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# Modeling Partial Least Square of Users Loyalty on the Public Hospital in Malang of Indonesia

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**Key words:** Loyalty, perception of costs, PLS, public hospital, satisfaction

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**Abstract:** The hospital as one of the health service institutions must be able to improve the quality of services for the community in order to obtain the highest level of health. The purposes of this study are to model the effect of service quality, perceptions of costs and imagery to satisfaction and loyalty and to know the factor that most influenced to satisfaction and loyalty of the public hospital users in Malang by using Partial Least Square (PLS). The data are secondary data in the form of a questionnaire with a sample size of 100 respondents. The data analyses were performed with R software. The results showed that the latent variable perception of costs had the greatest effect on loyalty with an absolute contribution of 32.49%. The PLS model as a whole can explain the phenomena related to satisfaction and loyalty of users on the public hospital in Malang by 72.78%.

## INTRODUCTION

In Indonesia, public hospitals play an important role in supporting society to get well body fit. The public hospital serves the public health service system. At present, health services in the public hospitals are not only curative but also rehabilitative, so that, targets in health services apply to individual patients, families patients and the general public. Therefore, Satrianegara believes that public hospital management needs to be done professionally when compared to other business services. It will make public hospital management to create a different strategy in reaching its goals.

In the scope of the public hospital, the quality of service must always meet the standard procedures. The study of Parasuraman *et al*.[1] showed that service quality has five dimensions including tangibles or physical evidence, reliability or level of reliability, responsiveness or readiness, assurance or knowledge and courtesy and empathy or caring. The public hospital service fee is determined on a mutual cooperation basis and is fair by prioritizing the interests of low-income people. In principle, public hospital services cost should be affordable and match the cost incurred with the service to be received. According to Rangkuti, a brand image is a group of brand associations that are formed in the minds of consumers or users. Based on the research by Echtner and Ritchie[2], a brand image consists of four dimensions, including attributes attached to a service provider, functional aspects of service providers, psychological aspects to measure impressions and holistic aspects that include reputation and image from the service provider.

In addition, Pohan also defines that a public hospital must always strive for the needs and satisfaction of patients who are users of these services. Patient

satisfaction can be measured by various indicators, including satisfaction with access, quality, processes and health care systems. Besides satisfaction, user loyalty also needs to be a concern because user loyalty is a measure of the likelihood that a patient will move to another health care provider (hospital). Loyal users will reflect the attitude of users of repeated use of services, the existence of hospital endurance against competitors and users who influence others to want to use the hospital's services.

Hidayat has conducted studies on the effect of service quality, perceptions of costs and perceptions of imagery on user satisfaction and loyalty at a public Hospital in Malang of Indonesia. However, the analysis used by researchers is regression analysis, so that, the effect obtained is only direct effects. the Indirect effects between variables cannot be detected, even though both models indicate that there is a direct influence among variables. The research results of Bei and Chiao's[3] show that service quality and perceptions of costs directly influence user satisfaction and indirect effect on user loyalty. From the statistical viewpoint, The multiple regresson is very not suitable if the data are involved in the latent variables. some information can not be explored which are in the construction of latent variables, the indicators which most constructing or reflecting does not be known, beside the direct or indirect effect among latent variable can not be evaluated.

In each statistical modeling always involves the optimization technique which the most popular is Ordinary Least Square (OLS) wherein the beginner used in regression analyses such as in Hidayat, time series analysis such as in Widodo *et al*.[4], Kusdarwati and Handoyo[5]. The applications of OLS in machine learning were conducted by Handoyo and Marji[6] and also by Handoyo and Efendi[7]. The further application of evolutionary optimization methods such as Particle Swarm Optimization (PSO) was done by Handoyo *et al*.[8] and also by Efendi *et al*.[9]. In principal the optimization methods (OLS and PSO) work well if the data can be observed directly which means not involving latent variables.

Based on the explanation above, to explore more information relating research conducted by Hidayat, so, the results can give important information for public hospital management, the data will be analyzed by using Partial Least Square (PLS). The PLS method considers comprehensively how to compute latent variables score and to estimate model parameters[10]. The purposes of the research are to model the effect of service quality, perceptions of cost and perceptions of imagery against user satisfaction and loyalty, to evaluate the direct and indirect effect, to determine the variables that most influence satisfaction and loyalty of the public hospital users in Malang of Indonesia.

## MATERIALS AND METHODS

A Structural Equation Modeling (SEM) according to Hair *et al*.[10] is a multivariate analysis technique in the form of a combination of factor analysis and regression analysis. The technique aims to measure the relationship between manifest variables and latent variables. One approach in SEM is Partial Least Square (PLS). The approach is based on the variance aimed at maximizing the variance explained in endogenous latent variables. the PLS uses a path diagram to visualize the relationships between variables.

Like the SEM model in general, the PLS model consists of several elements. The first element, namely the latent variable is a variable that cannot be measured directly. In the path model, latent variables are described as ellipses. Latent variables are further divided into two, namely exogenous latent variables and endogenous latent variables. The difference between the two types of latent variables lies in the error attribute that is owned. Endogenous latent variables have an error attribute because the variable is influenced by other variables (although, these variables also affect other variables). On the other hand, the exogenous latent variable has no error attribute because this variable only affects other variables.

Contrary to latent variables, manifest variables can be measured directly and are a quadrilateral. The manifest variable is the 'child' of the variable containing the raw data to be analyzed. In real research, latent variables are generally composed of various latent indicators. However, if the indicators are no longer divided into several items, the indicators will act as manifest variables. If the indicator is divided into several items, then those items will become manifest variables.

**Characteristics of PLS:** The PLS analysis considers of two characteristics that are data and model characteristics. The characteristics of the data analyzed in the PLS are divided into 4 characteristics. The first one is that the PLS can be used properly and efficiently on small sample data. Barclay, etc., say that the minimum sample size is ten times the number of the largest formative indicators. Second characteristic is PLS does not pay attention to the distribution of data because PLS is a nonparametric method. Third, PLS results in estimating parameters are very robust for both normal and highly abnormal data. However, a high level of robustness can be obtained as long as the missing data is still below the tolerance limit (generally 5% per indicator). Fourth, the PLS can be used in any form of data. In fact, binary data such as dummy variables can also be used but these variables can only be used on exogenous latent variables.

The second PLS characteristic is the model characteristics. These characteristics are broken down into four characteristics. First, PLS can handle almost all types of models. This is true if theoretical or conceptual assumptions support a large model and the availability of sufficient data. Second, PLS can easily handle formative and reflective measurement models. Third, PLS can be used on complex models, namely models with many relationships to the structural model. Finally, PLS analysis must consider both of PLS only applies to models that are recursive and the relationship between latent variables is linear.

**Linearity assumptions in PLS:** One of the rules or assumptions in PLS is the relationship between variables is linear. If this assumption cannot be met, the result of the analysis will be biased. Relationships between variables can be checked with Ramsey's Regression Specification Error Test (Ramsey's RESET) which was said by Gujarati and Porter[11]. The models used in the RESET can linear or nonlinear (polynomial) models. Both models will produce F test statistics as follows:

$$\frac{\left(R_b^2 - R_a^2\right)/\left(k_b - k_a\right)}{\left(1 - R_b^2\right)/\left(n - k_b\right)} \sim F_{(k_b - k_a, n - k_b)} \quad (1)$$

Where:

$R^2_a$ = Value on linear model
$R^2_b$ = Value on non linear model
$k_a$ = Number of parameters on linear model
$k_b$ = Number of parameters on non linear model

Hair *et al*.[10] suggested that there are several stages in the PLS analysis. The first stage defines the model that are two types, structural and measurement models. The structural model describes l the relationships among the latent variables. The measurement model illustrates the relationship between a latent variable and manifest variables. The measurement model has two types of indicators that are formative and reflective indicators. Solimun etc., added that the determination of latent variables, manifest variables and their relationships are based on a theoretical basis relating to research or the knowledge and experience of researchers.

If the p-value of the F-test statistic is significant, it can be decided that the relationship between variables is not linear and vice versa. After defining the model, the next step is to estimate the model parameters which consist of three stages, namely the estimation of weights (w) for calculating latent variable scores, estimating path coefficients and estimating loading coefficients Sanchez (2013). The estimation of weights (ω) is conducted by iteration to obtain a stable estimator. The iteration begins with the determination of the initial outer weight values, then proceed with the calculation of the external estimator of the latent variable and the inner weight. Next, the calculation of the internal estimator value of the latent variable is carried out, so that, new outer weight is obtained. Iteration is carried out up to the convergent limit of threshold or a maximum iteration[10]. The second stage, namely the estimation of the path coefficient is carried out by the Ordinary Least Square (OLS) method. Finally, the loading coefficient is calculated by the correlation between latent variables and manifest variables.

The final step in the PLS procedure is the evaluation of the model or testing of the goodness of fit and testing of hypotheses. Evaluation of the model is also divided based on the model types, namely evaluation of structural and measurement models (reflective and formative). Hypothesis testing is done by Bootstrap resampling method, both in structural and measurement models. The application of this method allows the entry of data that is free of distribution.

In this study, the evaluation of measurement models related to the validity and reliability of research instruments was not carried out because the data in this study were secondary data. Therefore, the evaluation of the reflective measurement model is only measured by testing the hypothesis of the loading coefficient while in the formative indicator model the testing of the hypothesis is carried out with two sides that are the outer weight and the loading coefficient. Hypothesis testing is done by t-statistics with the following formulas:

$$H_0: \omega = 0 \text{ vs } H_1: \omega \neq 0 \text{ and } t = \frac{\omega}{se^*_\omega} \quad (2)$$

$$H_0: \lambda = 0 \text{ vs } H_1: \lambda \neq 0 \text{ and } t = \frac{\lambda}{se^*_\lambda} \quad (3)$$

Where:

$\lambda$ = Loading value
$\omega$ = Outer weight value
t = t statistic test
$se^*_\omega$ = Standart error value of outer weight
$se^*_\lambda$ = Standart error value ofloading

The outer weight and loading values are said to be significant if the p-value of the t-test statistic is less than the significant level ($\propto$). In the evaluation of the formative indicator model, hypothesis testing of the loading value will be considered if the outer weight is not significant and the coefficient value $\lambda<0.5$. If the coefficient $\lambda$ is not significant, then the indicator must be discarded.

Evaluation of structural models is related to the goodness of the relationship among the latent variables. The indicators used in the evaluation of the structural model involve the significance of the path coefficient, the coefficient of determination ($R^2$) and $Q^2$ predictive

relevance ($Q^2$). Evaluation with the significance of the path coefficient is done by testing the hypothesis as a measurement model[10]. The hypotheses and test statistics used are as follows:

$$H_0 : \gamma = 0 \text{ vs } H_1 : \gamma \neq 0 \text{ and } t = \frac{\hat{\gamma}}{se^*_{\hat{\gamma}}} \quad (4)$$

$$H_0 : \beta = 0 \text{ vs } H_1 : \beta \neq 0 \text{ and } t = \frac{\hat{\hat{\beta}}}{se^*_{\hat{\beta}}} \quad (5)$$

Where:

$\hat{\gamma}$ = The estimating path coefficient among endogenous variables

$\hat{\beta}$ = The estimator of the connecting path coefficient between exogenous and endogenous variables

t = t statistic test

$se^*_{\hat{\gamma}}$ = Standart error value ofthe estimator of $\hat{\gamma}$

$se^*_{\hat{\beta}}$ = Standart error value ofthe estimator of $\hat{\beta}$

The evaluation of the second structural model based on the estimation of the structural model is carried out as the estimation of regression in general. The coefficient of determination measures the diversity of endogenous latent variables that can be explained by exogenous latent variables stated by the following formula:

$$R^2 = \frac{JKR}{JKT} = \frac{\sum_{l=1}^{n}\left(\hat{\eta}_{il} - \bar{\eta}_i\right)^2}{\sum_{l=1}^{n}\left(\eta_{il} - \bar{\eta}_i\right)^{22}} \quad (6)$$

The value of $R^2$ is categorised as low if $R^2<0.3$ as medium if $0.3\ R^2<0.6$ as high if $R^2>0.6$. The evaluation of the last structural model, Q-square predictive is defined by Solimun as a measure of the level of goodness of the structural model produced by the PLS Model. Q-square value calculation is done with the following formula:

$$Q^2 = 1-\left(1-R_1^2\right)\left(1-R_2^2\right), ..., \left(1-R_p^2\right) \quad (7)$$

Values $R_1^2, R_p^2, R_p^2$ are the values of the coefficient of determination of endogenous latent variables. The value $Q^2$ is equivalent to the coefficient total of determination $\left(R_m^2\right)$ in the path analysis with a range of $0<Q^2<1$. The closer the value of to 1, the model is said to be the better.

**Likert scaling with Summated Rating Scale (SRS) method:** Likert scale is a scale developed by Rensis Linkert that aims to measure social attitudes that were included as ordinal data. Therefore, there is a need for scaling, so that, the data becomes interval or ratio data. Scaling on a Likert scale uses the Sigma method that gives a score on each question response based on the assumption of a normal distribution. It aims to compare each score. This method is also known as summated rating. Setiawati, etc., describe the scaling steps with the method which are as follows:

- Calculate the frequency (f) of the subject's response to each item
- Turn frequency into proportion score by dividing frequency with many respondents (N)
- Calculate cumulative proportions
- Calculates the middle value of cumulative proportions $\left(MPK_i = \frac{1}{2}\left(PK_{i+1} + PK_i\right)\right)$
- Turn MPK into a critical point Z
- Change the lowest critical point to 0

**Data and operational variables:** The data used in this study are secondary data collected by Hanan Titis Hidayat. The study was conducted on service users (patients) at each outpatient installation polyclinic at a public hospital in Malang of Indonesia where the total sample size is 100 respondents. The data contained in the questionnaire are Likert scale, so that, later the data will have an interval scale. Previous studies have shown that the questionnaire data have fulfilled validity and reliability. However, linearity testing between variables has not been done in previous studies, so, linearity testing will be carried out in this study.

**Steps of research and data analysis:** Data analysis was performed on data that had been summarized previously. The R software is used in the PLS analysis with the help of LM-test and PLS-PM package. Based on the literature review that has been done, the steps of research and modeling with PLS model stated as the following:

- Determine variables and indicators
- Design research instrument and collect data
- Design structural models and measurement models
- Depict a path diagram of the model
- Turn the path diagram into an equation
- Estimate parameters of the PLS model
- Evaluate structural models and measurement models
- Perform interpretation and conclusion

The estimation steps of the PLS model are broken down into three stages as follows:

- Estimate the weights (ω) for calculating latent variable scores by iteration
- Estimate the path coefficient by the OLS method
- Estimate the loading coefficient with the correlation between latent variables and manifest variables

**The operational research variables:** The variables used in this study consisted of exogenous and endogenous latent variables. Exogenous latent variables consist of service quality, perception of cost and perception of the image. Endogenous latent variables consist of user satisfaction and user loyalty. Each variable uses several indicators with a Likert scale.

The first endogenous latent variable that is service quality was measured through five indicators based on the results of the study of Parasuraman *et al*.[1]. These indicators include tangibles, reliability, responsiveness, assurance and empathy. Second, the perception of costs is measured by two indicators including the afford ability and suitability of prices. Finally, the perception of the brain image is measured by four indicators based on the results of research by Echtner and Ritchie[2] that include the aspects of attributes, functional, psychological (atmosphere) and holistic (reputation).

The first exogenous latent variable, user satisfaction was measured by four indicators based on the results of Pohan's research (2004) which consist of patient satisfaction with access, quality, process and health service systems. User loyalty has three indicators including repeated use of services, resistance to competitors and influencing other users. All of these indicators are divided into several items but in the analysis, these items will be considered as indicators.

## RESULTS AND DISCUSSION

This study consisted of 100 observations with 55 total manifest variables (items) which were divided into five latent variables. The most manifest variables in the formative measurement model are 13 manifest variables in service quality latent variables, so, the minimum sample size is 130 samples. Therefore, it is necessary to summarize the indicators given the size of the existing sample, namely by doing averages and rounding on several items. Service quality variables and perceptions of images are summarized into five indicators and user satisfaction variables are summarized into four indicators. After the data is summarized, the data needs to be scaled up to the questionnaire data, so that, it can be analyzed further. Data scaling was carried out using the Summated Rating Scale (SRS) method with the help of R software. The results of the complete scaling are presented in Table 1.

**Result check linearity assumption of relationships among latent variables:** The checking linearity assumptions is done by testing the hypothesis, using Ramsey's RESET test. The hypothesis used is as follows:

$H_0$ : the relationship among variables is linear patterns
$H_1$ : the relationship among variables is not linear pattern

The following are the results of the linearity test presented in Table 2. Based on Table 2, it can be seen that all p-values are valued more than the real level of 0.05. So, it can be concluded that the relationship between variables is linear, meaning that the linearity assumption is fulfilled.

**The evaluation result of the PLS measurement model:** The evaluation of the first measurement model is done on reflective measurement. This study has one variable with the reflective measurement that is the user loyalty variable. This variable is an endogenous latent variable and has seven indicators. The hypothesis used in this evaluation of the first outer model is as follows:

$$H_0 : \lambda_{x12} = 0 \text{ vs } H_1 : \lambda_{x12} \neq 0$$

$$H_0 : \lambda_{x22} = 0 \text{ vs } H_1 : \lambda_{x22} \neq 0$$

$$H_0 : \lambda_{x72} = 0 \text{ vs } H_1 : \lambda_{x72} \neq 0$$

Table 3 presents the loading values of the reflective measurement model for the user loyalty variable. Based on Table 3, all loading values are significant because they have a significance value of <0.05. After evaluating the reflective measurement model, the next step is the evaluation of the formative measurement model. This study has four variables that have formative measurements which include service quality (five indicators), perception of cost (four indicators), perception of image (four indicators) and user satisfaction (four indicators). The service quality, perceptions of costs and perceptions of images are exogenous latent variables while the user satisfaction variable is endogenous latent variables. Evaluation is carried out on the outer weight first and the next of loading, if the outer

Table 1: Data quality of service before and after scaling (first five respondents)

| Service quality (before scaling) | | | | | Service quality (after scaling) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $X_{11}$ | $X_{21}$ | $X_{31}$ | $X_{41}$ | $X_{51}$ | $X_{11}$ | $X_{21}$ | $X_{31}$ | $X_{41}$ | $X_{51}$ |
| 5 | 5 | 5 | 5 | 5 | 4.28 | 4.31 | 4.41 | 4.37 | 4.28 |
| 4 | 3 | 3 | 4 | 4 | 2.89 | 1.87 | 1.66 | 2.94 | 2.82 |
| 4 | 4 | 4 | 4 | 4 | 2.89 | 3.09 | 3.03 | 2.94 | 2.82 |

weight is not significant. The hypothesis used in this evaluation is as follows: The hypothesis of outer weights:

$$H_0 : \omega_{x11} = 0 \text{ vs } H_1 : \omega_{x11} \neq 0$$
$$H_0 : \omega_{x21} = 0 \text{ vs } H_1 : \omega_{x21} \neq 0$$
$$\vdots$$
$$H_0 : \omega_{x43} = 0 \text{ vs } H_1 : \omega_{x43} \neq 0$$
$$H_0 : \omega_{y11} = 0 \text{ vs } H_1 : \omega_{y11} \neq 0$$
$$H_0 : \omega_{y21} = 0 \text{ vs } H_1 : \omega_{y21} \neq 0$$
$$\vdots$$
$$H_0 : \omega_{y41} = 0 \text{ vs } H_1 : \omega_{y41} \neq 0$$

Table 2: Linearity test results

| The direction of relationship | Statistics of $F_{(1, 97)}$ | p-values |
|---|---|---|
| Quality→Satisfaction | 2.5970 | 0.110 |
| Cost→Satisfaction | 3.8461 | 0.053 |
| Image→Satisfaction | 1.9829 | 0.162 |
| Quality→Loyalty | 0.6808 | 0.411 |
| Cost→Loyalty | 0.0017 | 0.967 |
| Image→Loyalty | 2.7995 | 0.098 |
| Satisfaction→Loyalty | 2.0077 | 0.160 |

Table 3: The significance of loading in the reflective measurement model

Loyalty user variables

| Indicators | Loading values | t-statiatics | p-values |
|---|---|---|---|
| $Y_{12}$ | 0.834 | 16.289 | 0.000$^s$ |
| $Y_{22}$ | 0.771 | 11.700 | 0.000$^s$ |
| $Y_{32}$ | 0.519 | 2.988 | 0.003$^s$ |
| $Y_{42}$ | 0.718 | 8.095 | 0.000$^s$ |
| $Y_{52}$ | 0.721 | 7.906 | 0.000$^s$ |
| $Y_{62}$ | 0.678 | 7.467 | 0.000$^s$ |
| $Y_{72}$ | 0..588 | 5.091 | 0.000$^s$ |

*s: significant, ns: not significant

The hypothesis of loadings:

$$H_0 : \lambda_{x11} = 0 \text{ vs } H_1 : \lambda_{x11} \neq 0$$
$$H_0 : \lambda_{x21} = 0 \text{ vs } H_1 : \lambda_{x21} \neq 0$$
$$\vdots$$
$$H_0 : \lambda_{x43} = 0 \text{ vs } H_1 : \lambda_{x43} \neq 0$$
$$H_0 : \lambda_{y11} = 0 \text{ vs } H_1 : \lambda_{y11} \neq 0$$
$$H_0 : \lambda_{y21} = 0 \text{ vs } H_1 : \lambda_{y21} \neq 0$$
$$\vdots$$
$$H_0 : \lambda_{y41} = 0 \text{ vs } H_1 : \lambda_{y41} \neq 0$$

The results of the evaluation of the formative measurement model are presented in Table 4. Table 4 shows that there are only four indicators that are significant outer weight. There are still some indicators that have insignificant outer weight. Therefore, the indicators are examined in the loading coefficient. If the coefficient $\lambda<0.5$, then the examination will switch to the significance level of the loading coefficient. The inspection results show that the indicator $X_{51}$ has a loading coefficient value of <0.5 and is not significant. However, the indicator cannot be erased because the removal of the indicator will reduce the meaning of the model, both structural and measurement models.

**The result of PLS structural model evaluation:** The evaluation of structural models can be done in several ways, including the significance of the path coefficient and the coefficient of determination. The hypothesis for the significance of the path coefficient is as follows:

Table 4: The value of the outer weight and its level of significance of the formative measurement model

| Indicators | Weight | t-statistic | p-values | Loading | t-statistic | p-values |
|---|---|---|---|---|---|---|
| **Service quality variable** | | | | | | |
| $X_{11}$ | 0.8843 | 3.023 | 0.003$^s$ | | | |
| $X_{21}$ | 0.2645 | 0.734 | 0.465$^{ns}$ | 0.694 | 3.292 | 0.001$^s$ |
| $X_{31}$ | 0.3885 | 0.861 | 0.391$^{ns}$ | 0.639 | 3.370 | 0.001$^s$ |
| $X_{41}$ | 0.3132 | 0.598 | 0.551$^{ns}$ | 0.677 | 3.070 | 0.003$^s$ |
| $X_{51}$ | 0.4798 | -1.026 | 0.307$^{ns}$ | 0.393 | 1.862 | 0.066$^{ns}$ |
| **Perception to costs variable** | | | | | | |
| $X_{12}$ | -0.0582 | -0.121 | 0.904$^{ns}$ | 0.58 | 2.868 | 0.005$^s$ |
| $X_{22}$ | 0.1326 | 0.324 | 0.747$^{ns}$ | 0.638 | 2.421 | 0.017$^s$ |
| $X_{32}$ | 0.9067 | 3.535 | 0.001$^s$ | | | |
| $X_{42}$ | 0.4661 | 0.953 | 0.343$^{ns}$ | 0.708 | 3.980 | 0.000$^s$ |
| **Perception to brand image variable** | | | | | | |
| $X_{13}$ | 0.7431 | 1.401 | 0.164$^{ns}$ | 0.883 | 3.515 | 0.001$^s$ |
| $X_{23}$ | -0.1695 | -0.271 | 0.787$^{ns}$ | 0.664 | 2.509 | 0.014$^s$ |
| $X_{33}$ | 0.5887 | 1.042 | 0.300$^{ns}$ | 0.878 | 4.138 | 0.000$^s$ |
| $X_{43}$ | 0.2923 | 0.442 | 0.659$^{ns}$ | 0.722 | 2.610 | 0.010$^s$ |
| **User satisfaction variable** | | | | | | |
| $Y_{11}$ | 0.7052 | 2.699 | 0.008 | | | |
| $Y_{21}$ | 0.2913 | 1.043 | 0.299 | 0.669 | 4.735 | 0.000$^s$ |
| $Y_{31}$ | 0.2191 | 0.734 | 0.465 | 0.75 | 7.382 | 0.000$^s$ |
| $Y_{41}$ | 0.5383 | 2.307 | 0.023 | | | |

*s: significant; ns: not significant

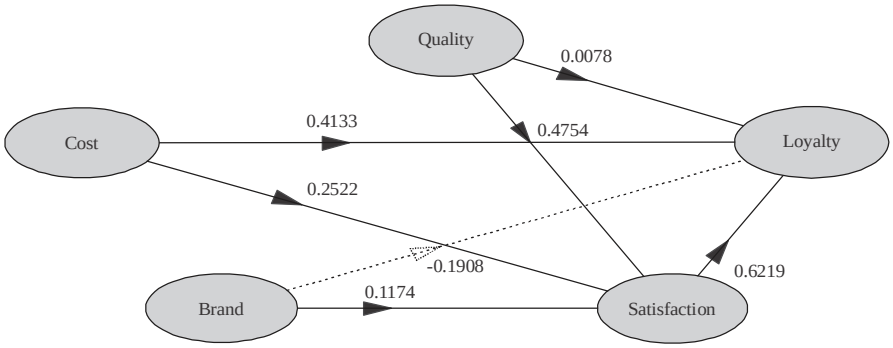


Fig. 1: The Inner model of PLS modeling in the public hospital in Malang

Table 5: The evaluation results of structural models

| Path direction | Path coefficient | t-statistic | p-values |
|---|---|---|---|
| Loyalty→Satisfaction | 0.475 | 5.74 | 0.000[s] |
| Cost→Satisfaction | 0.252 | 1.98 | 0.051[ns] |
| Image→Satisfaction | 0.117 | 0.92 | 0.360[ns] |
| Quality→Loyalty | 0.008 | 0.101 | 0.919[ns] |
| Cost→Loyalty | 0.413 | 3.97 | 0.000[s] |
| Image→Loyalty | -0.191 | -1.86 | 0.066[ns] |
| Satisfaction→Loyalty | 0.622 | 7.62 | 0.000[s] |

*s: significant, ns: not significant; The value of Satisfaction = 0,344; Loyalty = 0,585; Total = $Q^2$ = 0.7278

$$H_0 : \gamma_{11} = 0 \text{ vs } H_1 : \gamma_{11} \neq 0$$
$$H_0 : \gamma_{21} = 0 \text{ vs } H_1 : \gamma_{21} \neq 0$$
$$\vdots$$
$$H_0 : \gamma_{32} = 0 \text{ vs } H_1 : \gamma_{32} \neq 0$$
$$H_0 : \beta_{12} = 0 \text{ vs } H_1 : \beta_{12} \neq 0$$

Table 5 presents the significance level of the path coefficient and the value of the coefficient of determination.

Table 5 shows that all relationships among variables are not significant (with a significance level of 5%). The service quality variable significantly influences user satisfaction and perceptions of cost and user satisfaction significantly influence user loyalty. On the other hand, the variable perception of cost does not significantly influence user satisfaction and perception of the image does not significantly influence both user satisfaction and loyalty. Other evaluation results show that the value of R^2 of the user satisfaction and user loyalty variable is classified as a medium category. So, the diversity of user satisfaction can be quite explained by service quality, perception of cost and perception of image by 34.4%. The user loyalty variable can be sufficiently explained by the service quality, the perception of cost, the perception of image and the user satisfaction of 58.5%. In addition, the overall structural model has a Q^2 value of 0.7278. It means that the model can explain 72.78% of the phenomena related to user satisfaction and loyalty in the public hospital in Malang of Indonesia.

**The PLS of both inner and outer model:** The result of the analysis of the structural model uses the modeling PLS presented in Fig. 1-6.

Where:

$X_{11}$ = Tangibles
$X_{21}$ = Reliability
$X_{31}$ = Responsiveness
$X_{41}$ = Assurance
$X_{51}$ = Empathy
$X_{12}$ = Afford ability of maintenance costs
$X_{22}$ = Cheap maintenance costs
$X_{32}$ = Cost of services
$X_{42}$ = Cost compatibility with facilities
$X_{13}$ = Attribute Aspects
$X_{23}$ = Functional aspects
$X_{33}$ = Psychological aspects
$X_{43}$ = Holistic aspects
$Y_{11}$ = Access satisfaction
$Y_{21}$ = Quality satisfaction
$Y_{31}$ = Process satisfaction
$Y_{41}$ = System satisfaction
$Y_{12}$ = Commitment to stay treated
$Y_{22}$ = Accustomed to treatment
$Y_{32}$ = Pleasant to be handled
$Y_{42}$ = Satisfied with services
$Y_{52}$ = Provide recommendation
$Y_{62}$ = Have a positive impression
$Y_{72}$ = Loyalty for treatment

The equations of outer model formed is as follows:

$$Z_{Y22} = 0.77 \text{ Z.Loyalty}$$
$$Z_{Y32} = 0.52 \text{ Z.Loyalty}$$
$$Z_{Y42} = 0.72 \text{ Z.Loyalty}$$
$$Z_{Y52} = 0.72 \text{ Z.Loyalty}$$
$$Z_{Y62} = 0.68 \text{ Z.Loyalty}$$
$$Z_{Y72} = 0.59 \text{ Z.Loyalty}$$

$$\text{Z.Quality} = 0.88Z_{X11} + 0.26Z_{X21} + 0.39Z_{X31} + 0.4311Z_{X41} + 0.48Z_{X51}$$

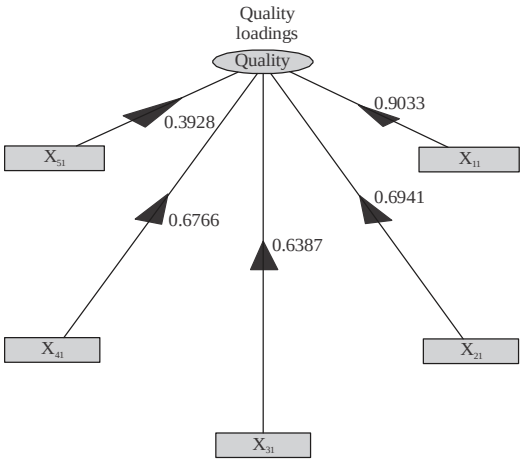


Fig. 2: Outer model of quality service Laten variable

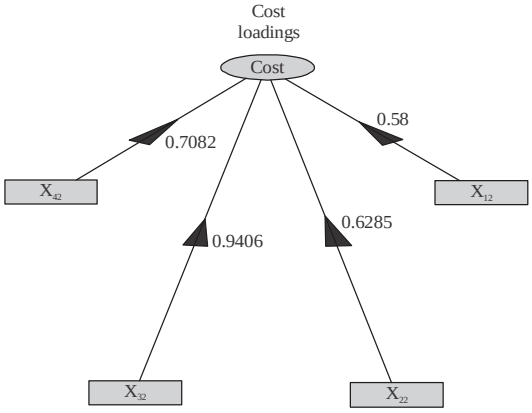


Fig. 3: Outer model of cost Laten variable

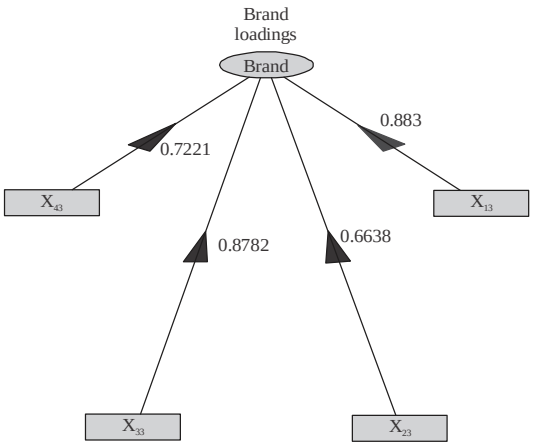


Fig. 4: Outer model of brand image Laten variable

$$Z.Cost = -0.06Z_{X12} + 0.13Z_{X22} + 0.91Z_{X32} + 0.47Z_{X42}$$

$$Z.Satisfaction = 0.71Z_{Y11} + 0.29Z_{Y21} - 0.22Z_{Y31} + 0.54Z_{Y41}$$

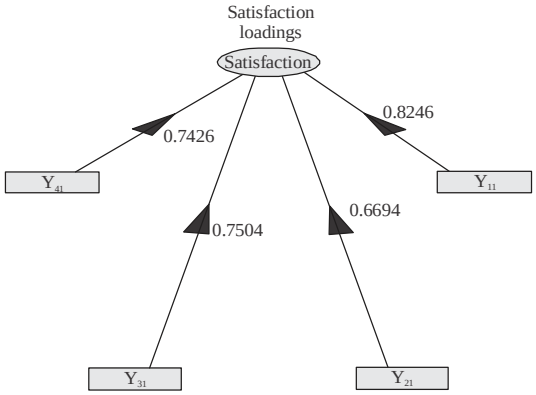


Fig. 5: Outer model of satisfaction Laten variable

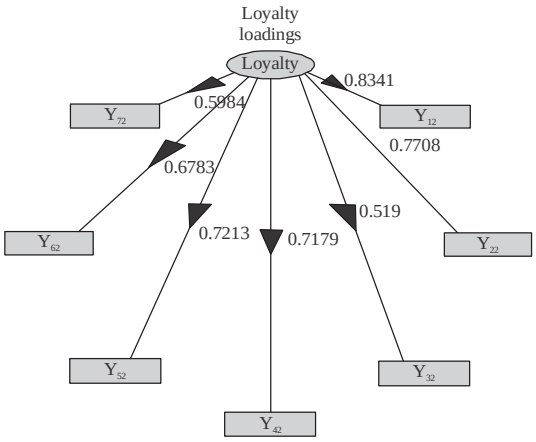


Fig. 6: Outer model of loyalty Laten variable

Table 6: The magnitude of direct, indirect and total effect of the variables

| | The effect of | | | |
|---|---|---|---|---|
| Path direction | Direct | Indirect | Total | Contribution (%) |
| Quality→Loyalty | 0.0078 | 0.296 | 0.318 | 0.1008 (10.08) |
| Cost→Loyalty | 0.4133 | 0.157 | 0.570 | 0.3249 (32.49) |
| Image→Loyalty | -0.1908 | 0.073 | -0.118 | 0.0139 (1.39) |

The equations of inner model (structural equation) formed is as follows:

$$Z.Satisfaction = 0.475\ Z.Quality + 0.252\ Z.Cost + 0.117\ Z.Image$$

In addition, Fig. 1 also shows that latent variables of service quality, perceptions of cost and perceptions of imagery have an indirect effect on loyalty. The magnitude of influence between variables is presented in Table 6.

Based on Table 6, it can be seen that the latent variable perception of cost has the highest absolute contribution to user loyalty with an absolute contribution of 0.3249. So, the perception of cost has the biggest effect on user loyalty with a contribution of 32.49%.

## CONCLUSION

The PLS Model obtained in the research can explain the relationship between latent variables. We get both the structural model and the measurement model. The direct effect of the cost perception, brand image and service quality on user satisfaction and user loyalty can be evaluated. The indirect effect of the cost perception, brand image and service quality on loyalty through user satisfaction can be evaluated too. The structural model of the PLS can explain phenomena related to user satisfaction and loyalty in the public hospital in Malang of Indonesia by 72.78%. In addition, the latent variable perception of cost has the greatest effect on user loyalty with an absolute contribution of 32.49%.

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