahmat & Isdaryanto Iskandar, 2023). A delay is a very undesirable situation because it is detrimental to both parties in terms of time and cost. In general, every construction project has a specific implementation plan and a specific implementation plan if the project must be completed and if it must be started when it must be completed how the resources are provided and the safety of the workers (Rahmat, 2024b)(Imron, Jefri et al., 2025). Making a Project Implementation Plan always refers to the conditions for estimating claim plans and schedules. Therefore, the problem arises in addition to increasing the cost of project implementation, it also increases the project implementation time. Construction Management is a system that manages construction project networks. This is similar to the correct function (Al-bab & Hepiyanto, 2024).

A development extension may be an arrangement of interrelated exercises to attain certain objectives (buildings/construction) within a certain time, taking a toll on quality limitations (Sutopo & Hendarti, 2022). A development venture may be a frame of action that takes place within a restricted time, with certain assets to create buildings or frameworks. Venture planning may be a shape of venture arranging that points to guarantee that the venture can be completed on time (Miftah Fauza, 2020) (Agnes Maria Wijaya, 2015) (Hardianta & Effendy, 2021). Projects with repetitive work packages require a scheduling method that can accommodate continuous and scheduled resources without obstacles (Soplanit Nony et al., 2021).

2. LITERATUR REVIEW

In completing construction work, scheduling is one of the most important aspects and must be considered. In scheduling, not only the allocation of available time but also other limitations are considered so that the completion of a project can be optimal (Abdillah et al., 2025). In development ventures, the application of administrative capacities (arranging, organizing, staffing, driving, and controlling) in venture usage is vital to bolster extended victory (Rahmat, 2025). The monitoring and evaluation of work is the main indicator of a job's success (Brianorman, 2019).

In general, every construction project has a clear plan and schedule for implementation, including when the project should start, when it should finish, and how to prepare the required resources. A project schedule is always based on the conditions predicted when a plan and schedule are made. Therefore, problems arise if there is a difference between the predictions and conditions in the field. The impact that often occurs is a delay in the project schedule and increase in implementation costs. Construction management is used to regulate the progress of a construction project, covering all aspects of planning (Al-bab & Hepiyanto, 2024).

Thus, a time management system is very important, and it also helps in determining clear priorities and trying to increase the effectiveness and efficiency in managing projects, in order to achieve optimal results from the resources available. All of this aims to achieve the goals of building construction, namely, success that meets the criteria of time, cost, and quality. In addition, good time management is needed; it must also be balanced with the implementation of the project, which is appropriate and right with the planning that has been made previously. With good time management and implementation, there is a risk of cost overruns (Munasir & Renaningsih, 2023).

Project-time management involves planning, preparing, and controlling the schedule of project activities. In this process, clear and specific guidelines are provided so that the project can be completed faster and more efficiently (Husen, 2011). There are five main steps in project time management: defining activities, arranging the order of activities, estimating the duration of each activity, creating a schedule, and controlling the schedule. Project scheduling is part of the planning results that provide an overview of the planned schedule and project progress in terms of resource usage such as costs, labor, equipment, and

materials, as well as project duration and development of time to complete the project. In the scheduling process, each activity and the relationship between the activities are designed in more detail. The aim is to facilitate the project evaluation process. Scheduling is the arrangement of the time available to carry out each job to complete the project optimally, considering the various existing limitations. The function of this time schedule is as a control tool to regulate the percentage level of work with the duration of its implementation. With this schedule, planning can be done based on what work must be done first, the start time of the work, and the deadline for the work to be completed according to the schedule that has been planned properly to avoid the possibility of delays (Munasir & Renaningsih, 2023).

The S-curve could be a strategy that can be used to screen a venture. The S-curve could be a chart created by Warren T Hanumm based on field perceptions of a number of huge ventures from the beginning to the conclusion of the extend. The S-curve can appear as a venture advance based on exercises, time, and movement weights, which are displayed as an aggregate rate over the complete extension (Sabariah et al., 2020). The S-curve could be a strategy that can be used to screen a venture. The S-curve could be a chart created by Warren T Hanumm based on field perceptions of a number of huge ventures from the beginning to the conclusion of the extend. The S-curve can appear as a venture advance based on exercises, time, and movement weights, which are displayed as an aggregate rate over the complete extension. The utilization of the S-curve in venture assessments offers the advantage of visualizing advances.

This bend is a comparison between plans and realizations over time, making it simpler for extended supervisors to discover conceivable delays or fetched invades (Anton et al., 2024). The S-curve is a diagram with the vertical axis representing the cumulative value of the cost or progress (progress) of activities and horizontal time. The S-curve shows the functionality of the project based on activities, time, and work weight presented as a cumulative percentage of all project activities. The S curve is a graph of the relationship between the duration or time required to carry out work and the accumulation of work progress, where work progress is a representation of the price of the work. Thus, in compiling this S-curve, it refers to the weighting of the price of work using the following equation:

$$Weight\ ((\%) = \frac{Cost\ of\ ecah\ job}{Total\ cost\ the\ job} \times 100\%$$

In this curve, the progress of the implementation can be easily observed until the deviation of the realization of the work implementation from the planned duration (Amani et al., 2012). In this curve, there are several rules made by Warren T. Hannum, and the inventor compiling this curve must be:

a. In the first quarter of the study period, the graph increased gradually to 10%.
b. Half the time, the graph rises sharply, reaching 45%.
c. At the end of the three-quarter period, the graph rose sharply, reaching 82%.
d. At the end of the experiment, the graph increased gradually to 100%.

With these rules, a graph will be depicted that resembles the letter S is very likely to be the beginning of the naming of this curve.

In this way, the time management system requires priority and implements it to achieve optimal results from existing resources and seeks to improve the effectiveness and efficiency of project management (Rahmat, 2024a). The whole project must achieve success that meets the objectives of the construction structure: time and cost standards and quality. In addition to excellent time management, it must be compensated by good prior planning and project implementation. The existence and implementation of good time management undermines the risk of increasing project costs, which ultimately has advantages for project organizers and contractors as managers (Munasir & Renaningsih, 2023). When setting up weights for progress activities, progress is made carefully so that all progress can be monitored clearly. The activity weights were first increased slightly, monitored centrally, then decreased, and then increased until the supplement decreased towards the end of the work (Sukindrawati et al., 2023).

The practicality of using the S-curve makes it the most widely used tool in construction projects. However, there are also quite a few projects that use this tool only as a wall decoration for the project

meeting room, even though the benefits of this S curve are quite numerous, in addition to being an indicator tool and monitoring the project implementation schedule. There are several benefits of applying the S curve:

1. The implementation of a project is controlled by comparing the deviation between the curve and the realization.
2. Controlling the progress of a project according to available time
3. Information for decision-making based on changes in the realization curve to the plan curve. This change can be in the form of a percentage of work that is faster or slower than the time specified for completing a project.
4. Accurate information is the correct time to make payments to suppliers.
5. This tool can be used to predict or forecast project completion.
6. A tool to review and create a work program for project implementation in weekly or monthly time units. Usually to accelerate.
7. As a basis for calculating project escalation.
8. Cash flow is calculated as a tool.
9. This is a tool for determining the development of acceleration.
10. As a basis for macro-management evaluations.

Overseeing development ventures requires a long time and is highly exactful. Microsoft Extend 2013 can bolster the error of overseeing development ventures to guarantee exact information (Sugiyarto et al., 2016). The advantage of Microsoft Extend 2013 is its capacity to handle action arranging, organizing, and controlling the time and taking a toll of adjusting input information yield information concurring to its reason. Overseeing Crane Podest Development Ventures with Microsoft Venture 2013 is planning for organizers and specialists who need to oversee their development ventures utilizing Microsoft Venture 2013 in a common sense, quick, and pertinent way.

Based on the description above, a project scheduling method is needed that is expected to be easy to compile but can provide clear information regarding the number of human resources directly involved in the work and their distribution in the scheduling period, in addition to the cost allocation in each scheduling period (Rahmat, 2019). Therefore, the purpose of this study is to compile and test a project schedule that can provide information on the estimated number of workers needed in each time period, in addition to information on cost requirements, which will facilitate the control of project implementation.

The project subject analyzed was the procurement of one unit of pedestal crane with a capacity of 15 tons, as well as the addition of modification elements required for its use on oil and gas well platforms. The West Belut Field is an offshore field located in Block B of the Natuna Sea. This field is located at a water depth of approximately 318 feet, approximately 11 km west of the South Belut Field, and approximately 13 km southwest of the North Belut CPP. The West Belut Field was included in the last phase of Block B development. The West Belut Field was discovered in 1998 by the Belut-3 well, which explored approximately 80 feet of net gas pay and 160 feet of net oil pay in the Arang, Udang, and Syn-Rift sections. The West Belut-2 well was drilled in 1999, and the gas pay (26 feet net gas) in the Lower Arang Formation was confirmed. Additional appraisal wells of West Belut-1 were drilled in Q3 2020 to confirm the presence of hydrocarbons in the Udang formation.

The project was implemented in accordance with the general contract system. The subject of the contract is an experienced construction company interested in the implementation of work status. It consists of the implementation of a comprehensive investment project involving the procurement of a complete pedestal crane unit and the implementation of the assembly and commissioning of the project after the assembly process. It should be emphasized that the initial contract with the General Contractor does not consider the final completion of the crane unit; therefore, the scope of work in the final completion section does not include the completion and equipment of the crane unit. The scope of the work assigned includes the completion of general parts such as boom cranes, jib cranes, engine rooms, and cabins. In addition to the contract, equipment for the unit's safety facilities, lightning protection, and

auto lube is required. The deadline for the implementation of the subject of the contract is scheduled from November 11, 2023, to April 01, 2024.

In one clause of this crane procurement cooperation contract, immediately after the effective date, the contractor must form and mobilize its project management team. The contractor must have sufficient personnel and qualifications to form a team specifically assigned to work. The assigned team must consist of highly qualified professionals who are proven in their fields, and must consist of at least one (1) Project Manager, one (1) Engineering Manager, and one (1) manufacturer's Principal Technical Representative dedicated to this project. The Contractor's Project Manager must have full authority to represent and act on behalf of the contractor in all matters relating to the contract, and must act as the primary point of contact between the Company and the Contractor. The Contractor's Engineering Manager must have authority to handle technical issues from the company.

The Contractor must assume responsibility for certifying that the Project Manager and Engineering Manager are qualified to perform the work. The contractor should not apply second-tier subcontractor processes. The engaged subcontractor shall comply with the company's AML. If the subcontractor is not listed in the company's AML, the engagement is subject to company approval. The contractor shall ensure that all materials procured are in accordance with the Company's Company Approved Manufacture List (AML) document as addressed in Exhibit H - Company Supplied Data. Any deviation required company approval prior to writing. All equipment and materials provided by the contractor were new and unused. All equipment and materials provided by the contractor shall be completed with all certificates, as required by the company.

3. RESEARCH METHOD

The S-curve method was used for the data processing. This method is used in construction projects to complete work according to the plan. The plan is carried out together with an analysis of each job with the existing workforce. Monitoring will take place for 52 weeks, according to an analysis of the 15-ton pedestal crane procurement project. The weight of the work determines the length of time of the work. The remainder of this paper is organized as follows (see Figure 1).

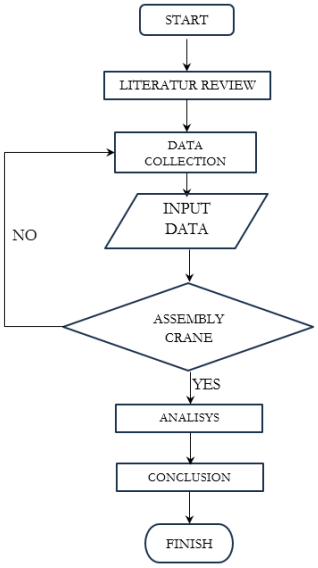

Figure 1. Research Flow Chart

4. RESULT & DISCUSSION

In the procurement project of pedestal crane units in the new gas well project - west belut–there was no description of the agreed bid price (Budget Plan) because the agreement between the contractor

and the developer was that the unit price of payment was based on the entire unit. However, data on the volume of each job was obtained without the unit price of the crane unit from the contractor. In the absence of unit price data for the work, in preparing the schedule with the S-curve, which usually uses work weighting based on the unit price of the work compared to the total price, in preparing the schedule for this project, weighting was used based on the work time compared to the total duration of the work.

The platform crane office was completed in December 2024, after 12 months of work. It is well known that the real date of commissioning and beginning of operation of the lodging was four months later than the arranged date, which brought about extra money-related misfortunes for the speculator. The investigation of the genuine advance of the work clearly shows how much the real conditions of the venture execution contrast from those initially accepted.

After commissioning, the pedestal crane unit was removed to prepare for shipping from Italy to Indonesia. The dismantling took approximately two weeks. They then packed the crane and moved it to the port to wait for shipping and customs to occur. Much communication occurred during this time to ensure that the shipping process was not delayed again. Normally, this shipping takes about 30 working days to reach Batam on the Riau Islands. The process occurred at the end of 2023, so delays were even more noticeable because in Europe, December was filled with Christmas and New Year holidays.

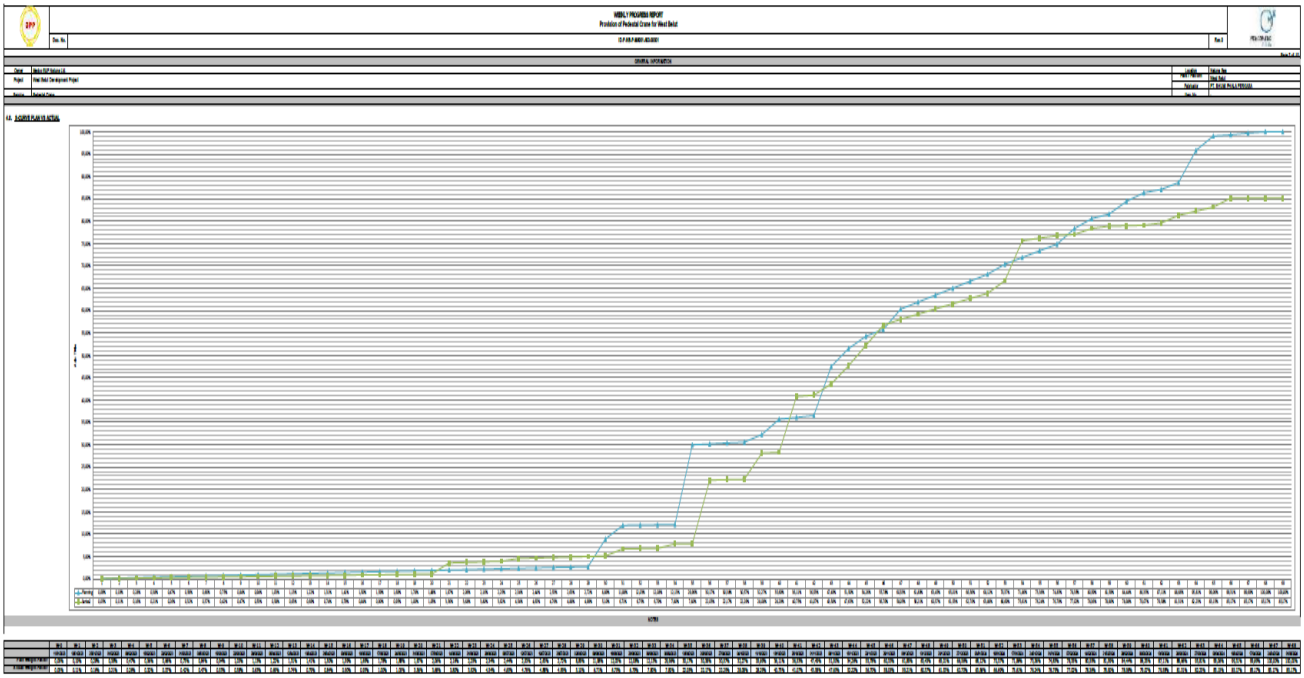

Figure 2. S Curve Plan Schedule Vs Actual

From Figure 2 of the planned schedule versus the actual schedule shown above, it can be seen that in the early phase of the procurement process, there was a significant acceleration of work over several weeks because, in the early phase, many engineering documents were prepared. However, in the fabrication phase, there was a slowdown in the work process due to delays from several subcontractors who could not supply parts according to schedule and winter holidays in Italy. Although this project has been known to have deviations that occurred in certain months, both time and cost deviations, the contractor has not addressed them because the work carried out was not based on critical work and all the work has not been completed.

The introductory budget for venture errors was thought to be small. The changes that occurred during the execution of the venture were brought about within the disappointment to meet the parameters accepted by the financial specialist by the conclusion of 2024 (i.e., the time and fetched of the extended

execution). The following reasons drive the disappointment in meeting the arranged due dates and usage costs:

1. Lack of proper preparation for construction projects at the investment-planning stage.
2. The Investor planned the implementation costs of the construction project based on the prices prevailing in 2024 and did not take into account price increases during the subsequent implementation period or financial fluctuations over time determined by the discounting procedure.
3. Investors' lack of experience in implementing similar construction projects.
4. The Investor has implemented several smaller projects in the past, but not in the hospitality sector.
5. Changes in initially adopted pedestal crane standards. The speculator misconceived the request for platform cranes and initially embraced lower benchmarks for the office than were required in this area.
6. Changes in the General Contractor's scope of work. The ensuing scope of work required the Common Temporary worker to create extra fetched gauges and offers, which required extra time.
7. The increase in the scope of work, in turn, resulted in a significant increase in employment at the construction site, especially with regard to specialist subcontractors.
8. The extension of implementation time led to an increase in the General Contractor's indirect costs. Current advertise lopsidedness within the development industry. Within the analyzed extended period between 2023 and 2024, there are major issues related to temporary worker companies and subcontractors at the initially expected fetched levels.

In analyzing the position of time and project costs, an earned value analysis is used to determine whether the project is experiencing delays or accelerations in time and is experiencing waste or cost savings by comparing planned achievements and comparing actual achievements with the actual costs incurred for the achievements achieved. The contractor should be more transparent and open to other parties involved in this project regarding the problems that occur in the project so that they can be identified and solutions can be sought together without harming all parties.

Ethical Approval
Ethical approval was not required for this study.

Informed Consent Statement
This research did not require informed consent.

Author Contributions
Conceptualization, RR., and DA; methodology, TJ., JI., and HS; validation, RR., and KM; formal analysis, RN., JI., and DA; resources, HS.; writing the original draft, RR., and DA; writing the review and editing, MN., and RN.

Disclosure Statement
No potential conflicts of interest were reported by the authors.

Data Availability Statement
The data presented in this study are available upon request from the corresponding author for privacy reasons.

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