Design Improvement of Supply Chain Information System For Public Transportation Services (Case Study: Trans Jogja)

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Abstract. The development of increasingly rapid globalization influence on the development of transport flows in several regions in Indonesia, especially Yogyakarta province. Transportation activities refers to the movement of products from one location to another in the supply chain. In the transportation industry, the delivery of information and communication to consumers is an important factor in the supply chain cycle. Information and communication technology is integrated with the application form of the android system. The aim of this research is to design Android system technology to facilitate passengers as consumers in knowing the information required to use transportation services Trans Jogja. Several methods will be used to implement the research's goal are method of prototyping, Kano model, method of Quality Function Development (QFD), and Morphological Chart. Methods will produce the design attributes and priority specifications of the design technology designed android system. Design attributes tailored to the needs of consumers through the voice of customer that will be integrated with the technical response in QFD. The technical response will give priority aspects of designing the android system technology and will be forwarded to the determination of specifications through Morphological Chart. The determination of these specifications produces an android system design technology that has been adapted to the needs of consumers who influence the supply chain management of transportation services Trans Jogja. In conclusion, the Android system technology that already designed is accessible to all consumers and improve the quality of a public transport service.

Keywords: Trans Jogja, Android, Information Technology, Supply Chain Management.

1. Introduction

The development of increasingly rapid globalization influence on the development of transport flows in several regions in Indonesia. One of the regions which has strong magnet and stimulate the public transportation is Yogyakarta, because it is one of the most favorite travel destination. Data from The Tourism Department of the province shows that the tourist arrivals in 2010

has been increased by 8% to 12% from the local and international tourists.

According to Soesilowati (2008), the increasing number of tourist arrivals in Yogyakarta triggers the traffic density and results the traffic jam as the national economic growth continues to rise, especially in the Sleman Regency (Udjianto, 2007). From the study of transportation experts traffic jam in the province has entered the alert threshold, it is because the number of passing vehicles are not comparable with the carrying capacity of existing roads (Basuki and Siswadi, 2009). For example, the Gejayan Street in the Sleman Regency has economic costs caused by the traffic light jam in amount of Rp. 11,282,482.21 per hour, this is a serious impact on the accumulation of huge economic losses in a regional area.

In 2008, the Yogyakarta provincial government launched a public transportation named Trans Jogja Bus, but the bus is not yet got a good impression of the users (Maryatmo and Suryadharma, 2011). According to Elka (2010), Trans Jogja got the low impression was shown by the low load factor score, which is only 45.95%, it is far from the government standard which is 70%. Also the maximum average speed is 21.02 km/hour, which is below the government standard which is 35 km/hour. The number of buses on each route path was also experiencing a shortage.

Hapsari and Mansur (2015) examined why people are reluctant to use the Trans Jogja bus, and some of the reasons were because Trans Jogja is not free from the traffic jam, route changes have not been communicated, the time gap between the buses is sometimes uncertain, and also the number of buses and stops are still limited. Some problems were also caused by the dynamic nature of the environment, such as passenger inequality between lines, changes in the level of passengers that are based on changes in hours and days, changes to bus routes for their closures by the Department of Transportation for the designation of cultural attractions, and so forth. It required the disclosure of information to all stakeholders so that passengers can predict the travel time, then the management can make a form of information about arrivals and departures, movement corridors and terminals, car bus arrival time, bus stops will be skipped, and car travel disruption bus. Developments in information technology and modern organizational approaches can help overcoming the problems of Trans Jogja bus service improvement. Research by Susetyo, Suprayogi, and Awaluddin (2012) about the making Applications of Trans Jogja Bus Route Map-Based Mobile GIS (Geographic Information System) using Android Smartphone, nevertheless this research has not integrated the needs of passengers with the bus operators and all stakeholders that result in the service sector is still less to serve the needs of all stakeholders related to the trans jogja bus.

Based on the definition of service, according to Ratminto and Winarsi (2005), it is products that are invisible (intangible) that involves human efforts and use the equipment. Grönroos (1990) service is an activity or series of invisible (intangible) that occur due to the interaction between customers and employees. Services are various actions or performance offered by one party to another that basically cannot see and do not generate property rights against anything. Production could refer to a physical product or not. According to Peter (2003), service is an activity or series of activity of a more or less intangible nature that normally, take place in the interaction between the customer and service employees and/or physical resources or good and or systems of the service provider, which are provided as solutions to customer problems.

GIS-based service system with android interaction begins with the overall system design services use the Kano model. According to Kano, Seraku, Takahashi, and Tsuji (1984) the Kano model is a theoretical model which links the requirements met by the products or services with customer satisfaction and identify three types of needs that can affect the highest customer satisfaction, i.e. must be requirement, one dimensional requirement, dan attractive requirement. The final results of the Kano model are questions that can be understood correctly (Hauser and Clausing, 1988); while Reverse Requirement (R) indicates that there is feature on products or service unwanted by customers and that they really expect it otherwise (Sauerwein, 1996). The next method after applying the Kano model is the Quality Function Deployment (QFD) which is a structured method that is used in the design and product development to establish specifications of the needs and desires of consumers, as well as the capability to systematically evaluate products and services to meet the needs and desires of consumers (Akao, 1988). QFD is a planning tool that focuses on project product or service quality by combining the needs of consumers. The given concept is the planning process, not as a tool for troubleshooting or analysis through the product planning, part planning, process planning, and production planning (Tjiptono and Diana, 2003). According to Cohen (2005), preparation of a matrix consists of a technical response, planning matrix, customer needs and benefits, relationships, and technical correlation. The last step is the Morphological Chart which is a list or summary of the systematic

analysis of shape changes to determine how the shape of a service product made (Yuliarty, 2013).

Previous studies on the GIS system based on Android has been conducted a lot. The first example is the research by Yulismatun and Singgih (2012) titled "Development of the Integrated Model of Kano-QFD to Optimize Customers' Satisfaction". This research resulted in development cost savings associated with the unimportant satisfaction items. The second example is research by Rifa'i (2009) titled "Graph Application of Land Transportation System in Yogyakarta (Case Study: Trans Jogja Buses in Route 3A)" which determined the shortest route of the Trans Jogja buses in route 3A by using the Graph application. The third is research by Mohamad Saiful Izwaan bin Saadon (2012) titled "The Effectiveness Of Integrating Kano Model and Servqual Into Quality Function Deployment For Developing Training Course Model" which measured the training and development using the Kirkpatrick evaluation model to determine the effectiveness of training programs. The fourth is research by Luqman (2014) titled "Dynamic Program Application for Long Distance Transportation Route Selection" to know which route has the least time or costs. The fifth is research by Niko, Rosnani, and Ukurta (2014) titled "Customers Satisfaction Using Integration of Kano and Quality Function Deployment" to help the company correctly understanding the voice of customers. The last example is research by Gumelar and Udjulawa (2014) titled "Android-Based Transportation Information System on PT. Sarana Pembangunan Jaya, Palembang" which resulted an android-based transportation information system of the Trans Musi that can help the society in getting the corridor information as well as the bus stops in each corridor, mileage to the stop destination from the customers' position, searching the closest stop to the destination point, and also the recommendation for the application to be developed more complex to update the Trans Musi information.

Based on those backgrounds, this research is conducted to build a working system that can provide solutions in upgrading the quality of services, such as simplifying the passenger in knowing the location of the awaited bus, finding out the bus route condition, and estimating the time of buses' arrival to minimize the waiting time, so it can increase the public interest in using Trans Jogja as public transportation while the Trans Jogja's management can maintain the routes as well as the dynamic scheduling automatically and optimally. The aim of this research is to design Android system technology to facilitate passengers as consumers in knowing the information required to use transportation services Trans Jogja using the integration of Kano, QFD, and Morphological Chart models.

2. Methods

2.1 Research Object

The object of this research is the information service system of the Trans Jogja. Trans Jogja is a fast, affordable, and air-conditioned bus as a public transportation system in Yogyakarta, Indonesia. Trans Jogja is part of the Bus Rapid Transit (BRT) application program launched by the Department of Transportation, Communication and Informatics of Yogyakarta provincial government.

2.2 Research Data

Data for this research consist of primary and secondary data. Primary data is a collection of facts obtained through research directly from the field. To simplify the implementation, the primary data collection includes the information system applied by the Trans Jogja management, the data of the customers' desire to service quality, general and specific information about the Trans Jogja, comparisons between the functioning or not functioning aspects for the customer, and the interest rate of the customers' desires. While secondary data was obtained from the collection of literacy from different parties or institutions that have correlation links including the literature study such as books, websites, articles, journals, thesis as well as the reports of previous studies associated with the object to support this research.

2.3 Research Respondents and Total Sample

In this study, there are two types of respondents i.e. the respondents in data collection using the interview method of discussion include representatives of the Trans Jogja UPTD Dishubkominfo Yogyakarta and survey respondents are trans jogja users with the age category of 17-25 years old (late teens), 26-35 years old (early adults), 36-45 years old (late adults) and 46-55 years old (early elderly). Total sample of this study had the reliability of 90%, the degree of accuracy (α) of 10% and a sampling error of 10%.

2.4 Questionnaires

This research used five questionnaires: 1) open questionnaire (customer voice), 2) questionnaire-level decision to open questionnaire, 3) questionnaire of functional and dysfunctional as an input to the processing model of Kano, 4) questionnaire to determine the level of interest in each attribute in designing the information system services as customer input on QFD, 5) questionnaire related in determining the design specifications that

have been formulated in Morphological Chart. The scale used in the questionnaire assessment is Likert scale. Likert scale is generally used to measure attitudes, opinions and perceptions of a person or a group of social phenomenon (Sugiyono, 2010).

2.5 Data Processing of The Kano dan HOQ Models

The data processing of this research used several stages which consist of: 1) Validity test by comparing the value of R table and R arithmetic, (2) Reliability test by comparing the Cronbach alpha of measured results, 3) Kano model categorizing by looking at the frequency response on the questionnaire, then import them to the evaluation table, and Kano model's requirements calculation with the attributes of customer satisfaction, 4) Arranging the house of quality, including the determination of the importance rating attributes, technical response, relationship matrix, the technical response correlation matrix, and the technical priorities.

2.6 Design Specification Selection Using The Morphological Chart

Morphological Chart in this research splits design through its function and means. Function will be an extension of the technical response based on the function you want to display, while the means will make some design specifications choices for each function available. Determination of the function and means was done by conducting interviews and discussions with one of the stakeholders of this research, i.e. Departments of Transportation, Communication, and Informatics of Yogyakarta. The next step is distributing questionnaires to the Trans Jogja users to choose one of the means' several design specifications which exist in each function. The chosen means at each function will be a reference in making the design of Trans Jogja information services system.

3. Results and Discussions

3.1 Number of Questionnaires and Trans Jogja Buses

The number of questionnaires distributed was 70 for the passengers of Trans Jogja at seven bus stops that have been set as the research objects. The passengers chosen were the ones who used Trans Jogja at least once. The number of buses used in the transportation service can be seen below:

Table 3.1 Number of Buses in Each Route

Route	Number of Buses	Kilometer/session (Km)
1A	12	36.065
2A	8	31.874
1B	10	31.348
2B	9	32.706
3A	11	38.908
3B	9	36.972
4A	4	15.278
4B	4	20.993

3.2 Determination of the System Design Attributes

The attributes determination was done by distributing the questionnaires to the respondents and they were asked to fill out the questionnaire as the Android-based information system design. The results of the open questionnaire are: 1) attractive color design, 2) various features, 3) the application's responsiveness, 4) congruity of the usage function, 5) ease of use, 6) time endurance of the application usage, 7) availability of information needed, 8) the system does not error when used, 9) development of advanced applications, 10) availability of the buses' route, 11) availability of the scheduled bus arrival, 12) interesting application design, 13) information of the buses' travel time, 14) traffic conditions passed, 15) data of the Trans Jogja bus stops, 16) the awaited bus locations, 17) mileage information from stop to stop, 18) congruence application menu, 19) easy application button to use, and 20) bus route choice information.

3.3 Validity Test

The validity test is how far the precision and accuracy of measuring instruments in conducting the measuring function (Yamin & Kurniawan, 2009). Validity test of the 20 attributes has a range of 0.400 – 0.700. The value is far above the value of the r tables so test the validity of this research is very valid.

3.4 Reliability

Reliability test was conducted using the SPSS 21.0 software and the result was shown by the Cronbach's Alpha in the amount of 0.908. This value is considered as a reliability coefficient with a very high correlation, so the statements in the questionnaire of this research were very good and reliable.

3.5 Kano Model Evaluation

Kano evaluation was used on the results of the functional and dysfunctional questionnaires distribution. The calculation results were used to determine the category of Kano on each attribute using the Blauth's formula. Category of Must Be (M) is the basic need that must be met by the developer, thus if the attributes are not met then the customer will not be satisfied. Category of Attractive (A) indicates that if the attributes are not

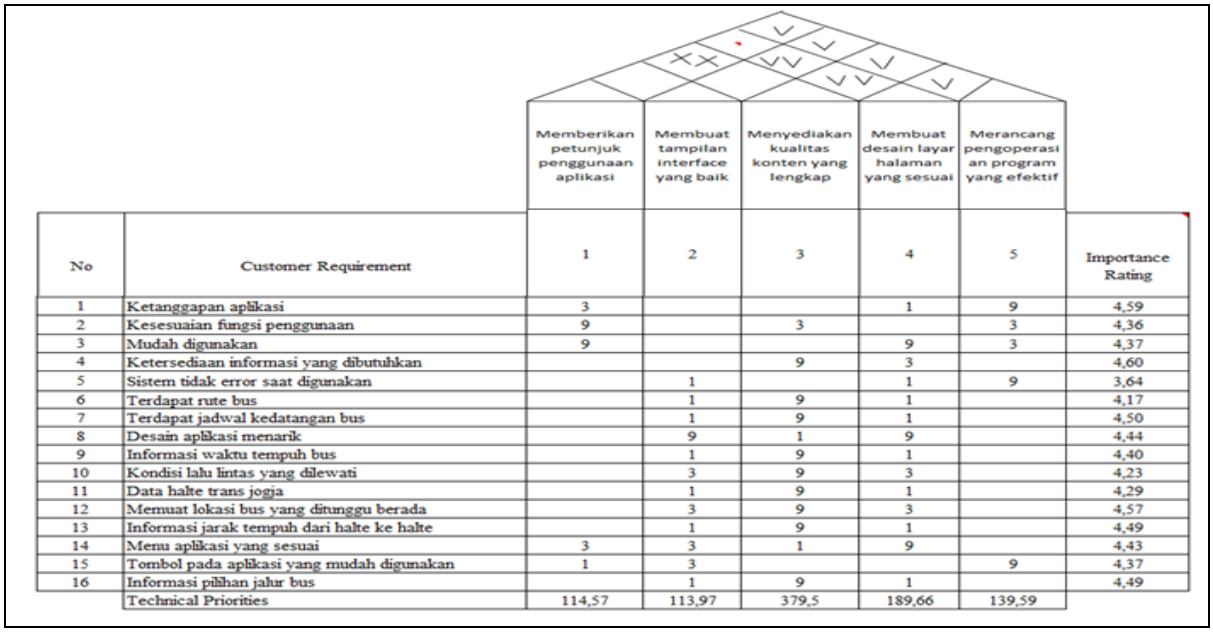
met then it will not cause a decrease in the level of satisfaction. The final categorizing results of the Kano model on each attribute are as follows:

Table 3.2 Last Attributes of the System Design

No	Attribute	Category
1	Application's responsiveness	M
2	Congruity of the usage function	M
3	Ease of use	A
4	Availability of information needed	A
5	The system does not error when used	M
6	Availability of the buses' route	A
7	Availability of the scheduled bus arrival	M
8	Interesting application design	M
9	Information of the buses' travel time	A
10	Traffic conditions passed	A
11	Data of the Trans Jogja bus stops	M
12	The awaited bus locations	M
13	Mileage information from stop to stop	M
14	Congruence application menu	M
15	Easy application button to use	M
16	Bus route choice information	M

3.6 House Of Quality (HOQ) Development

Quality Function Deployment systematically translates the customer voice to a technical requirements used as an advanced stage of the process, then it documents and describes the translation in the form of a matrix on House Of Quality.



No	Customer Requirement	Memberikan petunjuk penggunaan aplikasi (1)	Membuat tampilan interface yang baik (2)	Menyediakan kualitas konten yang lengkap (3)	Membuat desain layar halaman yang sesuai (4)	Merancang pengoperasian program yang efektif (5)	Importance Rating
1	Ketanggapan aplikasi	3			1	9	4,59
2	Kesesuaian fungsi penggunaan	9		3		3	4,36
3	Mudah digunakan	9			9	3	4,37
4	Ketersediaan informasi yang dibutuhkan			9	3		4,60
5	Sistem tidak error saat digunakan		1		1	9	3,64
6	Terdapat rute bus		1	9	1		4,17
7	Terdapat jadwal kedatangan bus		1	9	1		4,50
8	Desain aplikasi menarik		9	1	9		4,44
9	Informasi waktu tempuh bus		1	9	1		4,40
10	Kondisi lalu lintas yang dilewati		3	9	3		4,23
11	Data halte trans jogja		1	9	1		4,29
12	Memuat lokasi bus yang ditunggu berada		3	9	3		4,57
13	Informasi jarak tempuh dari halte ke halte		1	9	1		4,49
14	Menu aplikasi yang sesuai	3	3	1	9		4,43
15	Tombol pada aplikasi yang mudah digunakan	1	3			9	4,37
16	Informasi pilihan jalur bus		1	9	1		4,49
	Technical Priorities	114,57	113,97	379,5	189,66	139,59	

Picture 3.1 House of Quality (HOQ)

3.7 Morphological Chart

Morphological Chart is the advanced stage in the design of an information service system customized with technical response. Technical response that has been priority determined followed by more detailed Morphological Chart. Lastly, the technical response will be broken down structurally to determine the specifications of the design.

Table 3.3 Morphological Chart Final Results

No	Function	Means
1	Provide appropriate content of the page	Information as the passengers needs
2	Display the options menu on the main page	4 selection menu
3	Provide the options menu layout design	Center
4	Select menu size	Medium
5	Create account for users	No need
6	Provide switchover time choice between the opening page with the main menu page	3 seconds
7	Provide feature regarding the usage information	Help menu

No	Function	Means
8	Provide coloring on each page	Full color
9	Provide dominant color of the design	Yellow
10	Display page visual design	Texts and pictures

4. Conclusion

From the Kano model application, it can be concluded that there are 11 attributes in the Must Be (M) category, i.e.: 1) the application's responsiveness, 2) congruity of the usage function, 3) the system does not error when used, 4) availability of the scheduled bus arrival, 5) interesting application design, 6) data of the Trans Jogja bus stops, 7) the awaited bus locations, 8) mileage information from stop to stop, 9) congruence application menu, 10) easy application button to use, and 11) bus route choice information. The HOQ range score of the lowest importance rating is the application's responsiveness with score of 4.59. While from the Morphological Chart, it can be concluded that the application system design should be able to provide appropriate content of the page in the form of information as the passengers' needs, display the options menu on the main page with 4 selection menu, provide the options menu layout design in the center, select menu size in medium size, no need to create accounts for users, provide switchover time choice between the opening page with the main menu page for 3 seconds, provide feature regarding the usage information in help menu, provide full color in each page, provide the dominant color of the design in yellow, also display page visual design in texts and pictures.

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