

Construction project management monitoring system using s-curve

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Abstract

Every construction project generally has a specific implementation plan and implementation schedule: when to start the implementation of the project, when to complete the project, how to do the project, and how to provide resources. Making a plan for a construction project always refers to the estimates that exist when the scheduled development plan is made. Therefore, problems can arise if there is a mismatch between the plan that has been made and its implementation. With the limited resources in the company, thorough and good planning is needed as a guide in carrying out the project to use resources efficiently and organize work to be completed according to the time specified in the contract. To achieve this goal, the manager controls the project with an s-curve by comparing the actual curve graph with the plan curve graph. The method to be used in monitoring the progress of construction projects is the s-curve. The use of the s-curve method is very supportive because it is suitable for monitoring project progress in terms of performance, cost, and timeliness of project work. The results of this study show that the construction project management monitoring website using the s-curve can create a cost budget plan that follows the contract document, a schedule plan, a weekly project report, and a project report recapitulation. The output results are displayed in the form of a Gantt Chart, and S-curves are completed with plan curve lines and realization curve lines. This project management monitoring website has a multi-user feature so that more than one user can use it.

Keywords: S-curve; Construction; Project; Schedule; Cost Planning; Progress

1. Introduction

Rapid development in construction is characterized by many large-scale projects built by the government, the private sector, or a combination of the two. In a construction project implementation, a series of aspects are the key to the success of a project. Project management monitoring is one aspect of a construction project's work that involves keeping an eye on the project control system so that control can take resources into account, such as time, cost, and the performance of the project work so that it can be controlled [1].

Each construction project generally has a specific implementation plan and schedule, when the implementation of the project must begin, and when the project must be completed. Making a plan for a construction project always refers to the estimates that exist when the schedule development plan is made. Therefore, problems can arise if there is a mismatch between the plan that has been made and its realization. Therefore, the impact that often occurs is the delay in project implementation time which is accompanied by an increase in project implementation costs [2].

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2. Material and methods

2.1. Related Research

In a study, the results of previous research related to the research are needed. Likewise, this research uses literature sources from existing ones. In the research conducted by Revano Minochi Hardiman, an important role in the development of a project is to control project management. Managing a project from the preparation, planning, implementation, and evaluation stages. As a result, computer software is an alternative solution for better planning and ensuring more controlled and efficient project implementation [3].

Agus Siswanto stated that one of the Regional Government's development goals is to accelerate regional infrastructure development, which is elaborated in annual programs and activities carried out by the Public Works Office in the form of construction project implementation. The number of work packages, sometimes exceeding fifty (50), presents a challenge for the Commitment Making Officer (PPK), the official in charge of construction projects. These projects, in this case, are referred to as "Multi Construction Projects." [4].

2.2. Monitoring

Monitoring is one of the most important processes in organizational activities that can determine whether or not an organizational goal is carried out. The purpose of monitoring is to ensure that the main tasks of the organization can run according to a predetermined plan. The following are the objectives of monitoring:

- Assessing whether the activities carried out are by the plan.
- Identifying problems that arise so that they can be resolved immediately.
- Assess whether the work and management patterns are appropriate to achieve program objectives.
- Adjusting activities to the changing environment without deviating from the objectives.

2.3. Construction Cost Estimate

The Construction Cost Estimate is the estimation of the costs before carrying out construction project work. The cost for the same building will vary in each region, due to differences in material prices and labor wages. Cost is the sum of each estimated volume with the unit price of the work concerned. The calculation of the Construction Cost Estimate can be obtained using Equation 1.

$$\text{Construction Cost Estimate} = \sum \text{Volume} \times \text{Work Unit Cost} \quad (1)$$

The Construction Cost Estimate is an estimation of the monetary value of a project that has taken into account the Detail Engineering Design (DED) drawings, work plans, wage lists, material price lists, analysis books, cost budget plan composition lists, and a list of the number of each type of work [6].

2.4. The S-curve

The s-curve is a graph that relates the project implementation time to the accumulated value of the project implementation progress from the beginning until the project is completed. Project managers are accustomed to using the s-curve when planning and observing the schedules of both public and private projects. It is a curve that depicts the interaction between the total value of the budget, the number of person-hours used, or the percentage of work completed against time. The s-curve illustrates the progress of the volume of work completed throughout the project. If the curve is compared to a similar curve prepared based on the plan, it will be immediately clear if there is a delay. Progress and S-curve are integrated to see the deviation of work. Weekly progress is the accumulation of the project's daily work progress, calculated in one week. Then we integrate the weekly progress with the previously made S-curve (schedule) to see the deviation [7].

2.5. System Development Design

Figure 1 is the development design of the construction project management monitoring information system. The following is an explanation of the system development design:

- Admin will log into the system to manage master data, namely, users and employees.
- The Project Manager will log into the system to input new project work data.
- The Director will log into the system to approve projects that the project manager has input.

- The Project Manager logs in to input the cost budget plan based on the new project work.
- The Project Manager logs in to create a schedule based on the new project work's RAB/cost budget plan.
- The Field Manager logs in to create a weekly physical progress report based on actual progress in the field.
- The Field Manager will log into the system to create a weekly recapitulation report based on the weight of the physical progress report from the sub-activities in the project.
- The Manager can view the S-curve graph report on the project's progress that the system has automatically generated.
- The Director can view the S-curve graph report on the development of project progress that the system has automatically generated.

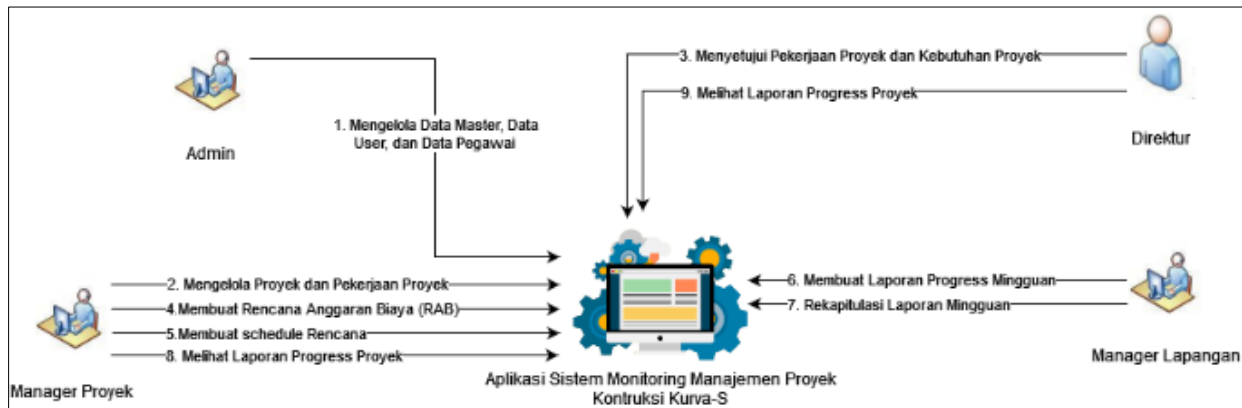


Figure 1 System Development Design

2.6. System Block Diagram

From Diagram 2, data such as users, employees, Construction Cost Estimates, and physical or actual progress will be processed. After input, the process will generate a schedule plan and a recapitulation. When the process is completed, the output will show the schedule plan graph and the physical progress graph, as well as the deviation value of the two graphs.

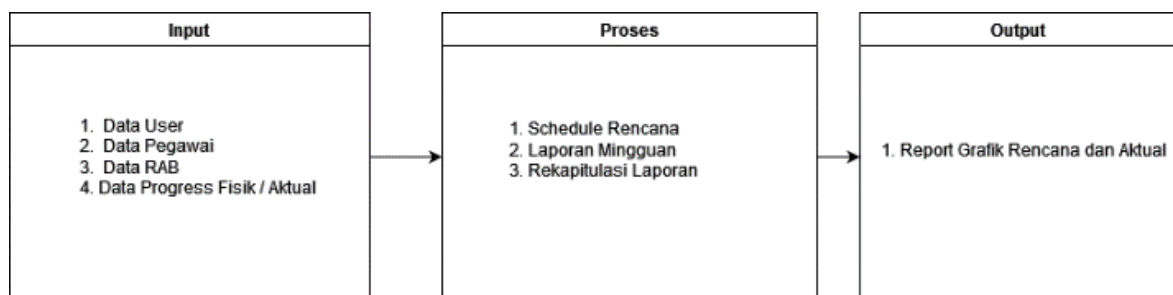


Figure 2 System Block Diagram

2.7. Flowchart Method

The s-curve method is illustrated in Figure 3 with a flowchart that explains the steps involved. The first step is to begin, followed by describing the problem's formulation. Next, find a literature study and gather data, including time schedules or planning times, cost budget plans, and project progress values. Finally, analyze the data that has been collected. After analyzing all the data, proceed to manage the cost data, work volume, activity prices, total activity prices, and estimated work time. A cumulative progress graph will then be created after receiving a percentage value of the workload capacity.

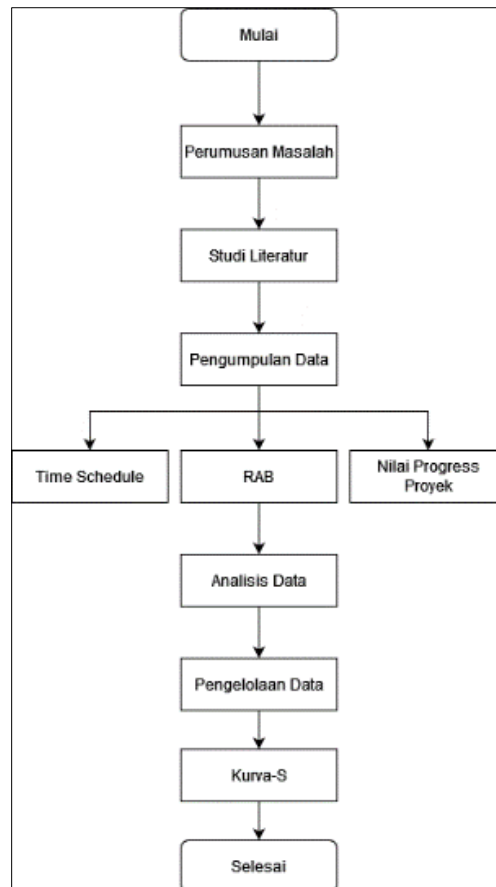


Figure 3 Flowchart Method

2.8. Flowchart System

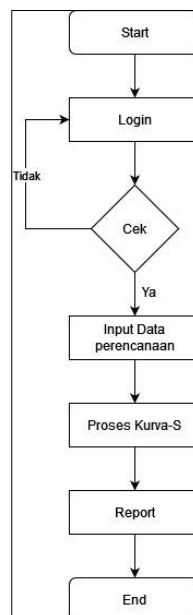


Figure 4 Flowchart System

In Figure 4, click Start and Log in to the system. The system will check whether the login is with the registered username and password. If it is wrong, it will return to the login menu. The system will continue to input planning data if the username and password are correct. The process will then be completed. It will produce a planned schedule, a physical

progress report, and a recapitulation. When the user has done the calculation, the data will be reported in the form of a graph of the planned schedule, physical progress graph, and the deviation value of the two graphs.

2.9. Data Flow Diagram (DFD)

Figure 5 has four users with different access. The Admin User can input login, user, role, and employee data into the system, with the system output being login verification. The Director User can input login data and approve projects into the system, with the system output being login verification and project progress reports. Project manager users input login data, project data, cost budget plan data, and plan schedule data. The output is login verification and project progress reports. Finally, there is a field manager user with login data, weekly report data, and weekly report recap data in the system, with the output of login verification.

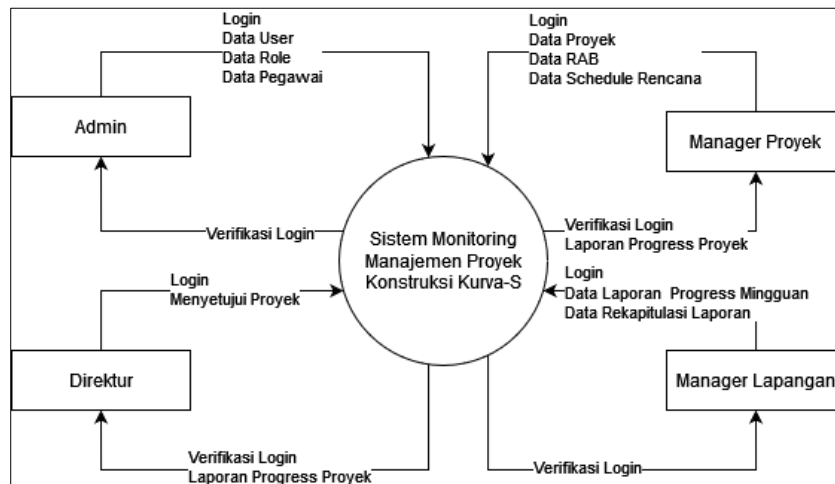


Figure 5 DFD level 0

3. Results and discussion

3.1. Login Page

Figure 6 illustrates the login display. In the login process, the user can use the username and password that has been registered. If the username is not registered or the password is incorrect, the user cannot perform the login process.

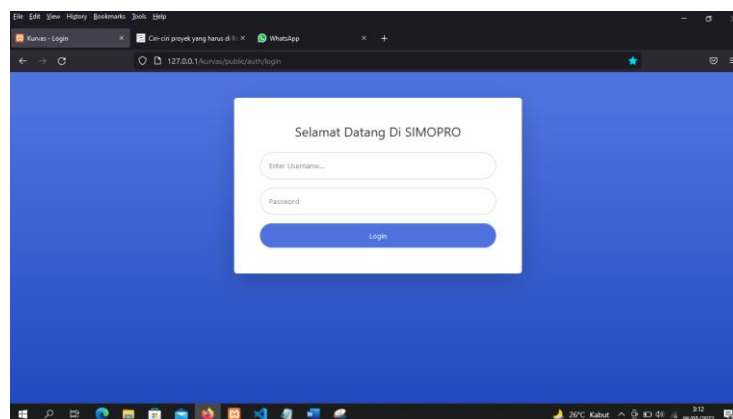


Figure 6 Login Page Display

3.2. Admin Dashboard Page

Figure 7 displays the Admin dashboard. If the user has successfully logged in using the Admin User, there are only user, role, and employee menus. In this case, the admin can only manage employee access rights to be able to log into the website.

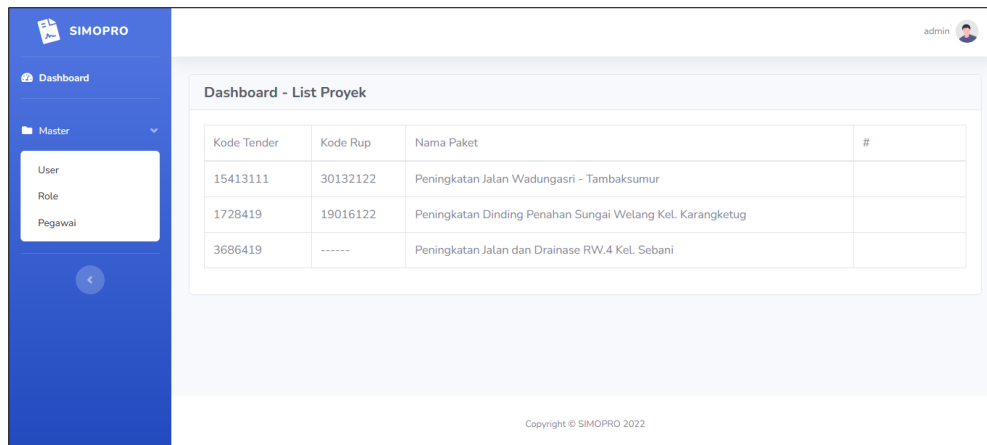


Figure 7 Admin Dashboard Display

3.3. Director dashboard page

Figure 8 displays the Director's dashboard page. If you successfully log in as the director user, you will see two menus: project data and project approval. Whereas if the project manager has entered new project data, the director can approve or reject the project.

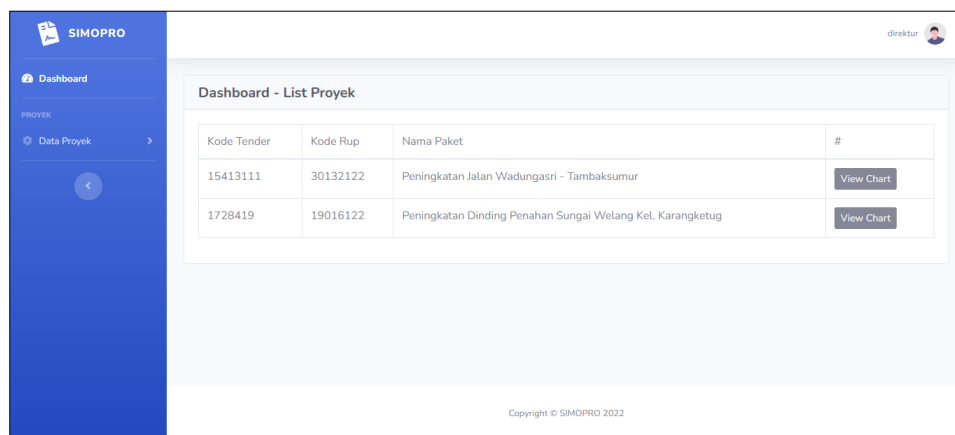


Figure 8 Director dashboard display

3.4. Project Manager Dashboard Page

Figure 9 is a view of the Project Manager dashboard page. If successfully logged in with the project manager user, there will be a menu that can be accessed, namely project data, project RAB/cost budget plan, and project schedule. The manager will input new project data. After the new project has been approved by the director, the project manager can create a cost budget plan.

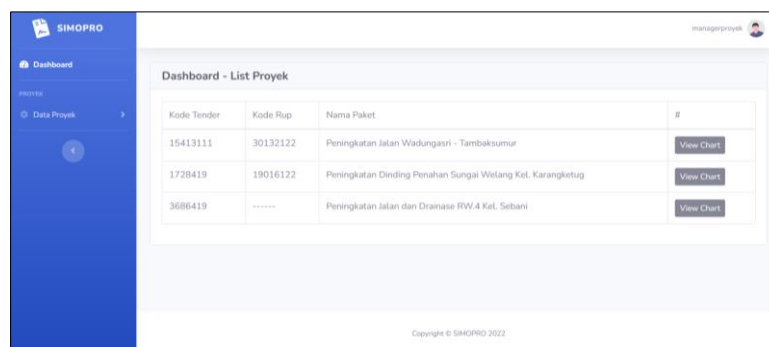


Figure 9 Project Manager Dashboard Page

3.5. Construction Cost Estimate Page Display

Figure 10 is a picture of the Construction Cost Estimate page display. The menu in this system is used to create the project cost estimate. By inputting the volume, unit and unit cost, the system will automatically calculate the total cost of each job.

No	Uraian/Jenis Pekerjaan	Volume	Satuan	Harga Satuan(Rp)	Jumlah Harga(Rp)	Jumlah Biaya/Pos(Rp)
I UMUM						
1	Mobilisasi	1	Ls	Rp. 22.365.000,00	Rp. 22.365.000,00	
2	Relokasi Utilitas	1	Ls	Rp. 13.000.500,00	Rp. 13.000.500,00	
	Keselamatan dan Kesehatan Kerja	1	Ls	Rp. 6.940.000,00	Rp. 6.940.000,00	

Figure 10 Construction Cost Estimate Page display

3.6. Plan Schedule Page

No	Jenis Pekerjaan	1	2	3	4	5	6	7
I UMUM								
1	Mobilisasi	0,28%	0,28%	0,28%	0,28%	0,28%	0,28%	0,28%
2	Relokasi Utilitas	0,16%	0,16%	0,16%	0,16%	0,16%	0,16%	0,16%
3	Keselamatan dan Kesehatan Kerja	0,09%	0,09%	0,09%	0,09%	0,09%	0,09%	0,09%
II DRAINASE								
1	Pengadaan dan Pemasangan U-ditch 40.50- 120cm + Cover (G.20 Ton)		8,03%	8,03%	8,03%	8,03%	8,03%	
III PEKERJAAN TANAH DAN GEOSINTETIK								
1	Galian Biasa	0,08%	0,08%	0,08%	0,08%	0,08%	0,08%	
2	Timbunan Pilihan dari Sumber Galian							0,21%
3	Penyiapan Badan Jalan	0,1%	0,1%	0,1%				
4	Pemotongan Pohon Pilihan 50 - 75 cm	0,06%						
IV PERKERASAN BERBUTIR								

Figure 11 Time Schedule Page Display

Figure 11 illustrates the form of making the schedule of the project plan. The calculation of the workload capacity is automatically carried out after inputting the duration and start of the week. The load capacity calculation will be divided by the duration per week.

3.7. Field Manager Dashboard Page

Figure 12 illustrates the Field Manager Dashboard page. If the user successfully logs into the system with the username field manager, there will be a weekly report menu and weekly recap in which the field manager has supervised the project, and developments in the field can be reported into the system.

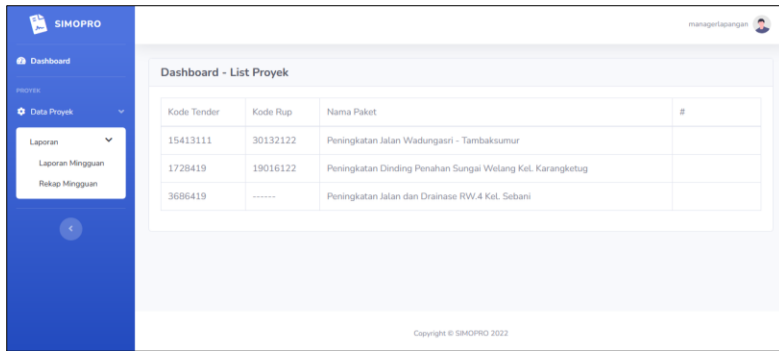


Figure 12 Field Manager Dashboard Page Display

3.8. Weekly report page

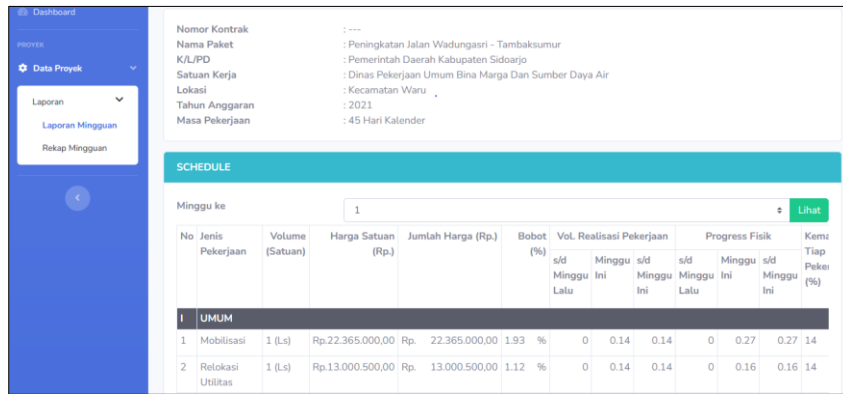


Figure 13 Weekly report page display

Figure 13 is the picture of making a weekly project report by inputting the realization volume the week, then the system will calculate the automation of the progress value of each job with the results of the physical achievement of the progress of all work.

3.9. Recapitulation Report Page

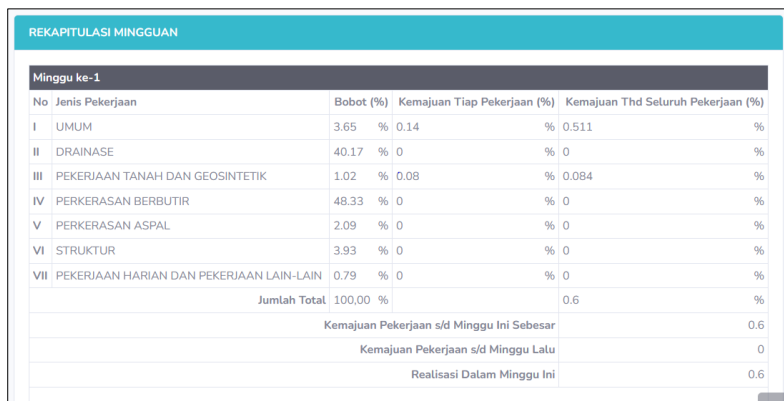


Figure 14 Recapitulation Page Display

Figure 14 illustrates how to make a recapitulation of this report without entering any data. If the weekly report is entered, the system will automatically make a recapitulation.

3.10. S-Curve Graph Display

Figure 15 illustrates the output results of the s-curve graph which is a graph of the project plan and a graph of the realization in the field. If the field manager has filled in the weekly report, the director will receive an email notification

to monitor that the data has been filled in by the project manager. Once the s-curve results appear, the graph includes a description indicating that the green curve represents the percentage of the project plan, while the red curve represents the percentage of realization.

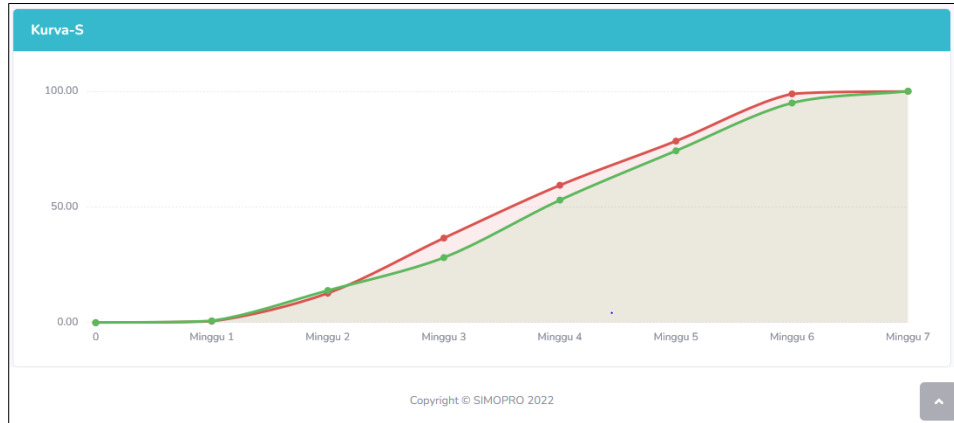


Figure 15 S-Curve Graph Display

4. Conclusion

Based on the research, there are several conclusions drawn:

- By comparing the schedule plan graph to the field realization, the S-Curve makes evaluating the risk of project delays easier.
- The information system is capable of making project plan schedules automatically. The operator only needs to enter data for the information system to create a project plan schedule, and then a weekly report can be generated using value data from the operator-entered weekly process.

Compliance with ethical standards

Disclosure of Conflict of interest

No conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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