

Cost Estimation System for Construction Project (CES-CP)

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Abstract— Bill of Quantity is a form used by the contractor to submit a price to the owner in order to obtain a construction contract. It takes the ability and experience to make bill of quantity, not everyone can do it. The development of “Cost Estimation System for Construction Project (CES-CP)” is aims to assist people to make Bill of Quantity. The development of this application use FAST (Framework for the Application of Systems Techniques) methodology. This application stored the knowledge that required to make Bill of Quantity. It can show which one of the Work Unit Price are recommended for use on Bill of Quantity and which ones are not. All Work Unit Data that used on Bill of Quantity of a project will be stored and can be displayed at any time as a reference. This application helps people to make Bill of Quantity and make the process of making Bill of Quantity becomes more efficient.

Keywords— Bill of Quantity, Construction Project, Cost Estimation

I. INTRODUCTION

Construction is one of industry that has fierce competition in terms of price [1]. In attempting to obtain a construction contract, the contract must follow the tender or bid price to the owner. Tender is an activity that aims to select, acquire, establish and appoint the most appropriate company for doing a job package [2].

The proposed price at the time of tendering obtained from the cost estimation process. This cost estimates used to determine the amount of the construction costs needed to build a project and also the profit made by the construction company, in this case is the contractor.

In most tenders, deals for the lowest prices who will get the contract. The dilemma that faced by the contractor is in asking the price. If the proposed price is too high then the contract will be awarded to another contractor, but if the price is too low then it will hit the contractor’s profit.

Therefore we need an optimum price that contractors obtain construction contracts and also benefit from the contract. Estimates of construction cost of the project is presented in the form of Bill of Quantity (BoQ).

In a large construction project, work items which will be calculated and analyzed even more numerous and diverse. For each type of work should also be analyze done by one from the material requirements, the equipment used and the wages used to do the job. The results of the analysis determines the amount of unit price for each type of work.

One of the unit price of the construction work is by using a computer program. One of them is SIEB program (Cost Estimation Information System)[3]. This system provides convenience in preparing the data to calculate the unit price of

construction work by using software. Users just insert material prices, wages or equipment required on a job along with the volume and the system will calculate the total cost of the work[3]. But this system only handles the Employment Unit Price calculation, not up to the making of the Bill of Quantity.

The program was developed by Erich and Lusiana [4], which makes an application to assist the process of making the Bill of Quantity, where the filling of unit price, this application can be connected with SIEB, or manually inserted. Disadvantages of this application is lack of classification where the recommended of the unit price and which ones do not. And the absence of a history of the work that used on the project.

This paper describes an application that is used to store the Employment Unit Price, and show where the Employment Unit Price recommended and which ones are not. Then, the data unit of Employment that is used on the project, is stored and can be displayed at any time if required to be used as a reference to determine the Employment Unit Price will be recommended in the future. Web-based application was developed due to web-based applications more efficient because it can be accessed from anywhere and at anytime. This is important, considering that a construction company could have a construction project at various places. So, if a user wants to create a Bill of Quantity or accessing existing data, can be done anywhere and at any time, regardless of time and place. In addition, a web-based application also has several advantages, including a multi-platform (can be run on any operating system, requiring only a browser) and easier to install (no need to install software applications one by one to a computer, simply by hosting).

II. METHODOLOGY

FAST (Framework for the Application of Systems Techniques) is used for system development, and the phase are; Scope Definition, Problem Analysis, Requirements Analysis, Logical Design, Decision Analysis, Physical Design, Construction, Installation and Delivery[5].

A. *Scope Definition*: In this phase, the collection of information that will be examined levels of feasibility and project scope is by using the PIECES framework (Performance, Information, Economics, Control, Efficiency, Service). This is done to find the core of the existing *problems*, the opportunity to improve organizational performance and the new requirements imposed by management or government (directives).

B. *Problem Analysis*: this phase will be examined issues that arise in existing systems. In this case the project charter resulting from the preliminary stages of investigation is

the key. The results of this phase is to improve the performance of the system that will provide benefits in terms of the company's business. Another result of this stage is a report that addresses the problems, causes, effects, and benefits solution.

- C. *Requirements Analysis*: In this phase will be sorting priority of the needs of existing businesses. The purpose of this phase is to identify the data, process and user interface of the desired new system.
- D. *Logical Design*: The purpose of this phase is to transform the business needs of the requirements analysis phase of the system model that will be built later. In other words, this phase will answer the questions surrounding the use of technology (data, processes, interfaces) that ensure usability, reliability, completeness, performance, and quality to be built in the system.
- E. *Decision Analysis*: In this phase of the selection will be considered a web-based application or desktop-based which will be selected and used in the implementation of the system as a solution to the problems and requirements that have been defined in the previous stages.
- F. *Physical Design*: The purpose of this phase is to transform business requirements represented as logical design into physical design will be used as a reference in making the system to be developed. If in the logical design will depend on a variety of technical solutions, the physical design represents a more specific technical solutions.
- G. *Construction*: After making the physical design, it will begin to construct a system that meets the business needs and design specifications. The database, application programs, and the interface will be built at this stage.
- H. *Installation and Delivery*: In This phase will be operated system that has been built. This stage will begin with deploy software to provide training to the users on the use of systems that have been built.

III. SYSTEM ANALYSIS

A. Processes Modelling

The modeling process is a formal way to describe how the business operates. Illustrates the activities undertaken and how the data flows among those activities. In this final modeling process for the new system will be described with DFD (Data Flow Diagram). CES-CP process modeling can be seen in

Fig 1.

Estimators provide input to the system in the form of a username, password and level, tasks on the project, work measure unit, and resources needed task measure unit.

Managers provide input to the system in the form of a username, password, and level, measure unit, suppliers, resource price, taskmeasure unit, and resurces needed.

The first process is the "Manage Users". Process Manager is used to manage users who can access this application. The second process is the process of "Managing measureunit". This process is used to manage the measureunit that exist in this application. Measureunit data stored in the measure unit table.

The third process is "Managing Supplier". This process manage existing supplier data. Supplier Data will be stored into supplier table. The fourth process is the process of

"Managing Resources". This process is carried out by the Manager to manage the data resources. The fifth process is the process of "Managing the Task unit". The process to manage the Task Unit. Both Manager and Estimator can manage it, in accordance with the authority given.

The sixth process is the process of "Manage Budget Plan". this process performed by the Estimator. And the eight process is the process of "View History", to display the history of existing work on application to the Manager.

B. Data Modelling

Data modeling is a formal way to describe the data used and created in a business system. This model can show the place, person or object in which the data is taken and relationships among the data. In this paper, data modeling is described using ERD (Entity Relationship Diagram). CES-CP data modeling shown in

Fig 2.

There are 11 entities relate to each other and represent 11 tables that exist in the database. User entity, contains information about the users of this system. Project entity, contains information about the project. Task category entity, contains category of tasks. Task entity contains project tasks. Task Unit, contains information about the task unit. Detail entity, contains information about the volume and price of each resource used by taks in the project. Measure unit entity, contains the measure unit that will be used to indicate the measure un it used on the task and resources. Resources Entity, containing information about available resources. Supplier Entity, contains information about the supplier of resources available. Resource Category Entity, containing information on the category of existing resources. Price Entity contains price information on resource suppliers.

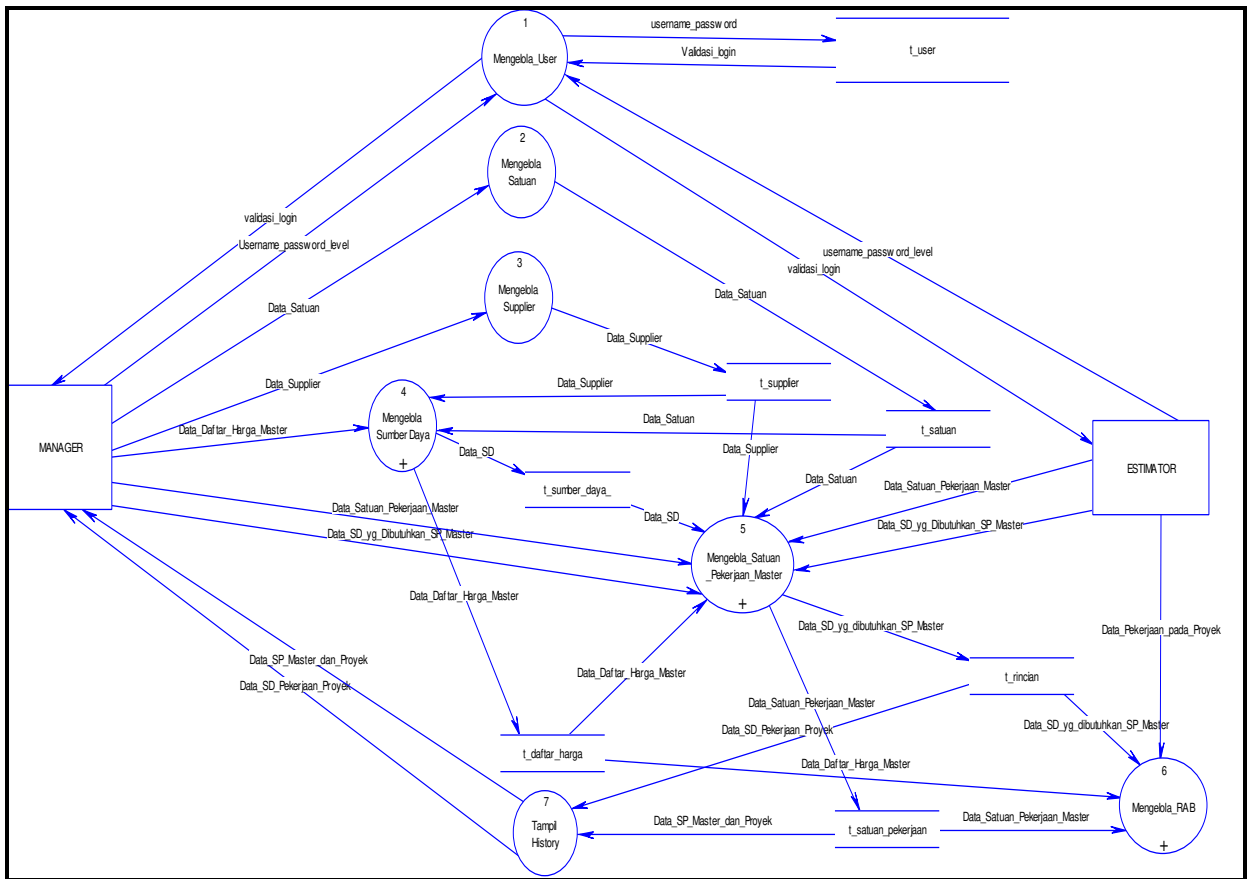


Fig 1. CES-CP Data Flow Diagram

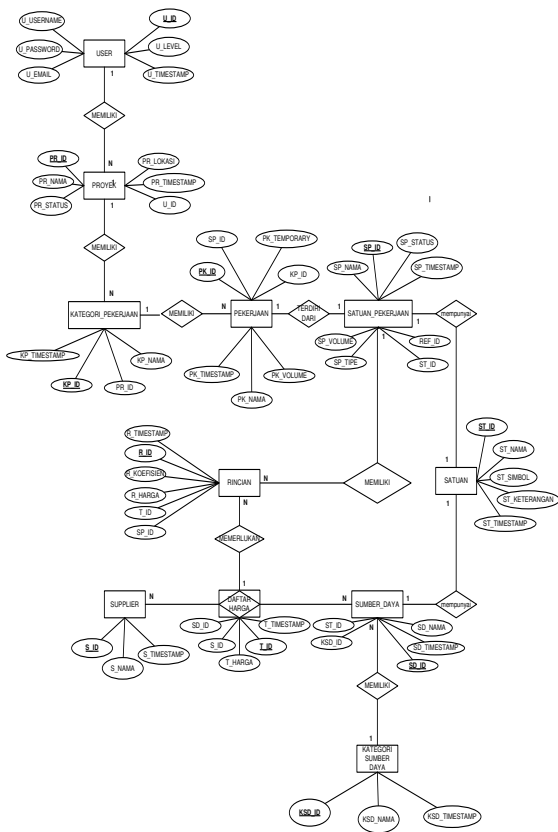


Fig 2. CES-CP Entity Relationship Diagram

IV. CES-CP IN USE

CES-CP consists of two pages, the user interface, which is the home page manager and estimator pages, each of which has a menu that is adjusted to the design of applications that have been made.

A. Manager Page

Fig 3 shows the main page for the manager. Manager page contains main data management such as; estimator, measure units, suppliers, resources, and tasks. The data management include create, read, update and delete.

In manager page, tasks from previous project are managed. The tasks from previous project serve as a knowledge to develop next project's BoQ. the tasks composed of resources and its coefisen. Task management page shown in Fig 4.



Fig 3. Manager Main Page

ID	Nama	Satuan	Volume Satuan	Harga Satuan (Rp)	Status
1	Pembersihan Area Pekerjaan	M2	1,200.00	1,079.58	rekomendasi
2	Pasang Bopstank	M	10.000	11,516.75	rekomendasi
3	Galian Tanah	M3	1.000	20,737.50	rekomendasi
4	Urugan Pasir	M3	1.000	92,175.00	rekomendasi
5	Beton Tumbuk Ad 1:3:5	M3	1.000	497,544.00	rekomendasi
6	Beton Bertulang Ad 1:2:3	M3	1.000	2,634,300.01	rekomendasi
7	Pasangan Aanstamping	M3	1.000	140,812.50	rekomendasi

Fig 4. Previous Task Management

ID	Kategori	Sumber Daya	Satuan	Harga (Rp)	Quantity	Supplier	Jumlah (Rp)
1	material	Kayu Kelas IV	M3	750,000.00	0.06	PT. XYZ	67,500.00
2		Paku Basah	Kg	0.000.00	0.06	PT. XYZ	480.00

Fig 7. Use of Resource Summary

B. Estimator Page

In this page (see Fig 5), project estimator assisted in managing project budget and viewing list of tasks from previous project.

Project budget plan development starts by clicking new project menu. On project budget plan worksheet page shown in Fig. 6, estimator able to manage categories, tasks, and resources. Estimator will be assisted in the preparation of the budget plan by the system with available existing task.

With the same page, estimator able to see the summary what resources has been used and its total amount. The summary can be shown in Fig. 7.

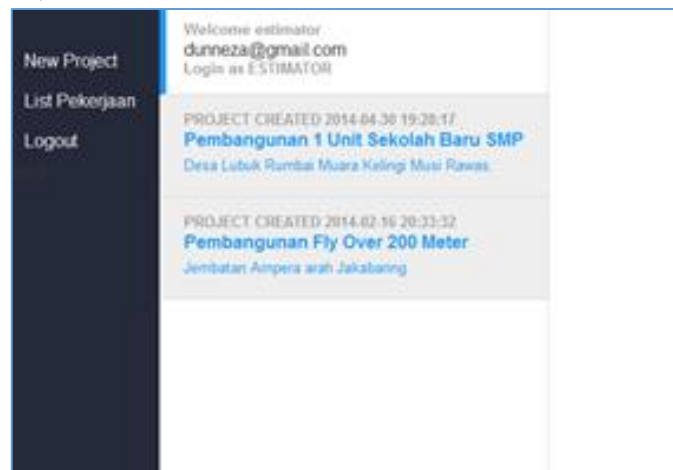


Fig 5. Estimator Page

Nama Pekerjaan	Satuan	Volume Satuan	Harga Satuan (Rp)	Volume Pekerjaan	Biaya (Rp)
1 Pembersihan Area Pekerjaan	M2	1,200.00	1,079.58	150.00	161,937.00
2 Pemasangan Pias Hampa Proyek	M	10.000	11,516.75	20.00	230,335.00

Fig 6. Project Budget Plan Worksheet

V. CONCLUSIONS

CES-CP is a web-based system that is used to calculate the cost of a project by considering the history data of the budget plan have been made previously. CES-CP is eligible to be designed in order to improve efficiency in making BoQ. With CES-CP, less experience cost estimator can make BoQ accurately.

REFERENCES

- [1] V. Benjaoran, "A Development of a Cost Control System for Small and Medium-sized Contractors," *Suranaree Journal of Science and Technology*, vol. 15, no. 1, pp. 1-11, 2007.
- [2] A. Malik, *Pengantar Bisnis Jasa Pelaksana Konstruksi*, Yogyakarta: Andi Offset, 2010.
- [3] Tofan and G. Ferdinand, "Uji Aplikasi Program Sistem Informasi Estimasi Biaya (SIEB) pada Proyek Rumah Tinggal Sederhana," Universitas Kristen Petra, Surabaya, 2006.
- [4] E. Hudi and L. Prasetya, "Penyiapan Bill of Quantity Untuk Estimasi Biaya Pekerjaan Konstruksi," Universitas Kristen Petra, Surabaya, 2007.
- [5] J. Whitten and L. Bentley, *Systems Analysis and Design Methods*, New York: McGraw-Hill, 2005.