Building Planning Analysis Using a Comparison of the Efficiency of Expert Resources Using Building Information Modeling (BIM) Software and Conventional Methods

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Abstract. This study aims to compare the resources of experts using the Building Information Modeling (BIM) method and conventional methods in the construction industry. BIM is an information technology-based approach that utilizes integrated 3D models to plan, design and manage construction projects. The conventional method, on the other hand, refers to the traditional approach which does not use an integrated 3D model. This study conducted a review of relevant literature and research articles that compared the two methods in terms of expert resources. The results of this literature review can provide useful insights for construction professionals and practitioners in considering the advantages and disadvantages of each method. the use of Building Information Modeling (BIM) software is more efficient in managing expert resources in planning the Makassar Apartment DELFT construction project compared to conventional methods. This conclusion is supported by statistical analysis showing significant differences between the two methods.

Keywords*:* Building Information Modeling (BIM), conventional method, human resources, construction industry.

INTRODUCTION

In the era of globalization and advances in information technology, technological developments in construction projects, especially Building Information Modeling (BIM), have a significant impact on the effectiveness and efficiency of work. BIM is an approach that enables better team collaboration in the planning, execution, and delivery of construction projects with the goal of reducing errors, defects, and costs. Even though BIM has developed rapidly in developed countries, most construction companies in Indonesia still use conventional software such as AutoCad, SAP, Ms. Excel, and Ms. Projects. This conventional method tends to be time consuming, has problems in quality control, and tends to be more expensive. This research aims to compare the process of implementing construction projects using conventional and BIM methods, with a focus on cost efficiency, human resources and time. Another aim is to identify the advantages of BIM compared to conventional methods in planning construction projects. The results of this research are expected to provide insight into the comparison between conventional methods and BIM in implementing construction projects. This research is relevant in the context of technological advances and paradigm shifts in the construction industry. Thus, the title of the author's final assignment is "Building Planning Analysis Using a Comparison of the Efficiency of Expert Resources Using Building Information Modeling (BIM) Software and Conventional Methods".

EXPERIMENTAL SETUP

This research method is used as a basis for steps that are structured based on the research objectives and is a tool used by the author to draw conclusions so that appropriate solutions can be obtained to achieve success in the research. This research was carried out by collecting data which included secondary data and primary data at the construction project site and conducting interviews using a questionnaire system which was distributed to each respondent to obtain results that were similar to the responses to the problems posed in the research. The data will be analyzed using an application. SPSS.

This research stage begins with getting an idea to conduct research, then identifying a problem is done by having an idea based on a predetermined topic. To get several problems from reading and analyzing an existing literature study, you will get a new problem that can be used. a problem in this research. In this problem formulation stage the author will create and compile research instruments that have been previously formulated regarding causes, dominant causes up to the solution stages for resolving work risks to make research easier.

This study was conducted to find out information in research that has been carried out previously regarding what will be researched, the aspects studied, the procedures studied, the results and obstacles encountered in the research.

In data collection activities, both primary and secondary data, compiling and distributing questionnaires and in secondary data is data obtained from literature studies.

Validation is confirmation through testing and providing object evidence that with certain requirements for a specific purpose and an expert is someone who is considered to be a reliable source of certain expertise abilities whose expertise is to assess and decide correctly or not in accordance with the provisions and status. by each other. Through education, training, publications, profession, or experience. An expert is believed to have special knowledge in his field where others can officially or legally rely on personal opinion.

In this research, technical data analysis was carried out by examining in depth the team of structural planning experts and quantity surveyors on the DELFT Apartment construction project based on analysis of respondent questionnaire data using SPSS software. This research was carried out at the DELFT Apartment Development project location, Makassar jl. Citraland Boulevard III, Centrepoint Off Indonesia Reclamation Area, South Sulawesi Province.

RESULTS

1. Statistical Data Analysis and Processing
   a. Grouping and Classifying Data for Each Variable.
      A. Building Information Modeling (X)

Table IV.1 Results of Kuelsiolnelr Tabulation of Building Information Modeling (BIM) Variables

No	Building Information Modeling (BIM) Statement	Statement Assessment Weight					
		STS (1)	TS (2)	C (3)	S (4)	SS (5)	Total
EXPERT RESOURCES							
1	Using BIM software uses few resources.	0	0	5	2	1	8
2	Using BIM software requires specific and competent resources in their field.	0	0	0	6	2	8
3	BIM software affects the distribution of work between several other BIM software so that it can use fewer experts.	0	0	5	0	3	8
4	Speed up the planning process so that it can reduce costs used in project planning.	0	0	3	3	2	8
5	Automation of planning tasks in BIM applications so that it can reduce the use of experts in project planning.	0	0	0	6	2	8
Total		0	0	13	17	10	40

Source: Data Analysis Results

The percentage results of respondents' answers based on the classification of scores obtained are shown by the SPSS results in the table. as follows :

Table IV. 2 Classification of Respondent Scores Statement 1

X1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quite	5	62.5	62.5	62.5
	Agree	2	25.0	25.0	87.5
	Strongly Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.2, it can be seen that in the statement zero molr 1, 5 people (62.5%) chose Fair (C), 2 people chose Agree (S) and 1 person chose Strongly Agree.

Table IV. 3 Classification of Respondent Scores Statement 2

X1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	6	75.0	75.0	75.0
	Strongly Agree	2	25.0	25.0	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.3, in the statement zero molr 2, 6 people (75.0%) chose Agree (S), 2 people chose Strongly Agree (SS).

Table IV.4 Classification of Respondent Scores for Statement 3

X1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	5	62.5	62.5	62.5
	Strongly Agree	3	37.5	37.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.4, in the statement zero molr 3, 5 people (62.5%) chose Fair (C), 3 people chose Strongly Agree (SS).

Table IV.5 Classification of Respondent Scores for Statement 4

X1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quite	3	37.5	37.5	37.5
	Agree	3	37.5	37.5	75.0
	Strongly Agree	2	25.0	25.0	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.5 on the statement zero molr 4, as many as 3 people (37.5%) chose Fair (C), 2 people chose Agree (S), and 2 people chose Strongly Agree (SS).

Table IV.6 Classification of Respondent Scores for Statement 5

X1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	6	75.0	75.0	75.0
	Strongly Agree	2	25.0	25.0	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.6 on the statement zero molr 5, as many as 6 people (75.0%) chose Selagree (S), and 2 people chose Strongly Agree (SS).

b. Conventional Method (X2)

Table IV. 7 Tabulation Results of Conventional Variable Kuelsiolnelr Methods

No	Statement of Conventional Method	Statement Assessment Weight					
		STS (1)	TS (2)	C (3)	S (4)	SS (5)	Total
EXPERT RESOURCES							
1	Using conventional software uses few resources	0	3	4	1	0	8
2	Using conventional software requires specific and competent resources in their field	0	0	1	7	0	8
3	Conventional software affects the distribution of work between several other conventional software so that it can use fewer experts.	0	2	5	1	0	8
4	Speed up the planning process so that it can reduce costs used in project planning	0	2	5	1	0	8
5	Automation of planning tasks in conventional applications so that it can reduce the use of experts in project planning	0	0	5	3	0	8
Total		0	7	20	13	0	40

Source: Data Analysis Results

The percentage results of respondents' answers based on the classification of scores obtained are shown by the SPSS results in the table. as follows:

Table IV.8 Classification of Respondent Scores Statement 1

X2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	37.5	37.5	37.5
	Quite	4	50.0	50.0	87.5
	Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.8, it can be seen that in statement 1, as many as 3 people chose Disagree (TS), 4 people (50.0%) chose Fair (C), and 1 person chose Agree (S).

Table I
V.9 Classification of Respondent Scores for Statement 2

X2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	12.5	12.5	12.5
	Quite	6	75.0	75.0	87.5
	Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.9, it can be seen that in the statement zero molr 2, as many as 1 person chose Disagree (TS), 6 people (75.0%) chose Fair (C). and 1 person chose Seltuju (S).

Table IV.10 Classification of Respondent Scores for Statement 3

X2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	37.5	37.5	37.5
	Quite	4	50.0	50.0	87.5
	Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.10, it can be seen that in the zero molr 3 statement, 3 people chose Disagree (TS), 4 people (50.0%) chose Fair (C) and 1 person chose Agree (S).

Table IV.11 Classification of Respondent Scores for Statement 4

X2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	25.0	25.0	25.0
	Quite	5	62.5	62.5	87.5
	Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.11, it can be seen that in the statement zero molr 4, 2 people chose Disagree (TS), 1 person chose Selagree (S) and 5 people (62.5%) chose Fair (C).

Table IV.12 Classification of Respondent Scores for Statement 5

X2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	37.5	37.5	37.5
	Quite	4	50.0	50.0	87.5
	Agree	1	12.5	12.5	100.0
	Totally	8	100.0	100.0	

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.12, it can be seen that in the statement zero molr 5, 3 people chose Disagree (TS) and 4 people chose Fair (C) and 1 person chose Agree (S).

2. Validity Test and Reliability Test

Testing the validity and reliability of the instrument in this research uses the IBM SPSS statistics 29 program

a. Validity test

The results of the validity test in this research are as follows:

Table IV.13 Validity Value of Building Information Modeling (BIM) and Conventional Methods.

Nol	Variabell	Itelm	r- hitung	r- Tabell	Keltelrangan
1	BIM (X1)	X.1	0,782	0,707	Valid
		X.1	0,894	0,707	Valid
		X.1	0,925	0,707	Valid
		X.1	0,772	0,707	Valid
		X.1	0,894	0,707	Valid
2	METODE KONVENSIONAL (X2)	X.2	0,868	0,707	Valid
		X2.	0,938	0,707	Valid
		X2	0,868	0,707	Valid
		X2	0,792	0,707	Valid
		X2	0,868	0,707	Valid

Source: SPSS Statistics 29 output in August 2023

Based on Table V.13, it shows that all BIM variable statement items (X1) and CONVENTIONAL METHODS (X2) have a calculated r-value (colrrelcteld – total colrrellatioln) > r-Table (0.707), namely at a significance level of a=0.04 and N = 8. The finite cell can be declared valid.

b. Reliability Test

Calculations for reliability are carried out using correct statements or questions. By using one measuring instrument that is only used once, it is possible to determine the reliability of the measuring instrument and save time and costs. Reliability testing evaluates the consistency of instruments when used in research. If the Cronbach alpha value is greater than (>) 0.60 or smaller than (??) 0.60, then the test variable being studied is considered reliable.

1. BIM reliability

Table IV.14 Value of BIM (Building Information Modeling)

Reliability Statistics	
Cronbach's Alpha	N of Items
.871	5

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.14, it shows that all variables are declared reliable where the Crolenbach's alpha of all variables is > 0.60, so that in the future every item in each variable column is suitable for use as a measuring tool.

2. Reliability of Conventional Methods

Table IV.15 Value of Conventional Methods

Reliability Statistics	
Cronbach's Alpha	N of Items
.912	5

Source: SPSS Statistics 29 output in August 2023

Based on Table IV.15, it shows that all variables are declared reliable where the Crolenbach's alpha of all variables is > 0.60, so that in the future every item in each variable column is suitable for use as a measuring tool.

3. Classic Assumption Test

a. Normality Test

The data normality test aims to test whether in the relation model, the model variables and the variable variables have a zero-normal distribution or not. A good Moldell relation is one that has a zero-normal or close to zero-normal distribution. In this research, to test zero-rmality, the Kollmolgolrolv-Smirnolv test was used.

The results of the zero-rmality tests that have been carried out by researchers are as follows:

Table IV. 16 Normality Test Values

One-Sample Kolmogorov-Smirnov Test			
			Unstandardized Residual
N			8
Normal Parameters[a,b]	Mean		.0000000
	Std. Deviation		2.79691911
Most Extreme Differences	Absolute		.194
	Positive		.194
	Negative		-.158
Test Statistic			.194
Asymp. Sig. (2-tailed)[c]			.200[d]
Monte Carlo Sig. (2-tailed)[e]	Sig.		.511
	99% Confidence Interval	Lower Bound	.498
		Upper Bound	.524
a. Test distribution is Normal.			
b. Calculated from data.			
c. Lilliefors Significance Correction.			
d. This is a lower bound of the true significance.			
e. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 2000000.			

Source: SPSS Statistics 25 output in August 2023

Based on the results of the zero-normality test in Table 4.16, it is known that the significance value is 0.200> 0.05, it can be concluded that the residual value has a zero-normal distribution.

b. Heltelrolskeldasticity test

A good model model is one that does not show heltel rolskeldasticity. The results of the heltelrolskeldasticity test that have been processed by the research team are as follows:

Table IV. 17 Heltelrolskeldasticity Test Values

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.646	4.773		1.392	.213
	BIM	-.242	.241	-.380	-1.005	.354
a. Dependent Variable: RES2						

Source: SPSS Statistics 29 output in August 2023

Based on the test results in Table IV.17, it shows that there is no heltelrolskeldasticity in the indelpelndeln variables and fulfills the hetelrolskeldasticity test with a significance value of 0.354> 0.05.

4. T Test (Unpaired T-test)

a. Comparative Test

To assess the effectiveness of behavior, the difference between the average before and the average after the behavior is given is marked.

Table IV. 18 Sample Statistical Test Values

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	KONVENSIONAL	31.5000	8	5.07093	1.79284
	BIM	59.2500	8	9.16125	3.23899

Source: SPSS Statistics 29 output in August 2023

Based on the test results in Table IV.18, it shows that on average BIM is better than conventional, it can be seen from the difference in the Std value. Deviation.

b. Test Correlations

Table IV. 19 Sample Correlation Test Values

Paired Samples Correlations					
		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	BIM & KONVENSIONAL	8	.999	<.001	<.001

Source: SPSS Statistics 29 output in August 2023

Based on the test results in Table IV.19, it shows that there is a relationship between the two variables and fulfills the correlation test with a significance value of 0.001<0.05. The use of Building Information Modeling (BIM) software is more efficient in managing expert resources in planning the Makassar Apartment DELFT construction project compared to conventional methods. This conclusion is supported by statistical analysis showing significant differences between the two methods.

CONCLUSION

Based on the results of this research, the use of Building Information Modeling (BIM) software is more efficient in managing expert resources in planning the Makassar Apartment DELFT construction project compared to conventional methods. This conclusion is supported by statistical analysis showing significant differences between the two methods.

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