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Development of a Database Management System Design Involving Quality Related Costs

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1. Introduction

All organizations in different sectors of the industries should implement quality management practices to improve their performances. In order to prove that a quality management program is cost effective, it is necessary to identify and measure the quality costs in the system (Love,2000; Aoieong, 2002). However, very few companies are interested in quality cost computations to quantify the benefits of TQM, due to the great number and complexity of phases and / or activities involved in the operations. In this study, it is notified that if a general approach in tracking and measuring quality costs in different fields of study is developed, companies will be encouraged to trace their quality management performances, decrease their costs of operations and increase overall profits. Hence, in this paper, a DBMS design has been proposed which makes it possible to track deviations from ideal quality successfully and the cost of deviations per unit object in a quality management system.

2. Quality Costs

All the costs associated with preventing, finding and correcting erroneous work and the forthcoming outcomes are the quality costs. Costs associated with failures resulting from inadequate systems may arise from internal and/or external sources (Crosby, 1979). If a defect or error is detected before a product leaves the organization whether in the intermediate stages or in the final state, the internal failure costs are incurred. As a result, operational costs in the organization or in other words, product / service costs arise due to the internal poor quality

costs such as material waste, cost of rework, or any other avoidable process losses. On the contrary, if the errors or defects are found after the product leaves the company or if the product or service of the company is no longer under its' control, external failure costs are incurred. External failure costs include product warranties, sales returns and allowances and lost sales, service calls. The companies loose profit from the external poor quality due to loss of future business, contractual claims or rectifications needed.

Companies incur appraisal and prevention costs not to incur internal and external failure costs. Appraisal costs consist of all monies spent to measure the conformity of different items to the required specifications of quality. Examples are cost of training associated with inspection, inspection and tests, maintaining test equipment etc. Prevention costs include any money spent in taking action to investigate, prevent or highly decrease the risk of nonconformity in production systems. Typical examples are cost of strengthening quality system design, machine or process capability studies, vendor surveys, employee training for production work or services etc.

In many cases, experimental data for the required quality cost computations are not available in organizations. The success of the evaluation process depends on the skills in combining all sources of data to reach practical results. The database developed in this study can be used to provide the necessary data on quality costs as well as quality cost totals for quality management.

3. Quality Cost Database Management System Design

In the quality cost database management system design, the goal is to provide an interface which lets one to store the data of quality system and which makes it possible to do necessary calculations to check whether the money spent for this system is put to good use. When using this software, it is important to differentiate the tasks associated with the quality system from those involved in the production system. Since, the design focuses only on the activities associated with the quality system, i.e. prevention activities, appraisal activities, internal or external activities. In short, this differentiation simplifies the complexity of the data collection process since quality system is a subsystem of a production system.

The entity-relationship diagram developed modeling the quality cost database management system is given in Figure 1. The boxes represent entities and the arrows represent the relationships among entities. Tip and tail of the arrows show the relationship either as one-to-many, zero to one or many to one. For example, there may be more than one "company" in entity "sector". On the contrary, the entity "company" prevails only in one "sector".

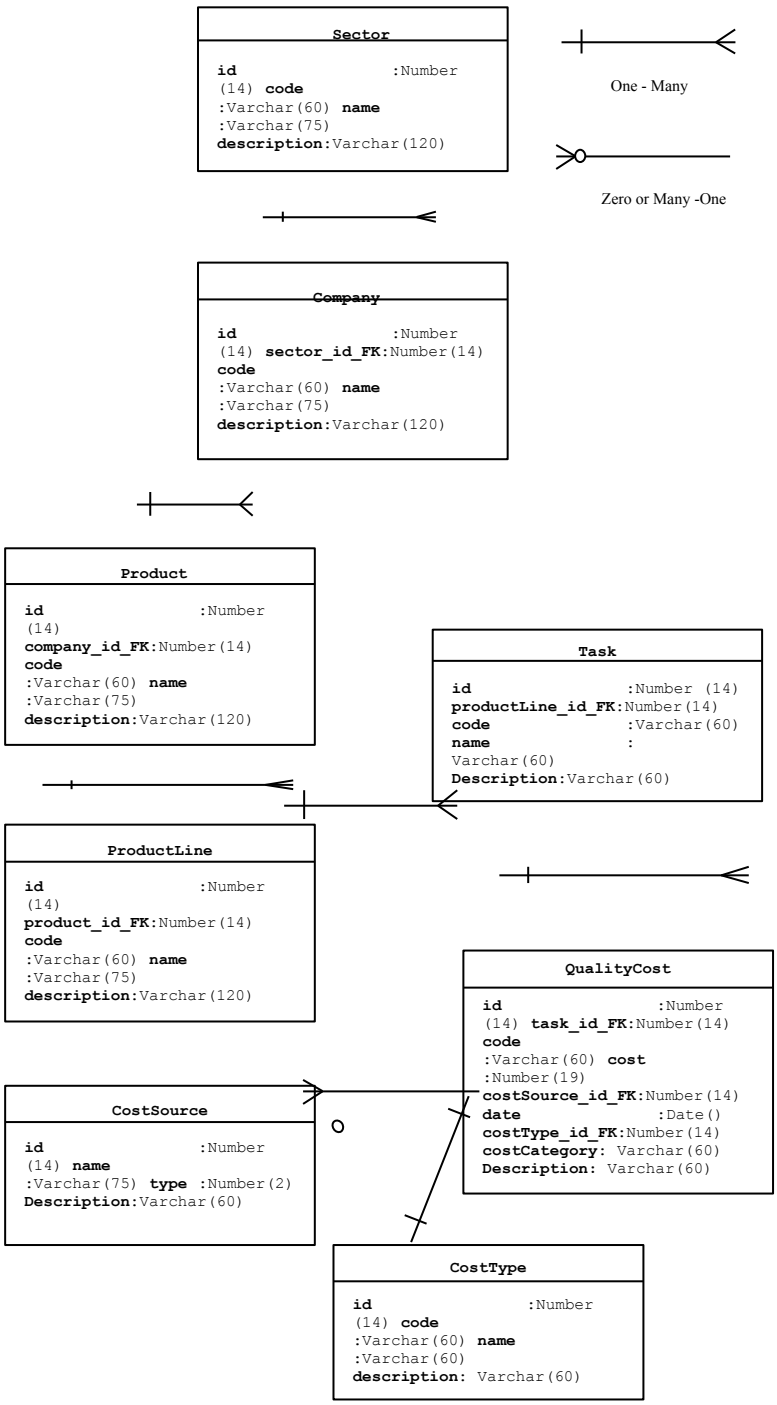

Figure 1. Entity – relationship diagram of the quality cost database management system

The first field “id” resembles the primary key for each entity. The foreign keys follow the primary ones in each file. The basic attributes of each entity are included into the conceptual model developed as code, name, description, etc. Integrity of the database has been normalized after specifying the relational schema. Data dictionary displaying the information about the size and type of each field is also given following each attribute in the E-R diagram.

To understand the results of quality cost study in the context of the production sectors for each company per product and also per production line, those classes as “Sector”, “Company”, “Product” and “Productline” are included into the DBMS design. ”Task” file has the attribute “task” which is associated with quality costs. “Quality-cost” file consists of primary attributes such as type of quality cost, quality cost value, and date the quality cost incurred. Sources of quality cost can also be included into the database.

The activity diagram given below (Fig.2) describes the workflow behind the system being designed. Object nodes are presented in the middle part of the diagram. Each node indicates an instance of a particular classifier in a particular state. Object flow in the diagram describes the flow of values to or from object values.

This diagram shows how the application proceeds after the processing type is selected by the user. A new sector can be included into the sector data listed. Erasing a data or making changes on the data are also permitted. All types of processing operations used in object “sector” can also be used in the following objects in the hierarchical structure. As shown by the workflow diagram, each processing are based on similar patterns letting access between each level.

Figure 3 shows a repetitive part of the client / server multilayer architecture in an application. The structure of “sector” and “ company” classes and their interrelations in the object-oriented design are shown in the diagram. The aim of using this structure is to separate the processing logic controlled by server and application part used by client. JSF (Java server faces) pages presented in the server’s side and backbeans (java bean class) coming through JSF implementations out of them direct the processing operations each time an information and event are received from a user. In the server side, the received data are processed, recorded on the database and send back to the user with related interpretations. The end users are permitted to add, change, delete or retrieve data in the database.

Java object-oriented programming language has been chosen for the system development. Hence, the code can be used with network computers. In other words, the processing code and the data can be stored on a network server. The software functions developed can be downloaded via the network when needed. Then, after the processing ends, the data can be saved through the network.

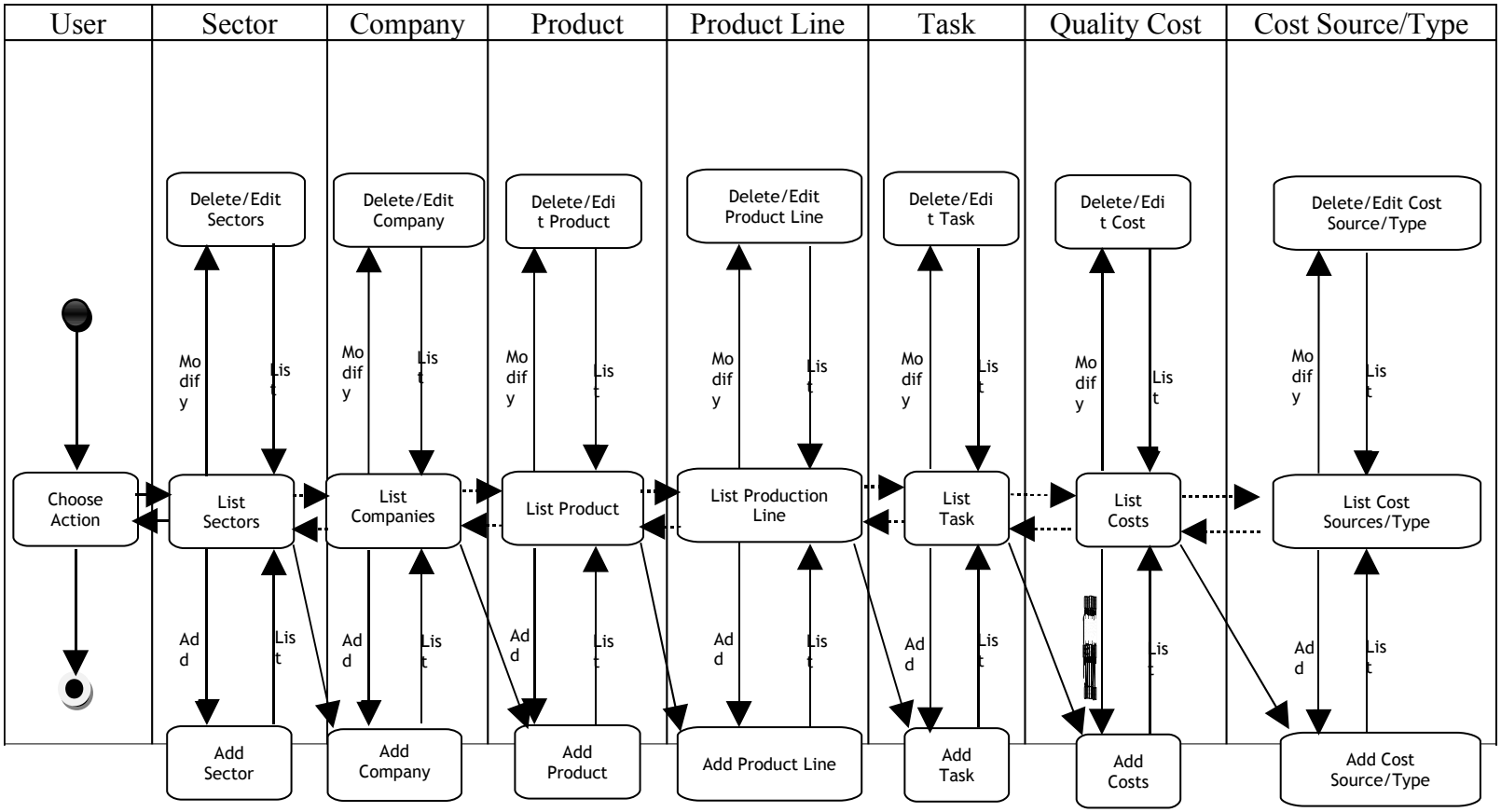

Figure 2. Activity diagram of the DBMS

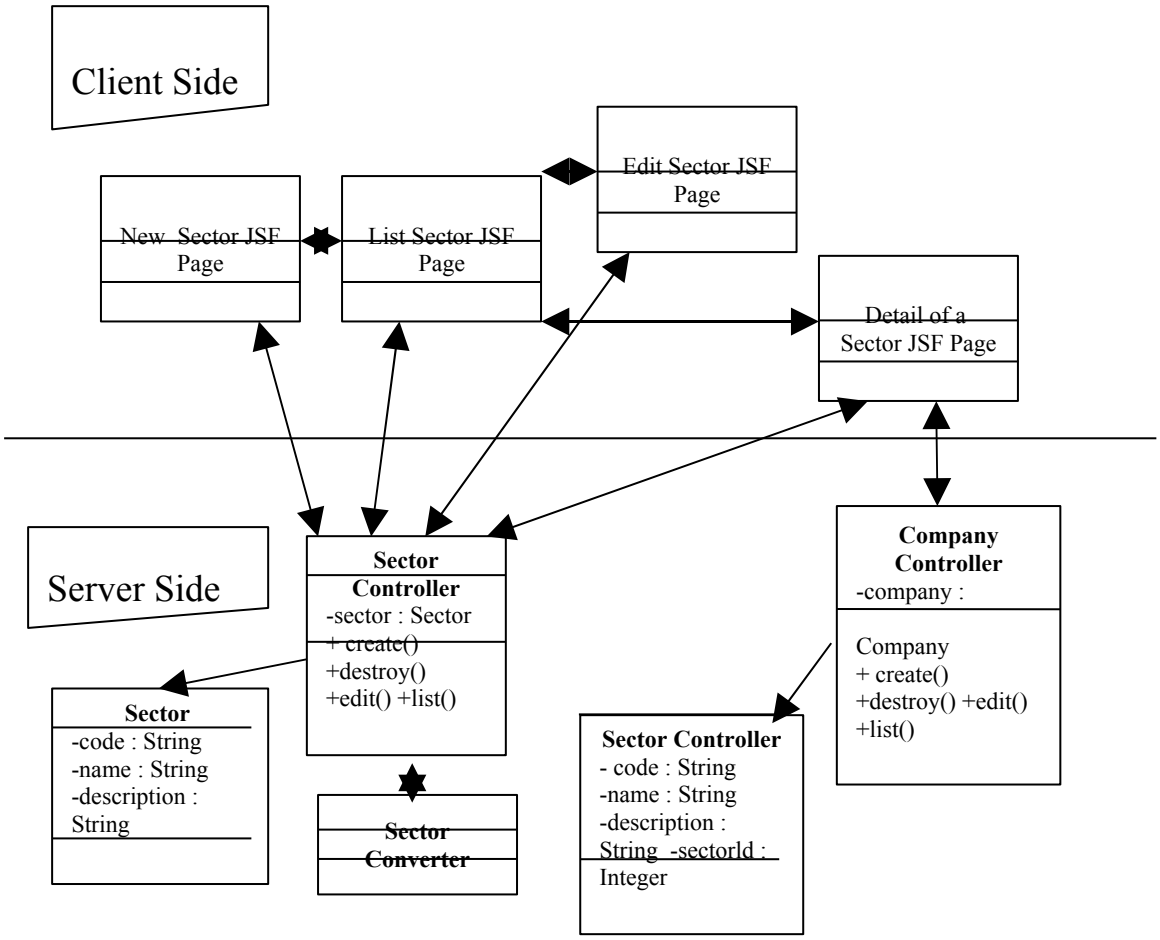

Figure3. Client / Server class diagram.

Conclusions

The biggest advantage of the quality cost DBMS is to provide a new platform as a resource repository. It provides a framework for explaining and computing the quality costs. More importantly, the system could be enhanced to incorporate each of the elements of manufacturing and production information systems.

The system design developed offers the benefit of inserting different categories of quality related costs. The design also offers a flexibility in coding different quality cost data. Lastly, the deviation between conformance and nonconformance costs will show the possibilities to decrease the total quality cost of production system.

5. References

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