The Modeling of Building Reliability of Menara Kudus Mosque Based on User Perception

Agung Sedayu[1], Ach. Gat Gautama[1]
[1]Faculty of Science and Technology, State Islamic University of Malang

Email: uinsedayu@gmail.com

Abstract. The Menara Kudus Mosque is one of the oldest mosque building sites in Central Java which became the center of Islamic development in Java by Walisongo, especially Sunan Kudus. The condition of the building of this mosque is still functioning properly because of the physical condition of the well-maintained building. The Menara Kudus Mosque is considered to have a good level of building reliability and resistance to all loading. Besides being reliable in terms of physical buildings, the mosque building which is the result of acculturation of local culture show tolerance and harmony of religious people. The architectural style that adopts the Hindu, Buddhist, and Javanese style of the building makes this building show Islam as a religion that supports peace and harmony in society. This study aims to make the modeling of the reliability of the Menara Kudus Mosque building based on user perceptions. The respondents who were targeted by questionnaires were mosque users, namely pilgrims who knew the development of the mosque. The data analysis method used is Structural Equation Modeling (SEM) with architectural and structural variables as exogenous variables, stability as moderator variable, and reliability as endogenous variable. The results of the analysis show that the two exogenous variables have a positive effect on the moderator and endogenous variable. The relationship between endogenous variable with moderator variable shows significant effects.

1. Introduction

The Menara Kudus Mosque is located in Kauman, Kota District, Kudus Regency, Central Java. This mosque was built in around 1549 by Sunan Kudus which is one of the wali songo (wali nine) as a propagator of Islam in Java. This mosque was a silent witness of tolerance from times between Muslims and followers of other religions at the time, namely Hinduism and Buddhism. This can be seen from the cultural acculturation and architectural style of the mosque tower (minaret) which has Javanese Hindu style, which at the time of Sunan Kudus preached to the majority of the community around the mosque who adhered to Hinduism, Buddhism, and animism [1]. The Menara Kudus Mosque has become a cultural heritage that has an ancient site, namely tower (minaret), gate (gapura), ablution place, original building with pyramid roof, and tomb area of Sunan Kudus and Family [2]. The application of Hindu culture in the Menara Kudus Mosque can be seen from the arrangement of spatial organization in Kudus City which follows the spatial organization arrangement in the Majapahit Kingdom. The combination of Islamic and Hindu culture in the Menara Kudus Mosque shows the interrelation and tolerance between Islam with Hinduism in the time but still guided by

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Islam [3]. The around area in the mosque is called Kauman to be a cultural preservation and destination for religious tourism which is constantly maintained and cared for by the Kudus Regency Government. This study aims to make a model of the building reliability of Menara Kudus Mosque based on user perception. Respondents who were targeted in distributing questionnaires were mosque users, namely pilgrims who knew the mosque's development. The worshipers of the mosque users from the surrounding community often use the mosque building as a place of worship. The Menara Kudus Mosque has similar typology and philosophy with other mosques in Nusantara, especially in Java such as the Ampel mosque Surabaya, the Great Mosque of Demak, Mataram Kotagede Mosque, the Great Mosque of Cirebon, and many other mosques.

2. Method

Some previous studies are used as a reference in the development of variables and research methods. This research develop and combine many variables, methods, and references from the previous studies. Sedayu [4] used method of Importance Performance Analysis (IPA) and Quality Function Deployment (QFD) to determine the priority of maintaining the reliability of sustainable construction at the Ampel Mosque Surabaya. He obtained 7 research variables include workability, serviceability, durability, security and safety, comfort and regularity, and maintainability. Salimi et. al. [5] tried to find the role and impact of religion on the architecture of mosques and churches. The hypothesis is In different religions, religion affects on the architecture of religious buildings. Taher et. al [6] conducted a research that has aim to shed the light on teh significant architectural practices in contemporary mosque design by analyzing minaret in order to reinterpret, evaluate and develop mosque design in the contemporary world. The outcome of the research, is to figure out the main characteristics of contemporary minaret through the familiar characteristic appearances of traditional minaret. Kalayci et. al [7] had study focuses on the judgments of high-school students who follow a religion based program in Aydın, Turkey. Participants judged 4 contemporary mosque design approaches. Scores were collected via questionnaire. General like-dislike responses was the dependent variable of the study whereas differentness, exterior, interior, suitability for praying, invitingness and style characteristics of mosques were the independents. The convenience of space circulation in the Mataram Kotagede mosque is influenced by one of them by the presence of a grenteng in a room. The existence of the grenteng which is right in the middle of the door gives an influence on the comfort of the visitors circulation. The research findings show that circulation comfort with the role of grenteng can be achieved on one side of the left either used as an entry or exit circulation [8]. Marwoto et. al. also conducted ar research about simbolism in the great mosque of Demak by studying the human relationship with the place which is motivated by factors of symbols that are dominated by the religious and historical aspects of the City of Demak. The results explain the relationship between human with god presented in the elements of decoration in the Great Mosque of Demak. The diversity of aesthetic elements that are displayed in the door leaf, pillars, symbol, and machinations are the messages in the teachings of Islam [9]. The location of this research is Menara Kudus Mosque, Central Java Province. The methods of data collection use a survey and interview to the respondents. The research instrument was in the form of a questionnaire with a validity and reliability test using the SPSS 20. After the instrument was declared valid and reliable, the next stage was carried out an analysis of Structural Equation Modeling (SEM) by using AMOS 19,0. The respondents in the study were mosque users namely pilgrims who had a lot of information about the development of Menara Kudus mosque. The scale measured is the level of user satisfaction. The determination of the research sample is sought by the Bernoulli equation [10] which produces 250 respondents. The measurement scale consists of 5 Likert scales:

1. Scale 1: not satisfactory
2. Scale 2: less satisfactory
3. Scale 3: quite satisfactory
4. Scale 4: satisfactory
5. Scale 5: very satisfactory

The validity and reliability test of the research instrument was carried out in a trial phase of 30 people [11]. Validity test is conducted to determine the validity of the questionnaire that will be distributed to

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research respondents. For the purposes of correlation testing, Pearson's product moment correlation is used. In this study, an instrument is said to be strongly correlated if the correlation value is above 0,6 [11]. The reliability test aims to find out whether the data collection tool basically shows the level of accuracy, stability, or consistency of the tool in expressing certain symptoms of a group of individuals, even if done at different times. To test Internal Consistency using the coefficient of consistency (Alpha Cronbach). The provisions of the research instrument are called reliable if the alpha coefficient (Cronbach Alpha coefficient) is above 0,60 [11]. The validity and reliability test of the questionnaire by using SPSS 20. The Structural Equation Modeling (SEM) analysis aims to create a model that explains the relationship between the variables of the reliability of the Menara Kudus mosque by using AMOS 19. The model developed is a path analysis model (recursive path analysis) which is a further development of multiple regression and bivariate analysis. Figure 1 shows the SEM model developed in this study.

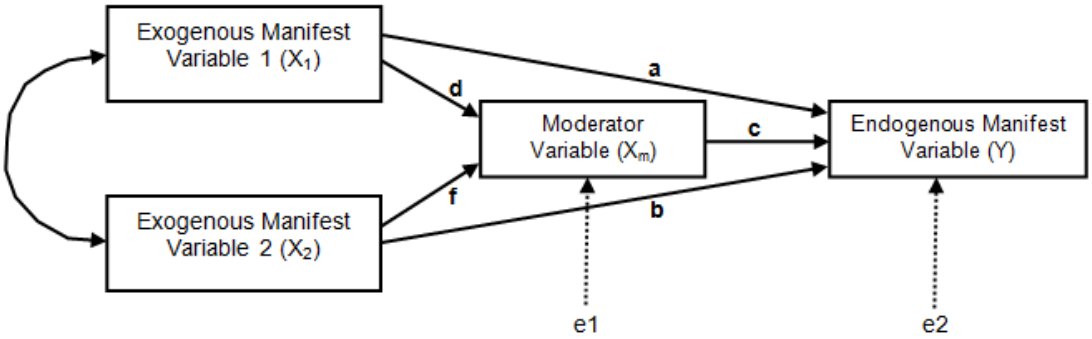

Figure 1. Model of SEM analysis

The research variables are divided into 4 variables such as the SEM model (see Figure 1), it can be described that the structural equation model consists of,

- Exogenous manifest variable 1 (X_1).
- Exogenous manifest variable 2 (X_2).
- Moderator variable (X_m).
- Endogenous manifest variable (Y).

From the model in Figure 1, here is the regression equation model:

$$Y = aX_1 + bX_2 + cX_m + e_1 \quad (1)$$

$$X_m = dX_1 + fX_2 + e_2 \quad (2)$$

3. Resuls and discussion

The results of the validity and reliability test of each instrument are divided into four variables of reliability of Menara Kudus mosque including Architecture (X_1), Structure (X_2), Stability (X_m), and Reliability (Y). The validity test results show that all items in the four research variables are greater than 0,6 (> 0,6), which means the instrument is said to be valid. While the reliability test results show that the Croncbach alpha value is 0,981 which includes greater than 0,6 (> 0,6), so the instrument is said to be reliable. Based on the results of the survey and the feasibility test of the instrument, the four research variables in the SEM model (see Figure 2) can be described as consisting of,

1. Architecture (X_1) as an exogenous manifest variable 1 has the meaning of architectural components in the mosque building including aesthetic, comfort, convenience, and the value of design philosophy.
2. Structure (X_2) as an exogenous manifest variable 2 has the meaning of structural components that support the building from all loading so as to create security, safety, and avoid damage to buildings.
3. Stability (X_m) as a moderator variable which means stability in building construction that ensures robustness to support no changes in the building's technical system.

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4. Reliability (Y) as an endogenous manifest variable means reliability within a period of time in accordance with the design plan technically on all building components.

Before the model is obtained, the data normality test is first performed wherein from the minimum number of respondents in the model which is entirely a manifest variable at least each variable has 15 data in the form of samples or respondents [12], so that 15 x 4 = 60 data. The number of respondents at the Menara Kudus Mosque was 250, so the normal distribution data requirements were considered to be fulfilling. The significance test of the variable by comparing the estimated value with the probability value (p) in the Maximum Likelihood Estimates as in Table 1.

Table 1. Regression weights variable Menara Kudus Mosque

The Relationship between variables			Estimate	S.E.	C.R.	P	Significancy
Architecture (X_1)	→	Stability (X_m)	0,221	0,125	4,092	0,014	Significant
Structure (X_2)	→	Stability (X_m)	0,329	0,109	7,926	***	Significant
Architecture (X_1)	→	Reliability (Y)	0,257	0,238	2,793	0,002	Significant
Structure (X_2)	→	Reliability (Y)	0,411	0,126	6,114	0,004	Significant
Stability (X_m)	→	Reliability (Y)	0,525	0,134	3,305	***	Significant

Table 1 describes that the estimate value for all variables is greater than the value of p. The value of p = *** means 0,001. The convergent validity test to determine the correlation of the model by comparing the extracted Variance value to the value of 0,5.

Table 2. Standardized regression weights variable Menara Kudus Mosque

The Relationship between variables			Estimate	Variance extracted	Validity
Architecture (X_1)	→	Stability (X_m)	0,206	0,373	Valid
Structure (X_2)	→	Stability (X_m)	0,727		
Architecture (X_1)	→	Reliability (Y)	0,145	0,149	Valid
Structure (X_2)	→	Reliability (Y)	0,411		
Stability (X_m)	→	Reliability (Y)	0,438		

Table 2 describes that the Extracted Variance value is smaller than 0,5 [12], which can be calculated as follows,

-Variable Stability (X_m) = $\frac{0{,}206^2 + 0{,}727^2}{2} = 0{,}285 < 0{,}5$

-Variable Reliability (Y) = $\frac{0{,}145^2 + 0{,}411^2 + 0{,}438^2}{3} = 0{,}127 < 0{,}5$

So from this test it can be concluded that the model is valid with the arrangement of the variables. Table 3 shows the estimated values between Architecture (X_1) and Structure (X_2). The results of this analysis obtain a path diagram model like in Figure 2.

Table 3. Relationship of X_1 with X_2 in Menara Kudus mosque

The Relationship between variables			Estimate
Architecture (X_1)	↔	Structure (X_2)	0,257

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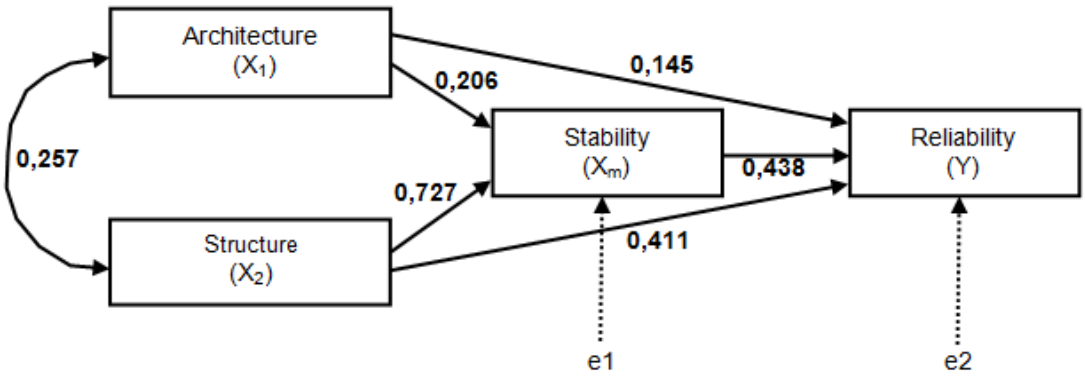

Figure 2. Model of path diagram of SEM in Menara Kudus mosque

The correlations that describe the effect between variables in SEM analysis are shown by a coefficient of determination. The effect model of the Menara Kudus Mosque is obtained:

- The effect model of overall variable: $Y = 0{,}145X_1 + 0{,}411X_2 + 0{,}438X_m$
- The effect model of moderator variable : $X_m = 0{,}206X_1 + 0{,}727X_2$
-

Table 4. Corelation of X_m and Y in Menara Kudus mosque

Variables	Estimate
Stability (X_m)	0,752
Reliability (Y)	0,833

The relationship between variables shows strong level of significances. Table 4 explains that the path diagram model obtained explains that the variability of Stability (X_m) explained by Architecture (X_1) and Structure (X_2) is 75,2%. While Reliability (Y) which can be explained by the variability of Architecture (X_1), Stability (X_m), and Structure (X_2) of 83,3%. While from the path diagram model, obtained direct and indirect effects between variables, so also resulted the total effect = direct effect + indirect effect. It can be concluded that the relationship of influence in the overall model is positive (see Table 5).

Table 5. Relationship between varibles in Menara Kudus mosque

The Relationship Between Varibles	Direct Effect	Indirect Effect	Total Effect
$X_1 \rightarrow Y$	0,145	(0,206) x (0,438) = 0,090	0,235
$X_2 \rightarrow Y$	0,411	(0,727) x (0,438) = 0,318	0,729
$X_m \rightarrow Y$	0,438	-	0,438
$X_1 \rightarrow X_m$	0,206	-	0,206
$X_2 \rightarrow X_m$	0,727	-	0,727
$X_1 \rightarrow X_2$ (recursive)	0,257	-	0,257

4. Conclusion

The Menara Kudus Mosque is located in Kauman, Kota District, Kudus Regency, Central Java. This mosque was built in around 1549 by Sunan Kudus which is one of the wali songo (wali nine) as a propagator of Islam in Java. This mosque was a silent witness of tolerance from times between Muslims and followers of other religions at the time, namely Hinduism and Buddhism. This can be seen from the cultural acculturation and architectural style of the mosque tower (minaret) which has Javanese Hindu style, which at the time of Sunan Kudus preached to the majority of the community around the mosque who adhered to Hinduism, Buddhism, and animism. The Menara Kudus Mosque is a cultural preserve that has many ancient sites and is a tourist destination for visitors, so it needs to be maintained so that the level of durability and reliability of the building is good. The results obtained four research variables that are components of the SEM model can be described include Variable Architecture (X_1) has the meaning of architectural components in the mosque building including

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aesthetic, comfort, convenience, and the value of design philosophy. Structure (X_2) has the meaning of structural components that support the building from all loading so as to create security, safety, and avoid damage to buildings. Stability (Xm) which means stability in building construction that ensures robustness to support no changes in the building's technical system. Reliability (Y) means reliability within a period of time in accordance with the design plan technically on all building components. The correlations that describe the effect between variables in SEM analysis are shown by a coefficient of determination. The effect model of the Menara Kudus Mosque is obtained the effect model of overall variable: $Y = 0{,}145X_1 + 0{,}411X_2 + 0{,}438X_m$ and the effect model of moderator variable : $X_m = 0{,}206X_1 + 0{,}727X_2$. The relationship between variables shows strong level of significances. The path diagram model obtained explains that the variability of Stability (X_m) explained by Architecture (X_1) and Structure (X_2) is 75,2%. While Reliability (Y) which can be explained by the variability of Architecture (X_1), Stability (X_m), and Structure (X_2) of 83,3%. While from the path diagram model, it can be concluded that the relationship of effects in the overall model is positive on direct, indirect, and total effect between variables. It can be concluded that the relationship of influence in the overall model is positive.

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