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PRODUCTIVITY ANALYSIS OF SUPPLY CHAIN MANAGEMENT PERFORMANCE ON BUILDING CONSTRUCTION FOR TIME EFFICIENCY (CASE STUDY OF RSHS BANDUNG PROJECT)

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ABSTRACT
This research can be a reference for other project management who want to implement supply chain management. Supply chain management is one of the important things in a construction project where the application of supply chain management will affect the success of a construction project both material management, type of work, and time schedule. Therefore, this study aims to reduce the risk of time losses and the effect of productivity performance on a project. By using a quantitative method that reviews the s-curve and distributes questionnaires, this study shows that the total deviation is 171.62 which results in an average deviation of 3.502 per week. Stating that the deviation results in a deviation of sure + and after conducting validity, reliability and satisfaction tests, the results show that supply chain management can accelerate and streamline time on building construction projects.
Keywords: Management Construction, Time Schedule

INTRODUCTION
The construction services industry is one of the fields that greatly affects the economic turnover. As a result, it is very important to pay attention and handle well, especially in terms of project management. Often, on some projects, there are quality violations and delays in completion, leading to frequent cost and time problems, which can result in losses for the owner or vendor (Hardiantianti, 2009). Time problems, which can result in losses for the owner or vendor (Hardianti et al., 2019). Construction projects consist of many interdependent activities. Any larger project has greater risks, starting from planning and managing resources such as labor, cost, time, equipment, etc. Project management is very important to complete the project. Project management is the science, skills, resources, and techniques used to carry out project tasks in a way that is in accordance with project requirements (Kurniawan & Anggraeni, 2020).

In situations like this, there are several methods that can be used to solve the problem of time that is not in accordance with the schedule. One method that can be used is supply chain management, which organizes materials, types of work, and project governance. It can be seen that the application of supply chain management will affect the success of a construction project (Kurniawan & Anggraeni, 2020). Poor construction supply chain management tends to have the potential to increase project costs by up to 10% (Soepiadhy et al., 2011). Obstructed material supply will certainly have an impact

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on the project implementation time which also has the potential to experience delays, so that efficiency in the aspect of project time cannot be achieved (Dan et al., 2023). Therefore, this research intends to conduct a study of the performance of supply chain management in the Hasan Sadikin Hospital Building Construction project, Bandung. So, it
can be known the factors of supply chain management performance that can affect the efficiency of the project implementation time.

This research will conduct a review of the performance of the use of Supply Chain Management in the construction of the Bandung hasan sadikin hospital, so that it can produce benefits for the smooth running of the project. So, the output that will be discussed is how the use of Supply Chain Management can save time, so that its performance will be useful for the smooth running of the project.

RESEARCH METHODS

This research uses quantitative methods that provide a framework for conducting research. The first activity in this research was preparation, which included identifying the problem and setting research objectives, as well as a literature review. After that, we conducted various surveys using quantitative methods, collected primary data and secondary data, prepared them, set evaluation objectives and indicators, collected data, analyzed the data, and made basic technical recommendations. Data on Research Results This scientific research is located in the parking lot behind Hassan Sadikin Hospital, Pasteur 38, Pasteur, Sukajadi District, Bandung City. Below is a map of the construction site:

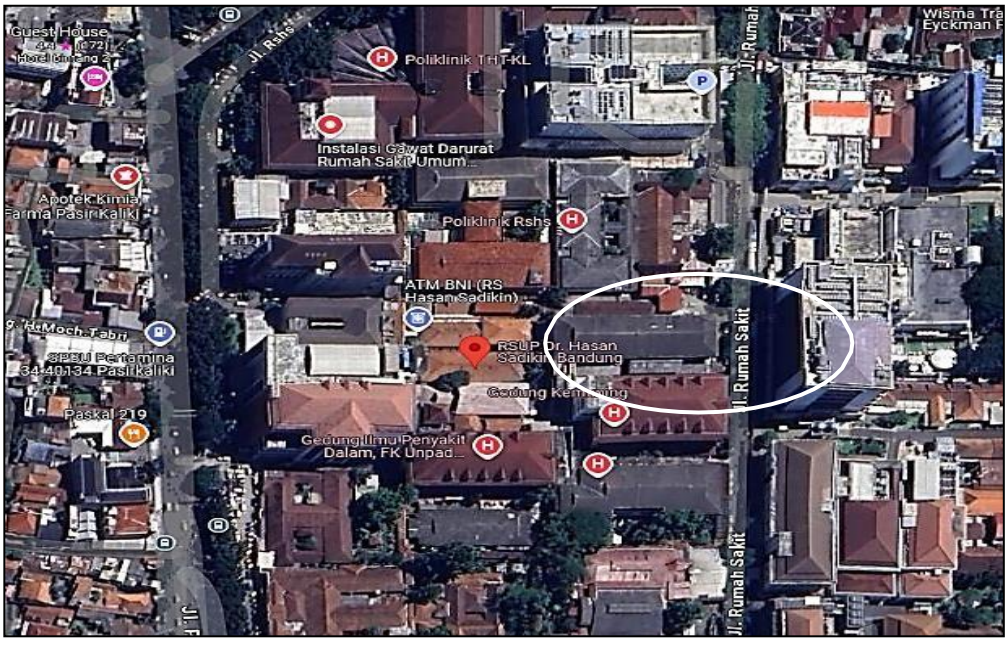

Figure 1 Research location

In this research, primary data is carried out in the form of determining the research location, making S curves using Microsoft Excel with reference to weekly work progress and distributing questionnaires. The results of the primary data survey are then processed and analyzed to produce output in the form of deviations as a review to see the development of the application of supply chain management in the project, as well as to produce validity and reliability values from the results of questionnaires processed using SPSS software. In making s-curves in primary data, it refers to secondary data in the form of weekly work progress data, which is obtained from the Hasan Sadikin Bandung Hospital construction project. The process of the research stages can be seen in the following Flow Chart:

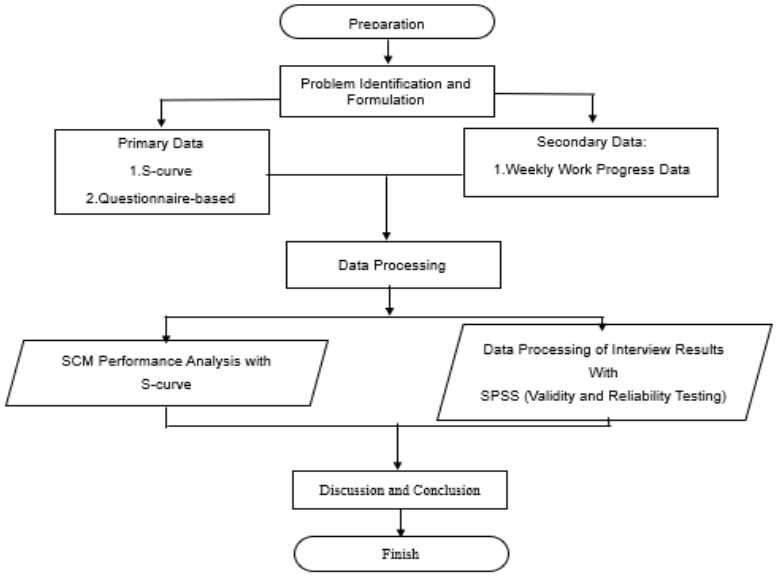

Figure 2 Research flow

Supply Chain Management Performance Analysis with S-Curve review

The S curve is used as a tool to measure the performance of supply chain management on construction projects. Weekly work progress is used in the audit to see the progress of the evaluated construction project. Subsequently, the S-curve, or planning curve, of the master plan was viewed, and an execution curve was created based on the weekly work progress to show the progress of SCM activities. This analysis involves creating an S-curve from the weekly work progress data that summarizes the contract weight, plan, completion, and deviation. The performance of the SCM can then be seen by looking at the deviation of the S-curve. The process of the research steps can be seen as follows:

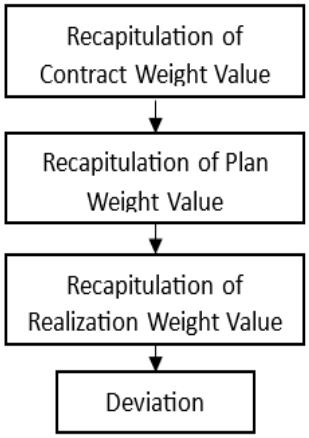

Figure 3 Flowchart of S-Curve Review

- Recapitulation of Contract Weight Value

  In the implementation of a construction project, after the work items included in the contract cost budget plan are determined, the weight value of each work item is needed to find out what the contractor can actually achieve when carrying out the work.
  - Contract Weight calculation example = (Total Price / Total Amount)

- Recapitulation of Plan Weight Value

  When the weight value of each work item has been determined, the plan weight and the cumulative plan weight of the work item weight value will be determined weekly.
  - Example of cumulative plan calculation
    Cumulative plan weight = Cumulative Weight + Plan Weight

- Recapitulation of Realization Weight Value

  In the realization analysis, you can find out the data in the form of a reference to measure the light weight of a job, then you will determine the realization weight and the cumulative realization weight of the weight value of the work item every week.
  - Example of calculating cumulative realization
    Cumulative Realization Weight = Cumulative Weight + Realization Weight

- Recapitulation of Deviation Weight Value

  Determining the deviation value is used in reviewing project progress to determine how far the project has gone or not.
  - Deviation calculation example:
    Deviation = (Cumulative Realization Weight) - (Cumulative Plan Weight

Processing Interview Data with SPSS (Validity and Reliability Testing)

Validation and Reability Test Next, the data obtained from the distribution of research questionnaires were collected and entered into the SPSS program to be analyzed as follows: The process of the research stages can be seen in the flow chart:

Figure 4 Data Processing with SPSS

- Validity Test

The testing criteria are: To test the validity of this study, the IBM Statistical Product and Service Solution program was used to check the correlation between the scores of each item and the total score, where the questions in the questionnaire were considered to be able to reveal the research topic. The calculated r value, which is the correlation between the item score and the total score, was compared with the r table value from the table calculation results using the distribution (r table) for ὰ = 0.5

1. If r count is positive or r count> r table, then the instrument or statement items are declared valid.
2. If r count is negative or r count < r table, the question items are declared invalid. All statement items that have been given to respondents have a value of r count> r table, so the statements are all valid. In connection with the validity of all statements, then proceed with the reliability test.

- Reliability Test

The reliability test is used to determine whether a variable in the questionnaire is reliable or not. The variable value is considered reliable if the Cronbach alpha value exceeds the value of 0.6. The reliability test was carried out on all variables in the questionnaire, and the results were compared with the value of 0.6. (Fatimah & Iqbal, 2021)

RESULTS AND DISCUSSION

Based on the objectives of this study to analyze the performance of supply chain management on building construction projects for time efficiency. Research data obtained from weekly progress results and questionnaires. The results of the data are processed and displayed in tabular and graphical form. The following displays the data analysis table and graph:

Analysis of Supply Chain Management Performance with S-Curve review

Based on the objectives of this study, namely to analyze the performance of supply chain management on building construction projects for time efficiency. Research data To see the progress of the construction project to be evaluated, the review will use the weekly work progress as a reference. Furthermore, the S-Curve master plan, or Planning Curve, will be viewed, and a Realization Curve will be generated from the weekly work progress to show how the SCM performance is evolving.

- Calculation Recapitulation of Contract Weight Value

Description	Amount (Rp)
Preliminary Work	8.638.348.218
Structure Work	117.857.744.515
Architecture Work	79.713.119.530
MEEP Work	125.228.579.304
External Work	4.785.334.191
Total	**336.223.125.758,51**

Figure 5 Contract Weight Value

Calculation:

A. Calculation of the weight of the preliminary work contract
- Contract Weight = (Total Price / Total Amount)
- Contract Weight = 8,638,348,218 / 336,223,125,758
- Contract Weight = 2.659%

B. Calculation of Weight of structure work contract
- Contract Weight = (Total Price / Total Amount)
- Contract Weight = 117,857,744,515 / 336,223,125,758
- Contract Weight = 35.053%

C. Weight calculation of architecture work contract
- Contract Weight = (Total Price / Total Amount)
- Contract Weight = 79,713,119,530 / 336,223,125,758
- Contract Weight = 23.708%

D. Calculation of the weight of the meep work contract
- Contract Weight = (Total Price / Total Amount)
- Contract Weight = 125,228,579,304 / 336,223,125,758
- Contract Weight = 37.249%

E. Calculation of external work contract weight
- Contract Weight = (Total Price / Total Amount)
- Contract Weight = 4,785,334,191 / 336,223,125,758
- Contract Weight = 1.423%

- **Table 1 Contract Weight Value**

Description	Amount (Rp)	Percentage (%)
Preliminary work	8.638.348.218	2,565%
Structure work	117.857.744.515	35,079%
Architecture work	79.713.119.530	23,699%
Meep work	125.228.579.304	37,231%
External work	4.785.334.191	1,423%
Total	**336.223.125.758**	**100%**

From the results of the calculation analysis regarding the calculation of

The weight value of all work obtained the value of the Contract Weight for Preliminary work of 2.659%, for structural work of 35.053%, for architecture work of 23.708%, for meep work of 37.249%, and for External work of 1.423% which aims to calculate or analyze the value of the planned volume, realization, and deviation of work.

- Plan Schedule Weight Value Calculation

Table 2 Plan Schedule Weight Value

Week	Plan Weight	Cumulative Plan Weight
47	0,455%	33,233%
48	0,459%	33,692%
49	0,463%	34,155%
50	0,468%	34,623%
51	51	51

Calculation of Plan Weight Value using sample week 48 - 51

- Cumulative plan calculation of week 48
  - Cumulative plan weight = Cumulative Weight + Plan Weight
    = 33,233 + 0,459
    = 33,692%
- Cumulative plan calculation of week 49
  - Cumulative plan weight = Cumulative Weight + Plan Weight
    = 33,692 + 0,463
    = 34,155%
- Cumulative plan calculation of week 50
  - Cumulative plan weight = Cumulative Weight + Plan Weight
    = 34,155 + 0,468
    = 34,623%
- Cumulative plan calculation of week 51
  - Cumulative plan weight = Cumulative Weight + Plan Weight
    = 34, 623 + 0,495
    = 35,188%

● Calculation of Realization Weight

Table 3 Realization Weight Value

Week	Cumulative Realization	Cumulative Realization Weight
47	1,808%	41,790%
48	1,348%	43,138%
49	1,190%	44,328%
50	0,554%	44,682%
51	1,495%	46,177%

Calculation of Realization Weighted Value using sample week 48 - 51

- Calculation of cumulative realization of week 48
  - Cumulative Plan Weight = Cumulative Realization Weight + Realization Weight
    = 41,790 + 1,348
    = 43,138%
- Calculation of cumulative realization of week 49
  - Cumulative Plan Weight = Cumulative Realization Weight + Realization Weight
    = 43,138 + 1,190
    = 44,328%
- Calculation of cumulative realization of week 50
  - Cumulative Plan Weight = Cumulative Realization Weight + Realization Weight
    = 44,328 + 0,554
    = 44,682%
- Calculation of cumulative realization of week 51
  - Cumulative Plan Weight = Cumulative Realization Weight + Realization Weight
    = 44,682 + 1,495
    = 46,177%

From the calculation of the realization value, the s-curve is obtained as follows:

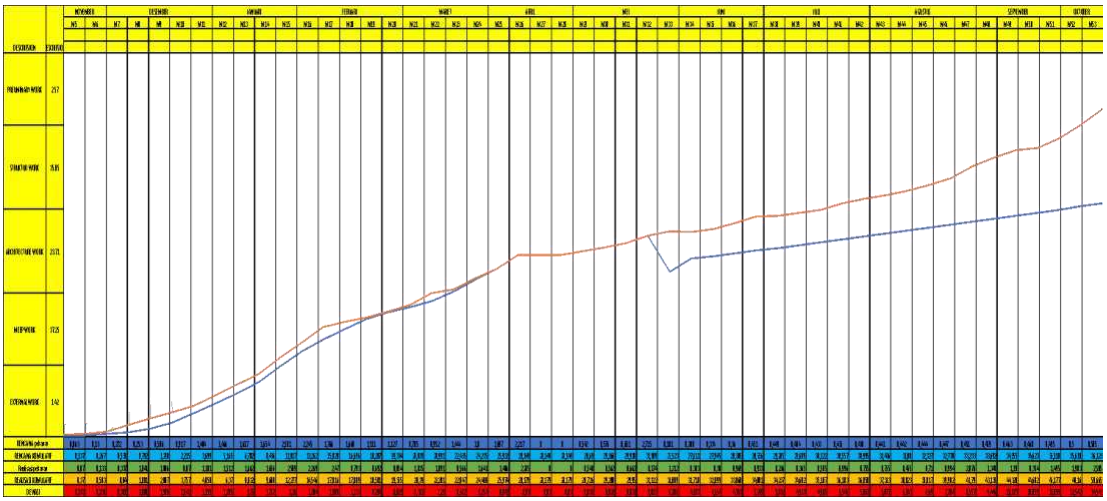

Figure 7 Realizations s-curve

From the weekly progress data that has been analyzed every week from the beginning of work week 5 to week 53, the final value weight of the cumulative plan is 36.123% and the final value weight of the cumulative realization is 50.665%, so it can be seen that there is an increase in the graph by 14.542%.

- Deviation Calculation

  In reviewing the progress of a project, the determination of the deviation value is used to determine whether a project is delayed or not, it can be seen in the following table:

Table 4 Weight Value Deviation

Week	Plan	Realizations	Deviation
51	35.118	46.177	+11.059
52	35.618	48.16	+12.542
53	36.123	50.665	+14.542

➢ Deviation calculation using week 51 sample:

- Deviation = (Cumulative Realized Weight) - (Cumulative Plan Weight)
  Deviation = 46,177 - 35,118
  Deviation = 11.059

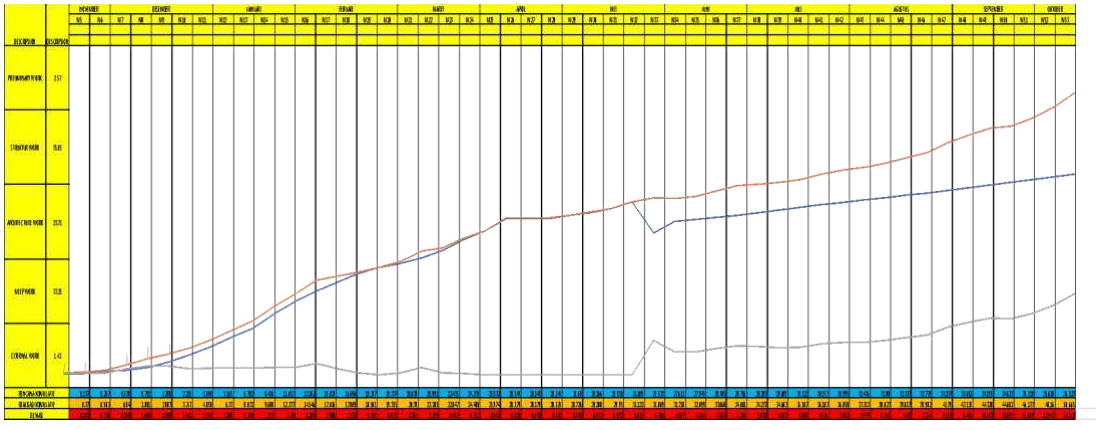

Figure 8 S-Curve of Plan, Realization, and Deviation

The results of the calculation of the planned volume with the realized volume for weeks 5-53 of the period November 2022 - October 2023 show that the total deviation is 171.62 which results in an average deviation of 3.502 per week. Stating that from the deviation results in a deviation of sure+, which indicates that the performance of Supply Chain Management is running well on the project and is time efficient for weeks 5-53 of the period Nov 2022 - Oct 2023.

After conducting an s-curve analysis that includes a recapitulation of the contract weight value, plan, realization, and deviation, it was found that each element related to the implementation of supply chain management proved to be effective and had a high efficiency value.

Processing Interview Data with SPSS (Validity and Reliability Testing)

- Validity Test

  Testing the questionnaire question items was carried out by analyzing using SPSS variable 20 and obtained an r-count value greater than r-table, where the df value is 20-2 = 18 and significance 0.05, so the r-table value is 0.443. The results of the validity test of each question item are shown in the table below:

Table 5 Validation Test Results

No.Item	r count	r table	Description
X1	0,713	0,443	Valid
X2	0,508	0,443	Valid
X3	0,539	0,443	Valid
X4	0,520	0,443	Valid
X5	0,555	0,443	Valid
X6	0,757	0,443	Valid
X7	0,517	0,443	Valid
X8	0,466	0,443	Valid
X9	0,660	0,443	Valid
X10	0,618	0,443	Valid
X11	0,457	0,443	Valid
X12	0,534	0,443	Valid
X13	0,641	0,443	Valid
X14	0,648	0,443	Valid
X15	0,489	0,443	Valid
X16	0,473	0,443	Valid
X17	0,482	0,443	Valid
X18	0,655	0,443	Valid
X19	0,550	0,443	Valid
X20	0,573	0,443	Valid

From the results of the validity calculation in the table above, it can be seen that r count> r table of 20 questionnaires which are declared valid, because r count is more than r table.

- Reliability Test

Table 6 Valid Test Results

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

Table 7 Reliability Test Results

Cronbach's Alpha	N of Items
.744	21

The results of the reliability test on the question variable can be seen from the table above that Cronbach's alpha 0.744 on this variable is higher than 0.60, where this figure is the basic value and it can be concluded that all statements on this variable are declared reliable or trustworthy.

Table 8 Questionnaire Satisfaction Result

Variabel	Jumlah Parameter Kepuasan (%)				
	1	2	3	4	5
V1	75%	20%	5%	0%	0%
V2	45%	40%	15%	0%	0%
V3	30%	45%	25%	0%	0%
V4	55%	40%	5%	0%	0%
V5	55%	35%	10%	0%	0%
V6	60%	30%	10%	0%	0%
V7	55%	45%	15%	0%	0%
V8	50%	45%	5%	0%	0%
V9	40%	45%	15%	0%	0%
V10	50%	45%	5%	0%	0%
V11	45%	45%	10%	0%	0%
V12	55%	35%	10%	0%	0%
V13	60%	30%	10%	0%	0%
V14	60%	25%	15%	0%	0%
V15	40%	40%	20%	0%	0%
V16	55%	40%	20%	0%	0%
V17	50%	30%	20%	0%	0%
V18	45%	30%	25%	0%	0%
V19	60%	40%	0%	0%	0%
V20	50%	50%	0%	0%	0%

The satisfaction table shows the highest results in Likert paramater 1 (Strongly agree) which is found in the variable "Supply chain management can affect the efficiency of work time on a project to be faster?" (V1) which means that the existence of supply chain management can accelerate and streamline the time for building construction projects.

CONCLUSION

Based on the results of research on productivity analysis of supply chain management performance on construction projects for time efficiency, then in each week from the beginning of work week 5 to week 53, the weighted final value of the cumulative plan is 36.123% and the weighted final value of the cumulative realization is 50.665%, so it can be seen that there is a graphical increase of 14.542%. The results of the calculation of the planned volume with the realized volume for weeks 5-53 of the period November 2022 to October 2023 show that the total deviation is 171.62% which results in an average deviation of 3.502% per week. Stating that the deviation results in sure+, which shows that the performance of Supply Chain Management has increased every week so that it can be concluded from the data analysis that the s curve has been running well on the project and is time efficient.

Testing the questionnaire items was carried out by analyzing using SPSS variable 20 and obtained an r-count value greater than the r-table, where the df value is 20-2 = 18 and significance 0.05, so the r-table value is 0.443. From the results of the validity calculation, it can be seen that r count> r table of 20 questionnaires which are declared valid. The results of the reliability test on the question variable can be seen from the table below that Cronbach's alpha 0.744 on this variableon this variable are declared reliable or trustworthy. From the results of the questionnaire, the results of this study show the highest results in Likert paramater 1 (Strongly agree) contained in variable 1 "Supply chain management can affect the efficiency of work time on a project to be faster?" (V1) which means that the existence of supply chain management can accelerate and streamline the time for building construction projects.

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