



DIMENSION 6 BIM IMPLEMENTATION (SUSTAINABILITY & EFFICIENCY) IN THE PROCUREMENT PROCUREMNT CYCLE GOODS & SERVICES

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ABSTRACT

The application of the Building Information Model (BIM) method in a construction project, especially in Indonesia, can be counted as few who have implemented it in aligning the planning and implementation of a construction project activity, while if there is an application of the BIM concept, most of it is only as a formality only on the completeness of the Form document. of course, where the reality is that in practice there are many procedural deviations in creating an "Environment" of collaboration between work disciplines. In writing this paper, the problems will be analyzed: How is the process of implementing BIM in the 6D Dimension in the Supply Chain Cycle of the Procurement of Goods and Services problems? Writing based on this research has reference to knowledge base management, namely time management from references (eg PMBOK/Jurnal/BIM KEMENPUPR, etc.) and various relevant research results, and literature review. This study uses the Fault Tree Analysis (FTA) method to answer the above problems. The results of this study are 1. 2. 3. conclusions/research results. In the analytical technique method that identifies system failures, the definition of failure is a delay. The use of Top Down Analysis as a framework initially identifies and groups into Top Events in work delays, visualized into FTA graphics starting from Top Events to the most basic events.

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INTRODUCTION

In the industrial era 4.0, especially in the supply chain in the construction industry, where the planning of a construction activity must be able to move quickly, precisely and sustainably. Based on these demands, actors in the construction world must be able to adapt to technological developments in an effort to digitize every planning activity that takes place so as to create an ecosystem of activities that are well thought out and

documented to be used and needed again in the future; both as a reference for similar project problems, development and as a blueprint / As Built Maintenance of the construction product itself. Industry 4.0 is a comprehensive transformation of all aspects of production in the industry through the merging of digital technology and the internet with conventional industries (Herman dkk., 2015).

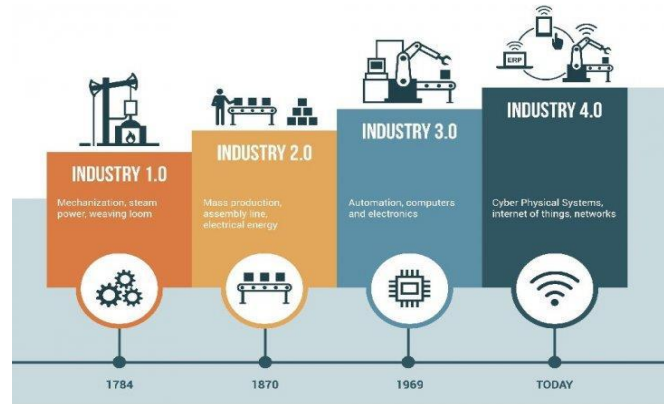


Image 1.
The Development of the Industrial Revolution

One of the activities that can be applied in maintaining the integrated quality is the application of the BIM (Building Information Modeling) concept as an alternative solution for now to integrate every scope of work with the main aim of reducing waste and improving performance based on information data owned by each individual. stakeholders / Stakeholders both in the implementation process, the period of use to the maintenance period. BIM is a paradigm shift that has had various benefits, in addition to those who are engaged in building construction but also for the wider community, a better activity is a business activity whose implementation process uses energy, namely less labor and capital. Eastman et al., 2008). BIM is basically a digital platform that aims to conceptualize an idea to an activity in a virtual space in the application of modeling BIM must be able to include all activity information in work that functions to collaborate, predict and make decisions regarding a design, construction, cost budget and maintenance phase.

The development of Information Technology Digitalization has challenged traditional work concepts and stimulated modernization changes, especially in data information in the field of E-Business and building Information Modeling (BIM). Nederveen and Tolman (1992) explain in a paper introducing and showing the first time the term Building Information Model, Building Information Modeling (abbreviated BIM) did not become popular until 10 years later. Slowly but progressively the development of technology towards integration in the construction process shows potential profit prospects to be developed. The many Digital Platforms and software applications that

support effectiveness in collaboration, information management and information sharing that are available today capture supply chain communications enabling increased process efficiency and project management capabilities in leveraging the role of information throughout the life cycle of creating an information-driven environment. Considering supply chain issues in procurement, especially in construction projects, the BIM approach is very supportive in the process of E-Procurement activities, the hypothesis behind the proposed framework is that BIM-based solutions can reduce the negative effects of fragmentation of the construction project life cycle by integrating information throughout the procurement process.

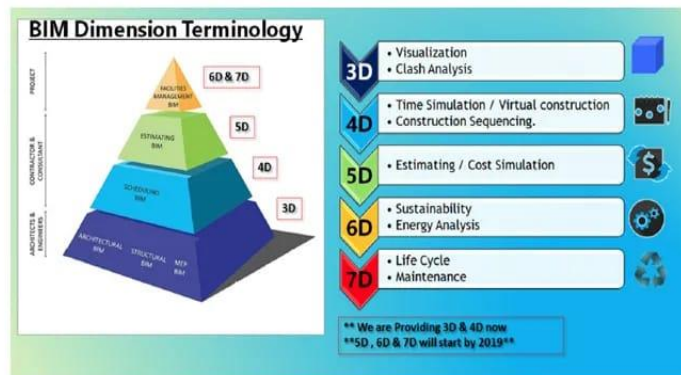


Figure 2.
BIM Dimensions and Terminology

The results of the integrated instrument for each activity will become a knowledge and information base that has a lot of data information needed and is able to carry out sustainable activities and is able to strengthen transaction relationships and cooperative relationships in all procurement supply chain activities. The achievement of the purpose of writing this paper starts from reviewing the literature on the concept of E-Procurement and BIM which focuses on the major developments and the most significant impact on the construction industry. Testing the validity of the BIM-based E-Procurement model was developed in a model formulated using the Fault Tree Analysis method or can be abbreviated as FTA. Papadopoulos (2004) explains that this FTA method is a deductive analysis method that aims to identify the occurrence of errors in a system by projecting other steps regarding events in a structured block diagram.

Deductive analysis can be carried out on all complex systems, the beginning of the FTA analysis is to identify failures at the top level in a system. FTA can provide an overview of the state of the elements in the system from the basic level to the top level, the relationship between systems is expressed by Logic set Cut Set and minimal Cut Set that assembles a component system, which if failure occurs will result in failure in all systems. The results of this paper are more focused on pilot case studies and reports on the main research results.

The purpose of this research is to find out the causes of delays by testing the theoretical model of the effect of work meaning and support for the BIM concept with the attachment of expert theory as the basis for testing the variables studied with empirical data on a construction project at BSS. To find out, examine the effect of the BIM concept in the procurement of goods/services on the impact of delays in construction projects in the study of performance on the BSS. To examine the effect of organizational support that is examined in the implementation and utilization of BIM on the performance cycle of goods/services procurement in procurement activities, a study of the implementation of BSS supply chain activities. The results of the research are expected to be useful to enrich the knowledge of goods and services procurement activities in the use of technology for digitizing interconnected data and have a digital track record that can be identified and accounted for in the future in general, and may be used as a reference regarding the meaning of work, organizational support and its impact on sustainability with the attachment of a blueprint as the basis for concept development. The results of this study are also expected to be used as a source of information for further research in the field of procurement of goods and services in an activity. The limitation of the problem in this study is the scope of observations carried out by the author, namely the procurement of goods and services at BSS. Research observations are devoted to supporting infrastructure project activities, both new construction and building maintenance during operations both at the Jakarta head office and branches throughout Indonesia. Research observations using the FTA (Fault Tree Analysis) method. The limitation of the evaluation of research observations refers to the sustainability of the supply chain process in an activity that repeats its work pattern, so as to reduce the SLA time needed to complete job request tickets.

Writing in this study will identify factors and utilization variables that occur in the application of concepts that can measure the level of effectiveness in the application of the supply chain cycle on time performance or delays in the process of procurement of goods and services and analyze the factors causing delays so that they can carry out mitigation and prevention of delays and cost overruns from the initial agreed budget, especially for repetitive work so as to reduce the decrease in cost performance, quality and uniform time between typical activities.

METHOD

Based on the data and information that has been collected from the respondent's questionnaire, the use of statistical analysis methods with a correlation approach is to explain the relationship between the independent variable risk factor (X) and the dependent variable, namely the performance of the implementation time (Y). Statistical data analysis using the SPSS 25 software application by entering a data matrix of the X

variable for the frequency and influence/impact of the risk variable and the Y variable according to the number of respondents. The variables resulting from the regression analysis test were then tested for normality to find out how the independent and dependent variables had a normal distribution. In the SPSS program, data processing was carried out using the Kolmogorov Smirnov test with the results obtained, namely the significance value with conditions > 0.05 . So it shows that the data is normally distributed.

Multicollinearity test, this test is included in the general assumption test in multiple linear regression analysis, which has the aim of knowing the occurrence of correlations between independent or independent variables. The results of this test are determined by passing the test at the value of VIF (Variance Inflation Factor) < 10 and the value of Tolerance > 0.1 in the SPSS program. From these provisions, the research data in the regression model can be accepted and there is no multicollinearity. The linearity test is used to find the dependent variable with the independent variable having a significant linear relationship or not. To get a linear relationship, in the ANOVA table the linear regression model, the significance value must be > 0.05 from the results of SPSS processing. Meanwhile, if < 0.05 , then there is no linear relationship between the two variables.

RESULT AND DISCUSSION

Based on the results of library studies such as journals, articles, previous research and problems that usually occur from the respondents, 22 variables are obtained which are divided into 3 risk factors for the procurement cycle of goods/services that affect the performance of the implementation time. Among others, as below:

Table 1. Recapitulation of the Number of Variables

No	Factor	Number of Variables
1	Goods & Services Procurement Activity Planning	8
2	Logistics & Handling	8
3	Goods & Services Procurement Cycle Management	6
Total Variables		22

Source: Researcher Data Processed Results, 2022

Based on observations based on the factors and variables obtained, then validation is carried out to practitioners in accordance with the field according to the research topic. Observations of this research can be defined as a systematic effort in determining standards that are in accordance with the goals and objectives of activities, designing data information systems, comparing the implementation of the activity cycle in accordance with applicable regulations, then checking again so that the resources used

in activities can be utilized optimally, efficiency and sustainability as the goal of achieving efficient and sustainable targets in the cycle of procurement activities. With the main objective of obtaining products that comply with the specifications agreed in the contract and to avoid deviations or the most minimal errors, especially in a repetitive activity.

The factors include the variables that have been identified, which are then distributed to practitioners in the form of a questionnaire by answering the questions Agree or disagree, Do the existing risk variables affect the performance of the implementation of the goods/services procurement cycle, as can be seen in the questionnaire table in Appendix 1. The profile practitioner/expert respondents in the field according to the topic of this research are as shown in the table below :

Table 2. Practitioner Respondent Profile Index

No	Practitioner	Position	agency	Work Experience (Years)	Education
1	Practitioner 1	Procurement Manager	Owner/ User	>5 Years	S1-S2
2	Practitioner 2	Owner/Business Owner	Service & Goods Provider	>5 Years	S1-S2
3	Practitioner 3	Owner/Business Owner	Expedition	>5 Years	S1
4	Practitioner 4	Experts	Consultant Supply Chain	>5 Years	S2
5	Practitioner 5	Experts	Government Goods/Services Procurement Policy Institute (LKPP)	>5 Years	S2

Source: Researcher Data Processed Results, 2022

Of the 24 variables that have been validated by expert practitioners, 3 out of 5 expert practitioners answered that they are irrelevant/no effect on the performance of the implementation time, namely the variables with the code X20 (financial condition of goods/services providers), and X24 (Theft of Intellectual Property Rights).

After validating the risk variables by expert practitioners, a pilot survey is then conducted by distributing questionnaires to prospective respondents who have experience in accordance with the research topic. The second research problem regarding what are the risk factors and variables that have the most influence on the time performance of the Goods and Services Procurement Cycle, is the result of risk analysis on 22 independent variables (X) and dependent variable (Y) collected from the results of the answers to questionnaires distributed to respondents. The statistical data analysis of the validity test begins by setting the value of $r \text{ table} = n - 2$, which is obtained from the product moment table at a significance level of 0.05, where n is the number of

respondents, namely 62 respondents. From the table, the value of r table is 0.254. Of the 24 variables that were tested for validity with the SPSS program, on the scale of the frequency level of the risk variable, 22 variables passed the test, while for the scale of the level of influence/impact of the risk variable, 22 passed the test.

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1) Normality Test

This test was carried out using the Kolmogorov Smirnov method with the help of SPSS software. The requirements in the normality test are as follows :

- a) If the value of Sig > 0.05, then the data is normally distributed.
- b) If the value of Sig < 0.05, then the data is not normally distributed

Table 3. Normality Test Results Frequency(X) Risk
One-Sample Kolmogorov-Smirnov Test

		Total_Faktor_X
N		62
Normal Parameters ^{a,b}	Mean	74.8710
	Std. Deviation	11.73685
Most Extreme Differences	Absolute	.079
	Positive	.079
	Negative	-.058
Test Statistic		.079
Asymp. Sig. (2-tailed)		.200 ^{c,d}

a. Test distribution is Normal.

b. Calculated from data.

- c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Table 4. Normality Test Results Effect/Impact (Y) Risk
One-Sample Kolmogorov-Smirnov Test

		Total_DAMPAK_Y
N		62
Normal Parameters ^{a,b}	Mean	83.6129
	Std. Deviation	14.68283
Most Extreme Differences	Absolute	.086
	Positive	.070
	Negative	-.086
Test Statistic		.086
Asymp. Sig. (2-tailed)		.200 ^{c,d}

- a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

2) Multicollinearity Test

In the multicollinearity test, it is seen from the value of the variance inflation factor (VIF) and the resulting tolerance value, with the condition that in this test, if the VIF value is < 10 and the tolerance value is > 0.1, it means that there is no multicollinearity between independent variables in the regression model. The results of multicollinearity testing in this study can be seen in the table below:

Table 5. Test Results of Frequency (X) Multicollinearity Risk

Coefficients ^a								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	27,550	7,839		3,515	0,001		
	PERENCANAAN_X8	7,445	1,996	0,418	3,731	0,000	0,708	1,412
	MAN.SIKLUS_X22	5,575	2,088	0,297	2,669	0,010	0,717	1,394
	PERENCANAAN_X3	3,478	1,373	0,241	2,533	0,014	0,985	1,016

a. Dependent Variable: Total_DAMPAK_Y

Table 6. Multicollinearity Test Results Effect/Impact (Y) Risk

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	34,761	5,404		6,433	0,000		
	MAN.SIKLUS_Y22	5,934	1,361	0,444	4,360	0,000	0,826	1,210
	PERENCANAAN_Y6	4,735	1,237	0,390	3,827	0,000	0,826	1,210

a. Dependent Variable: Total_Faktor_X

Source: Processed SPSS 25. test data

From tables 4.31 and 4.32 it can be seen that all variables have a VIF value < 10 and a tolerance value > 0.1. So it can be concluded that there is no multicollinearity between independent variables in the regression model in this study.

3) Heteroscedasticity Test

The method used to perform the heteroscedasticity test in this study is to use the glejser test. If the probability of each independent variable > 0.05, it can be concluded that there is no heteroscedasticity in the regression model.

Table 7. Heteroscedasticity Test Results Frequency (X) Risk

Coefficients ^a						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	23,614	4,102		5,757	0,000
	PERENCANAAN_X6	-2,469	1,054	-0,287	-2,342	0,056
	LOGISTIK_X11	-1,992	0,926	-0,263	-2,150	0,076

a. Dependent Variable: abs_res1

CONCLUSION

Based on the final results regarding the analysis of the causes of delays, it can be concluded that there are five variables from the main variables causing the highest delays based on the frequency scale on the impact/influence of risks causing delays in the cycle of procurement of goods/services both on cost, quality and time performance and significantly there is an increase in the five variables that can increase the risk in the implementation of the cycle of procurement of goods and services. Suggestions that researchers can give in this study are related to the use of BIM in the cycle of procurement of goods and services, namely the external category (related to vendors). Activity Planning (selection of vendors providing goods & services). The presence of the BIM concept is expected to assist practitioners in selecting service providers. The use of the BIM concept in the involvement of the procurement cycle is related to external parties of the procurement team with Suppliers / Manufacturers and delivery logistics, both in engagement, procurement methods applied, selection criteria, types of contracts used, utilization, types of product users and scope of work. For example, the use of best value or cost plus fee contracts tends to result in a high BIM adoption rate, so that the solution to the problem of selecting vendors for procurement of goods and services can be more effective by using the BIM concept.

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