Business Intelligence System Model Proposals to Improve the Quality of Service at PT GIA

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ABSTRACT

PT. GIA is an Indonesian national airline serving both domestic and international flights. The object of this study is the flight from Jakarta to Surabaya. The average level of customer satisfaction was in the satisfied level with the value of 55.64%. The methods in this research are business intelligence, unified modeling language (UML), Extract Transform Loading (ETL). Data Warehousing and data mining. The study is started by identifying the attributes of the service by using interviews through questionnaires and the received average Gap Score the on flights Jakarta - Surabaya amounted to -0.215. Subsequently from the Kano Model, 9 attributes were classified to Must Be, 6 attribute to performance and 7 attributes to delighter. The House of Quality was prepared with the problem of communication with consumers as the conclusions of the most dominant factor. In this research flights Jakarta - Surabaya based on data mining using bayes method be concluded that the level of satisfaction of the service provided to the respondent companies are at the level of satisfied. The role of business intelligence systems in this study was to enhance customer satisfaction and to develop decision support tools to improve customer satisfaction by the service provided.
Keywords: Business Intelligence (BI), Service Quality, Data Mining.

1. INTRODUCTION

Background

PT. GIA is a national airline of Indonesia which serves domestic and international flights. The aviation industry especially commercial-scheduled flight has developed very rapidly since the issue of air transport regulation in 1999 which consisted of deregulation packages. One of these regulations is Ministry Decree No. 81, 2004 regarding airline establishment in Indonesia. Increasing number of airlines which operate in Indonesia leads to a tight competition. Though the price of fuel is rising, the national aviation industry is growing too fast.

The development of the airline services from year to year has attracted the attention from people. This can be seen from the intense competition of services, pricing and promotions offered by various airlines. Furthermore, the attractiveness of aviation industry is quite large and promising. Giving a large number of the airlines, PT.GIA tries to maintain rates by adjusting the maximum service quality for international and domestic flights which has been acknowledged by all users of aviation services facility.

In terms of market size, airline industry is quite interesting because more than 3.6 million passengers use airline service every day. Thus, the market size is large enough. In addition, the demand for air transport is very possible for an increase above the amount, especially during the peak season such as school and college holidays, religious holidays or a particular season / weekday (low season). Today, marketing activities are an integrated process which focuses on the customer. Surveys on customer satisfaction are essential to improve and enhance the internal performance of the services concerned. Data from the surveys can encourage the management of PT.GIA to understand customer behavior so that it can be used as an important source to develop customer relationship management (CRM). Every company, whether engaged in the service and non-service, requires a strategy in conducting business activities which would put the company in the best position to able to compete and to grow by optimizing all

potential resources owned (Sitepu, 2005). Marketing in the aviation service industry is a process of adjustment between passenger demand at this time, the potential demand, future demand for, and supply of the airlines (Natalisa, 2005).

Problem Formulation

PT.GIA is an airline which serves both domestic and international flights and is facing competition in flight services business. In order to be competitive, the company has to meet a number of criteria, one of which is the dynamic nature of customer satisfaction which is strongly influenced by the level of progress in the telecommunication and information technology. The level of customer satisfaction within the aviation world is affected by many factors, but mostly punctuality. Based on the historical data of PT. GIA, on time performance (OTP) from the last few years decreased starting in 2011 and 2013 with an average reduction of 0.85% OTP. Meanwhile, in the following year in 2014 there was an increase, but it declined again based on the history data in 2015 compared to the previous year by 0.8%.

Research purposes

The purpose of this research includes:

1. Knowing the level of customer satisfaction of the GIA
2. Identifying the actions performed by PT.GIA on business intelligence systems to meet customer needs
3. Providing analysis and design of the business intelligence systems repair services using the approach flight with Unified Modeling Language (UML)
4. Proposing a model business intelligence system for PT. GIA in terms of customer relationship management (CRM)

2. LITERATURE

Business Intelligence

Business Intelligence (BI) can defined as all capital excavation businesses to benefit from the available data, both scattered on different systems and integrated into a centralized storage area (Yulianton, 2008). The function of Business Intelligence is a decision support system where the system and this application modify the data in the organization (operating data, transactional data, or other data) into forms of knowledge with the aim in general which serves a variety of information tailored to the needs of each user (Imelda, 2013).

Data Warehouse

Data Warehouse involves the process of extracting, cleaning, unification, and delivery of data storage to multidimensional and supported and implemented by the *query* and used for decision-making purposes (Kimball & Caserta, 2004).

Data warehouse transaction is also separates analysis of workload from workload and allows an organization to merge / consolidate data from various sources.(Inmon, 2002).

KANO MODEL

Kano Model is a model aimed to categorize attributes of a product or service based on how well the product or service satisfy the needs of customers. The model was developed by Dr.Noriaki Kano. He divided three categories of the desired product which could affect customer satisfaction (Sauerwein et. Al, 1996), namely: must be, one dimensional, attractive.

Quality Function Deployment (QFD) is a structured method of planning and development in which enables the development team to define customer needs and expectations clearly, and to evaluate the ability of a product or service through a systematic method to meet the needs and expectations (Ariani, 2002). According to Subagyo in Marimin 2004, Quality Function Deployment is a way to improve the quality of goods or services by understanding the needs of consumers, and then connect it with the technical provisions to produce goods or provide services for the each stage. QFD is used to improve understanding of the customer and to develop products, services and processes in a more

customer-oriented method (Rampersad, 2006).

SERVQUAL *(Service Quality)*

SERVQUAL method is formulated based on the comparison of two main factors, namely the customer's perception on an actual service they received (perceived service) and the actual services expected by customers (expected service). If the reality is better than the customer's expectation, the service can be said to be of top quality, whereas if worse than the customer's expectation, the service is said to be satisfactory. Thus, this SERVQUAL method defines service quality as how far the difference between reality and expectations for customer service received (Parasuraman.et.al.,1990).

Unified Modeling Language (UML)

Unified Modeling Language (UML) is a form of language, which is according to its founders UML a visual language to explain, give specifications, design, make a model, and to document aspects of a system (Nugroho, 2004). Meanwhile, according to Munawar (2005: 45), UML is a very powerful tool in the object-oriented system development. Using UML models, all types of software applications can be created, where the application can run on any hardware, operating system and any network, and can be written in any programming language. Data mining is a semi-automatic process which uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify potential knowledge and useful information stored in the large databases (Turban et al, 2005). According to Gartner Group, data mining is a process of finding meaningful relationships, patterns, and trends by checking a large set of data stored in the storage using pattern recognition techniques such as statistical and mathematical techniques (Larose, 2006).

3. RESEARCH METHOD

The methods used in this research include System Development Business intelligence, Data Mining and Integration of Quality Function Deployment (QFD), Service Quality, and Kano Model. In addition to these methods, this research also used House of Quality to determine the priority of the proposed improvements which can be used to solve the problems facing the company in the flight Jakarta - Surabaya.

The stages of primary data collection in this research involved distributing questionnaires to customers on the flight Jakarta – Surabaya and conducting interviews with the authorities of customer insight division at PT. GIA to investigate customer satisfaction and customer service. The data obtained consisted of a questionnaire on flights Jakarta - Surabaya, attributes of services provided, and voice customers on flights Jakarta - Surabaya.

The secondary data was obtained from the data collection phase consisting of common company's data such as the company's history, vision and mission of the company, the power fleet, organizational structure both organizational structure and organization which was directly involved in the issues of customer satisfaction. The data was obtained from the company and has been approved.

Gap Score obtained from a difference of the satisfaction score and importance score. From Table 2 the *Gap Score* are obtained in negative score (-), because the satisfaction score is smaller than the importance score.

4. RESULTS AND DISCUSSION

Calculation Process of *Adjusted Importance*

In creating the House of Quality (HoQ) will using data that related to customer requirement which is the attribute of aviation service Jakarta – Surabaya and

technical response from management. The attribute service is incorporation between the Servqual method and the Kano Model. Therefore, it is necessary to adjust the importance level (Adjusted Importance) of attribute service before will be integrated into House of Quality, so that be required the calculation of adjusted importance score from that attribute services. The first step is calculate the adjusted importance score of attribute. Here are the steps on the calculation of Adjusted Importance :

1. Calculate the Satisfaction Score
   Satisfaction score are searched by using the calculation formula :

Satisfaction score = Gap Score x Importance Level.....(1)

2. After the Satisfaction Score are known, the next step is calculated the Adjusted Importance, using by this formula :

Adjusted Importance = Satisfaction Score x Kano Category.....(2)

The following categories :

- Attribute with Delighter categorie will get weight 4
- Attribute with Performance categorie will get weight 2
- Attribute with Must Be categorie will get weight 1

Integration Process of Quality Function Model

In figure 1, there is House of Quality for flight Jakarta – Surabaya. Creating this House of Quality are doing with combining the previous calculation result. A relationship of technical response and attribute service are given to House of Quality is located at the center, while the upper part contains information about a relationship in any technical response. While at the bottom part containing a number, that column is the result of multiplying a number of weight relationship with adjusted importance score. While in the column below shows a percentage of total amount. On the result, it can be seen which a technical response can be used to improve customer satisfaction on flight from Jakarta – Surabaya, airline management capabilities into the solution for addressing issues of customers satisfaction, with a percentage of 13.65%.

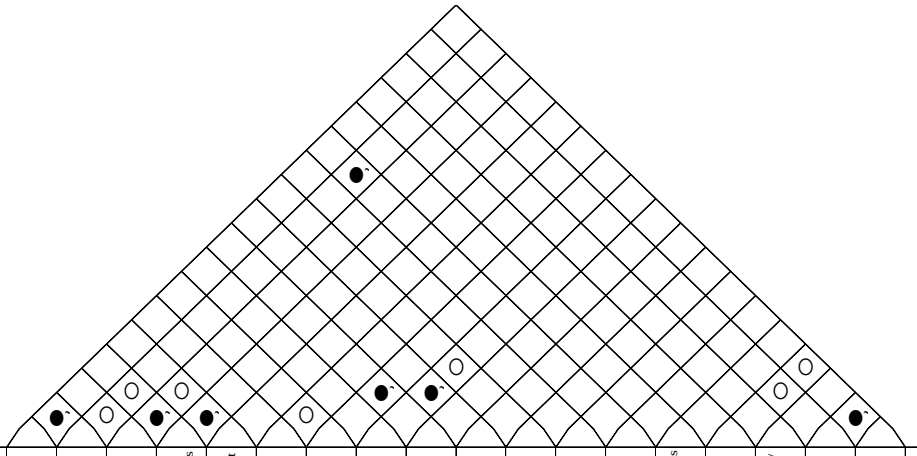
Process of Mining Data

At this stage, several stages of calculation, the initial stage is the prior probability calculation on customer satisfaction data.

$$Prior\ Probability = \frac{x_i}{\sum_{i=1}^{n} x} \text{ .....(3)}$$

Table 1. Prior Probability On Jakarta – Surabaya Flight

Classification	Count	Probability Prior
Very satisfied	52	0,390977444
Satisfied	74	0,556390977
Neutral	6	0,045112782
Not satisfied	0	0
Very not satisfied	1	0,007518797
Total	133	1



	Customer Importance	*Kano Category*	*Importance Level*	Room Cleanliness	Rooms Condition	Conditions Physical Form	The Frequency of Maintanance Airline Facilities	Airline Facilities Improvment	Scheduling Management System	Airline Management Capabilities	The Effectiveness of Talk	Staff Service Excellence	The Effectiveness of Communicate	Improvements Behavior Airline Staff	Number of Airline Staff	Availability of The Modern Facilities of Airlines	Cooperation With Distributors Newspaper / Magazine	Replacement Food Menus	Cooking Ability Stewardess / Steward	Cooperation With The Food Distributor	Food Material	Perfoamnce Goal
Development Direction				↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	
Website Service	4,511	Perfomance	1,15				○		○	○												5
Contact Center Service	4,477	Must Be	1,05								●		●	○	●							5
Sales Office Service	4,365	Must Be	0,55	●	●		△			○			●	○	○							5
Check-in Service	4,633	Must Be	1,23										●									5
Self Service Check-in	4,410	Delighter	1,23				○		○			△	△	△	△	○						5
Costomer Service	4,506	Delighter	1,01	●	●						●	●	●									5
Executive Lounge	4,397	Delighter	1,08	●	●	●		●	△			○		●			○	●	●	○	●	5
Boarding Management	4,562	Perfomance	1,83							●	○		△									5
On Time Perfomance	4,739	Must Be	2,57				○		●	●	△	△	○									5
Cabin Crew Service	4,752	Perfomance	0,51	○	○						○	●	●	●	○							5
Cabin Condition	4,673	Delighter	0,70	●	●	●	●	○	△							○						5
Seat Comfort	4,664	Must Be	1,21			●	●	○		△	△											5
Lavatory	4,618	Perfomance	1,20	○				○					△			△						5
Food & Beverage	4,543	Must Be	1,16				△				△							●	○	●	●	5
In Flight Entertainment	4,445	Must Be	0,81			○	○	○		△				△		●						5
Reading Material	4,331	Perfomance	0,27								△			△			●					5
Cabin Amenity	4,329	Must Be	0,30				△			△												5
In Flight Sales	3,840	Delighter	0,97					△												○		5
Baggage	4,581	Must Be	1,66				△	○		○												5
Garuda Frequent Flyer	4,483	Delighter	1,10	△						●		●			△							5
Delay Management	4,526	Perfomance	2,45						●	●	●		●		△							5
Service Recovery	4,517	Delighter	1,53	△	△					●	●		●		△							5
Total				125,85	114,23	77,28	71,39	69,40	96,01	210,80	164,50	105,39	188,80	59,12	34,51	32,80	17,88	49,31	42,38	34,99	49,31	
Percentage				8,15%	7,40%	5,01%	4,62%	4,49%	6,22%	13,65%	10,65%	6,83%	12,23%	3,83%	2,24%	2,12%	1,16%	3,19%	2,74%	2,27%	3,19%	
The order of priority				4	5	8	9	10	7	1	3	6	2	11	16	17	18	12	14	15	13	

Figure 1. House of Quality (HoQ) On Jakarta – Surabaya Flight

The next stage after obtaining prior probability is obtaining probability of getting the interaction between each attribute with classification. Attribute interaction probability with classification. After obtained interaction probability of each attribute with classification, the next stage in classification used of Bayes method is to calculate P (At|K) or known as probability of attribute interaction with classification. P (At|K) is found by multiplying interaction probability to classification of respondents.

$$\mathrm{P\ (At|K)} = \mathrm{P\ (At|K)}_{1}\ \mathrm{x\ P\ (At|K)}_{2}\ \mathrm{x\ \ldots .x\ P\ (At|K)}_{n} \quad \text{.....(4)}$$

After calculation of P (K) P (At | K). Calculation by means of multiplication a prior probability of classification with interaction probability that has been obtained.

Next calculate the posterior probability, posterior probability can be obtained in the following manner:

$$Posterior\ Probability = \frac{\mathrm{P(K)\ P(At|K)}}{P\ (T)} \quad \text{.....(5)}$$

Posterior probabilities are calculated on all the possibilities that come from customers.

Table 2. Summary of Posterior Probability On Flight Jakarta – Surabaya

Classification	**Probability Prior**	**Probability Posterior**
Very satisfied	0,390977444	0,000926908
Satisfied	0,556390977	0,068565567
Neutral	0,045112782	4,07E-19
Not satisfied	0	0
Very not satisfied	0,007518797	8,46E-10

Prior probability is the probability has been obtained from preliminary data of this research, while the posterior probability is a probability that has been repaired after obtaining additional information or after doing research.

Conclusion on the Bayes method using the posterior probability of data results in a way to see the results of posterior probabilities. Conclusions drawn at the time of highest posterior probability values in classification or can be formulated as follows:

$$h_{MAP} = arg\ max\ P(x|h)\ P(h) \quad \text{.....(6)}$$

In this research flights Jakarta - Surabaya based on table 2 can be concluded that the level of satisfaction of the service provided to the respondent companies are at the level of satisfaction.

Process of Business Intelligence Systems

Business intelligence systems architecture model proposed in this research can be seen in Image 2. Consists of two modeling is modeling quality and CRM, then extracted, transformation and loading is made into a meta data repository which is the creation of new data warehouse.

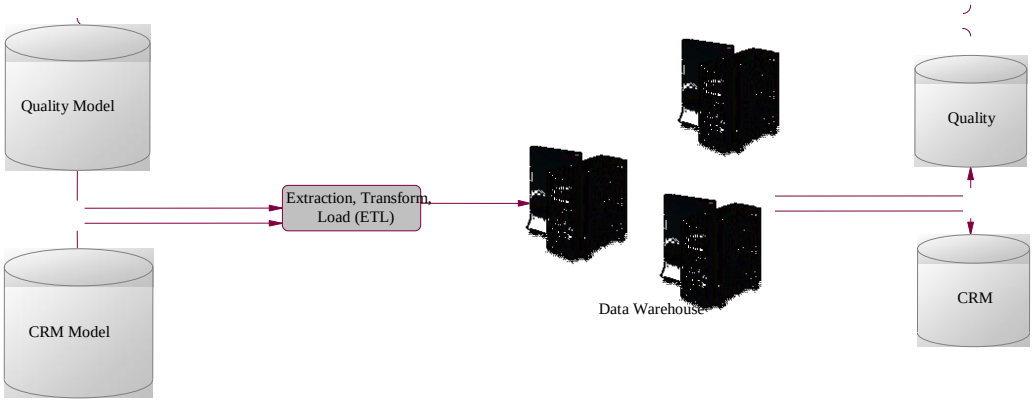


Figure 2. Proposed Business Intelligence Systems

Process of Class Diagram

Figure 5 is a class diagram quality modeling. On the quality class there are flight integer number, the average number of each attribute float, the servqual of each attribute float, Kano models, technical requirements, a relationship of attributes with technical requirements, and the importance level of a string type attribute.

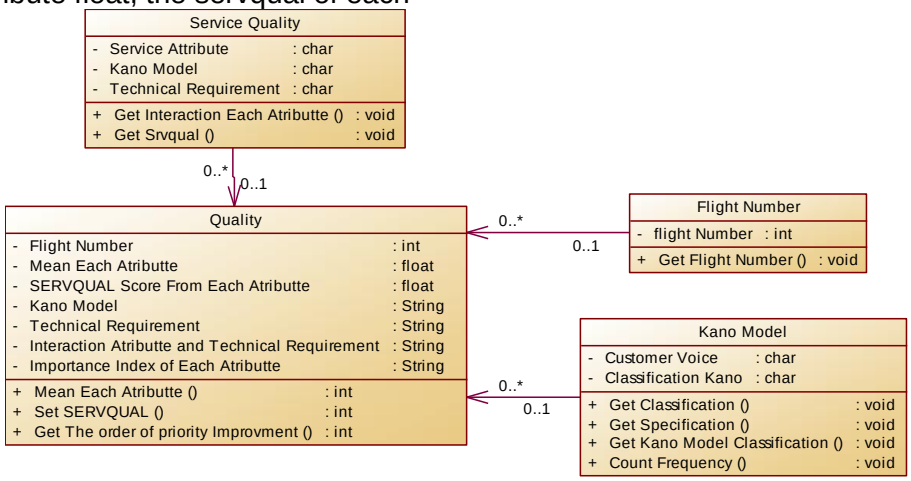


Figure 3. Class Diagram Quality Modeling

Process of Database

The data warehouse is a set of extracted data from multiple operating systems that has been transformed and load consistent data for analysis. The data warehouse is making into the planning stage in business intelligence system. In this research, the data warehouse is using sqlyog software as a research database.

Process of Extraction, Transfrom, and Load (ETL)

In a business intelligence system in the Figure 4 is using transformation data on pentaho, which is the result of the system would produce database on sqlyog with transformed data. It can be seen in the Figure 4 that the input data required is a customer's comment, and the database that contained a meaning information of each is used code.

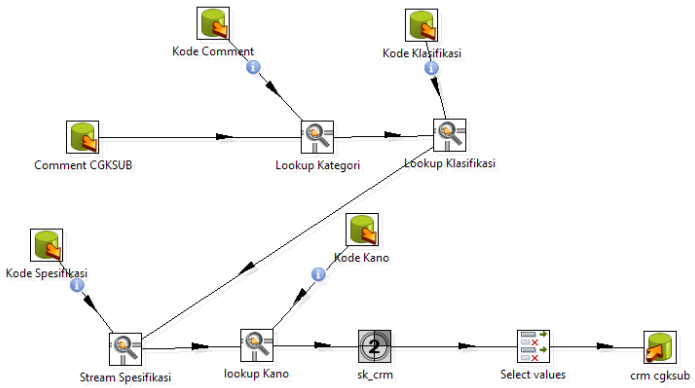


Figure 4. CRM Modeling On Flight Jakarta – Surabaya

3. CONCLUSION

1. The measures which were taken by PT.GIA to meet customer needs included room cleanliness, condition of the room, condition of physical form, frequency of treatment the airline facilities, airline facility improvement, scheduling system management, airline ability management, speech effectiveness, staff service excellence, communication effectiveness, improvement of airline staff behavior, airline staff number, the availability of modern facilities, cooperation with distributors newspapers / magazines, foods replacement, cooking ability of stewardess / steward, cooperation with the distributor of foods, food ingredients.

2. Several divisions were involved in the business intelligence system, including customer insight and service division. Some data were also required to run business intelligence system in the Quality sub-model, which include the data of flight number, the value of the level of importance and satisfaction on every attribute, the relationship between the attribute and technical requirements, as wellas technical requirement. Meanw hile
3. the CRM sub-model required the data of customer comments, flight number, and class.
4. The role of business intelligence systems in this study for the CRM sub-model was to enhance customer satisfaction by Kano Model approach using the consumer's voice which was received by the company. For the Quality sub-model, the role of business intelligence systems was to develop decision support tools to improve customer satisfaction by the service provided. The highest of priority the capability of the Quality sub-model based on integration methods of QFD (Quality Function Deployment), Service Quality, and Kano Model was the ability of the airline management while the capability of CRM sub-model was based on the method of Kano Model.

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