Design of Data Warehouse for Monitoring Hotel's Food and Beverage Cost

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Abstract - Monitoring is a mandatory process which carried out in every company. Through monitoring process, each business processes within company can be controlled more properly, problems that might occur in the business process can be anticipated, and company's revenue can be optimized. However, based on survey conducted in some hotels, it is found that there is over-budget problem in food and beverage costs due to difficulties in monitoring process. Therefore, this study aims to design a data warehouse that can help to optimize monitoring process of hotel's food and beverage costs. Design of proposed data warehouse was built using nine step design methodology developed by Kimball & Ross. Furthermore, proposed data warehouse design was assessed using feasibility assessment of Likert scale. Based on assessment results, it is known that, the proposed data warehouse design has feasibility value of 84%, which is shows that respondents agreed with the design.

***Index Terms* — Monitoring Process, Food and Beverage Costs, Data Warehouse, Likert Scale.**

I. INTRODUCTION

Application of data warehouse as a business process monitoring tool has been widely studied over past few decades. Monitoring is mandatory process which carried out in every company, including hotels. Through this process, each business processes within company can be controlled more properly, problems in business processes can be anticipated before the problem occurs and plan to optimize company's revenue can be done. However, based on a short survey conducted in five hotels that located in Bali, Indonesia. Three of five hotels stated that they are experiencing over-budget problem in food and beverage costs due to difficulties in monitoring process. Monitoring process of food and beverage costs requires a complicated process, there are many reports that must be considered as a reference for the process including restaurant's daily sales reports, bar's daily sales reports, Food and Beverage Service (FBS) department purchase reports, Food and Beverage Product (FBP) department purchase reports, hotel's occupancy reports, hotel daily revenue report, warehouse inventory report, and warehouse items usage report.

Based on research [1], [2] which discusses use of a data warehouse as a business process monitoring tool, Authors chose a data warehouse to be solution to the problem. Author proposes use of a data warehouse because there is an Extract, Transform, Load (ETL) process in data warehouse that allows data from several sources to be combined into one [3] - [7], or in other words, data which needed in each reports mentioned above can be collected together in one report. So that it can facilitate monitoring process of hotel food and beverage costs.

Based on the description, purpose of this study is to design a data warehouse that can optimized monitoring process of hotel food and beverage costs, with hope of reducing occurrence of over-budget problems due to uncontrolled purchases. Part II of this study discusses literature review which conducted on several research that discusses data warehouse application for business process monitoring. Part III discusses the research methodology. Part IV discusses design stages of proposed data warehouse, then followed by conclusions explanation in section V.

II. LITERATURE REVIEW

Data warehouse was proposed by author is based on research [1], [2] which discusses the use of a data warehouse as business process monitoring tool. For example, research conduct by hidayat, et al [1] which discusses e-procurement data warehouse to assist monitoring process, audit and fulfillment of real time access to information in procurement of goods or services in

government agencies. This shows that application of data warehouse for this kind of purposes have been done. Furthermore from research [3] - [7], authors found that in data warehouse there is an ETL process. As shown in figure 1, in ETL process, data from source systems is taken and then changed to be entered into data warehouse [3] - [7].

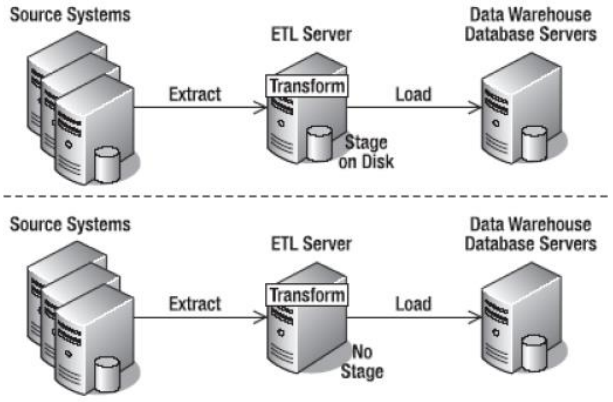

Fig 1.ETL Process Schema [3]

Purpose of ETL process is to collect, filter, process and combine data needed from various sources to be stored in data warehouse [5]. According to author, this is in line with the need for problem solving discussed in this study. Furthermore, based on research [5], [8] - [10], [11] design of data warehouse is built using methodology nine-step design method developed by Kimball & Ross including process selection, grain selection, dimensional identification and adjustment, fact selection, pre-calculation storage in fact tables, completing dimension tables, selecting database duration, tracking dimensions that change slowly, and determining physical design. [12]

III. METHODOLOGY

A. Research Location

This research took place at Mercure Bali Nusa Dua Hotel, in Accounting Department, Cost Control section.

B. Data Collection Methods

--Interview, , was done with Mr. Hery Suryawan as person in charge of cost control section of Mercure Bali Nusa Dua Hotel. Data obtained using this method are data from each report considered in Mercure Bali Nusa Dua hotel food and beverage cost monitoring process including amount of restaurant's daily revenue from restaurant's daily sales reports, amount of bar's daily revenue from bar's daily sales reports, amount of purchase FBS from FBS department purchase reports, amount of purchase FBP from FBP department purchase reports, occupancy rate from hotel's occupancy reports, amount od hotel's daily revenue from hotel's daily revenue reports, inventory data from warehouse inventory reports, and item usage data from warehouse items usage report.

--Document review, was carried out in research that related to data warehouse and reports that used in hotel's food and beverage costs monitoring process of Mercure Bali Nusa Dua Hotel

C. Data warehouse Design Method

Design of data warehouse in this study was built using Kimball and Ross nine-step design methodology with following stages :

1. Choose the Process
   Choose the process is used to determine subject and clarify boundaries of data warehouse created.
2. Choose the Grain
   Choose the grain is used to determine grain or data to be presented in fact table. After determining the grain for fact table, then dimensions table can be determined.
3. Identify and Conform the Dimension
   Identify and connect dimension tables with fact tables. Dimension is a collection of important points of view to describe facts contained in fact table.
4. Choose the Facts
   Selection of facts used based on the grain that has been determined in previous stage.
5. Store Precalculations in the Fact Table
   At this stage, calculation results for an attribute need to be considered to be stored in database. This is to reduce risk of errors in program every time calculations done on these attributes.
6. Round Out the Dimension Tables
   Complete the dimension set specified in previous stage into a dimension table that contains attributes with complete relevance.
7. Choose the Durations of the Database
   Determination of time duration from data source entered into data warehouse.
8. Determine the Need to Track Slowly Changing Dimensions
   To anticipate changes in data in dimension table that might occur.
9. Decide the Physical Design
   At this stage, physical design of data warehouse is carried out through the ETL process.

IV. ANALYSIS AND DESIGNING DATA WAREHOUSE

A. Business Process Analysis

Based on interviews conducted, it is known that monitoring process of food and beverage costs at Mercure Bali Nusa Dua Hotel uses many reports, which is can reduce speed and accuracy of monitoring process. Based on this finding, design of data warehouse which is proposed in this study aims to be able to simplify monitoring process of food and beverage costs.

B. Designing Data Warehouse

Design of proposed data warehouse in this study was built using Kimball and Ross nine step methodology as follows:

1. Choose the Process
   Process chosen is monitoring process of hotel food and beverage costs.

2. Choose the Grain
   Grains that used in this study are Purchase, Sales, and Stock Usage
3. Identify and Conform the Dimension
   Dimensions that used in this study are Items Dimension, Hotel's Occupancy Dimension, Purchase Dimension, and Sales Dimension
4. Choose the Facts
   Facts that used in this study is Monitoring Fact.
5. Store Precalculations in the Fact Table
   There is no pre-calculation, so that design process is continued to next stage.
6. Round Out the Dimension Tables
   Next step is to add text that is intuitive and easy to understand by users in dimension table.

TABLE I
ROUND OUT THE DIMENSION TABLE

Dimension	FieldKey	Description
Item	Id Jml_stok	View monitoring costs based on the amount of stock in the warehouse
Hotel Occupancy	Id Jml_pakai	View monitoring costs based on the amount of use of items in the hotel room
Purchase	Id Jml_beli	View monitoring costs based on the number of purchases of goods
Sales	Id Jml_jual	View monitoring costs based on the number of sales of goods

7. Choose the Durations of the Database
   Database duration is set two years, which is this year and last year.
8. Determine the Need to Track Slowly Changing Dimension
   To anticipate data changes that might occur, field of refresh data was added in each table. This field is used to reset data of last year when starting new year data.
9. Decide the Physical Design
   The last stage is physical design of database that contains tables of facts and dimensions. Database is designed using Snowflake Schema.

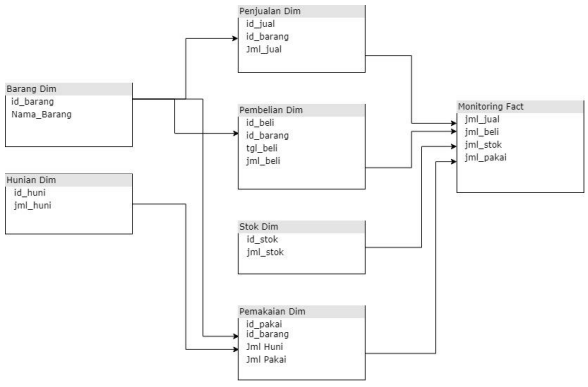

Fig 2. Snowflake Schema

Fact and dimension tables contained in the schema are as follows:

1) Monitoring Fact Table
   Monitoring fact table contains four attributes: jml_jual, jml_beli, jml_stok, jml_pakai.
2) Sales Dimension Table
   Sales dimension table holds items sold data and number of items sold in one transaction.
3) Purchase Dimension Table
   Purchase dimension table holds item purchased data and number of items purchased in one transaction.
4) Stock Dimension Table
   Stock dimension table contains attributes of number of stocks and id_barang.
5) Usage Dimension Table
   Usage dimension table contains jml_huni, jml_pakai and id_barang attributes.
6) Item Dimension Table
   Item dimensions table contains attributes of item details.
7) Occupancy Dimension Table
   Occupancy dimensions table contains attributes of hotel's occupancy rate.

Results of the data warehouse that has been designed can be seen in Figure 2.

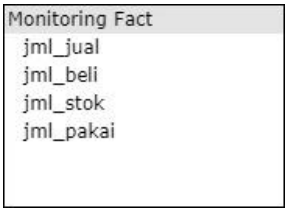

Fig 3. Design of Data warehouse

C. Feasibility Assessment Using Likert Scale

This feasibility assessment is used to find out two thing, which is whether this design already represented existing business processes or not, and whether this design can overcome the problems that occur in monitoring process of hotel's food and beverage cost or not. Feasibility assessment is done using Likert Scale to accommodate user's opinions. Assessment is done using questionnaire which is distributed to two person in Cost Control section. Statement that mentioned in the questionnaire are as follows:

TABLE II
QUESTIONNAIRE

No	Statement	TS	RG	S	SS
1	Monitoring process of food and beverage costs is very complicated				
2	Solution is needed to simplify monitoring process of food and beverage costs				
3	Field in proposed data warehouse table is field that used in monitoring process of hotel food and beverage costs in Mercure Bali Nusa Dua Hotel				

4	This design represents current monitoring process of food and beverage costs
5	Design of proposed data warehouse can simplify monitoring process of food and beverage costs

In those questionnaire, answer options of Disagree (TS) has value of 2, Doubt (RG) has value of 3, Agree (S) has value of 4, Strongly Agree (SS) has value of 5. Results obtained from users answer are as follows :

- 1st Statement ; 1 S, 1 SS
- 2nd Statement : 1 SS, 1 S
- 3rd Statement : 1 S, 1 S
- 4th Statement : 1 S, 1 S
- 5th Statement : 1 SS, 1 RG

Likert scale calculation of those results can be described as follows:

- 1st Statement ; 4 + 5 = 9
- 2nd Statement : 5 + 4 = 9
- 3rd Statement : 4 + 4 = 8
- 4th Statement : 4 + 4 = 8
- 5th Statement : 5 + 3 = 8
- Overall Total Score = (9 + 9 + 8 + 8 + 8)/5=8.4

Maximum score with two users as respondent is 10, then can be calculated percentage index of feasibility as follows :

- Index (%) = (Total Score / ScoreMaximum) x 100
- Index (%) = (8.4 / 10) x 100
- Index (%) = 84%

Based on feasibility assessment result, it is known that although total value of feasibility of proposed data warehouse design is 84%. Answer of 5th statement shows that users is still doubt that proposed data warehouse design can simplify process of monitoring food and beverage costs. However, from user's clarification, it is known that proposed design represents current monitoring process of food and beverage costs but needs to be tested directly to prove whether this design can indeed facilitate monitoring process or not

V. Conclusion

Based on above description, conclusions that can be drawn in this study are as follows:

1. Design of proposed data warehouse can be used in monitoring process of food and beverage costs of Mercure Bali Nusa Dua Hotel
2. Based on feasibility assessment, it is known that proposed design represents current monitoring process of food and beverage costs but needs to be tested directly to prove whether this design can indeed facilitate monitoring process or not

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