Proceeding International Joint Conference on Science and Technology (IJCST) 2017

ISBN : 978-602-99806-3-9

COST ESTIMATING DATABASE MODEL FOR CONSTRUCTION PROJECT

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Abstract. Cost estimating is one of the most important steps in project management. A cost estimate establishes the base line of the project cost at different stages of development of the project. A cost estimate at a given stage of project development represents a prediction provided by the cost engineer or estimator on the basis of available data. Numerous computer aided cost estimation software systems are now available. However, most practitioners is still using a spreadsheet application to estimate project costs, which is easy to use, but on the other hand is lack of providing the information that we needed quickly, because it stores the data not in database format. This study aims to develop a database model to estimate the cost of construction projects at different stages of project development. The study starts from analyzing the old system is already running, then proceed with developing a process model and database model in accordance with the results of earlier analyzes.

1. Introduction

Information Technology (IT) is already widely used in construction organizations and much more dramatic effects are anticipated for the years to come. Several surveys have been conducted in many countries with regard to the use of IT in the construction industry such as: Australia [9], Brazil [17], Canada [11],[12], Hongkong [5], Indonesia [16], Jordan [2],[4], Malaysia [8], New Zealand [3], Nigeria [10], Scandinavia [7], Singapore 6], South Africa [1], Sweden [14],[15], Turkey [18]. From these survey results it can be concluded that the use of IT in the construction industry progressively increasing.

One application that is widely used in business processes in the construction industry is for costing / budgeting. As we know, estimating the cost of the project is time-consuming, so the use of computer applications is indispensable. In Indonesia, the use of IT for costing / budgeting as much as 65% [16]. Numerous computer aided cost estimation software systems are now available. However, most practitioners in Indonesia are still using a spreadsheet application to estimate project costs. About 76% of respondents did not use a special application for estimating project costs [19]. Although easy to use, spreadsheet application is lack of providing the information that we needed quickly, because it stores the data not in database format.

This study aims to develop a database model to estimate the cost of construction projects at different stages of project development. The study starts from analyzing the old system is already running, then proceed with developing a process model and database model in accordance with the results of earlier analyzes.

2. Methodology

Our research methodology is described in the fishbone diagram as follows. The study starts from analyzing the existing systems: weakness analysis, requirement analysis and feasibility analysis, continued with

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developing logical design in accordance with the results of earlier analyzes, and then finally into the new system (physical design).
This paper focuses on system requirements and the logical design (which consists of process modeling and data modeling).

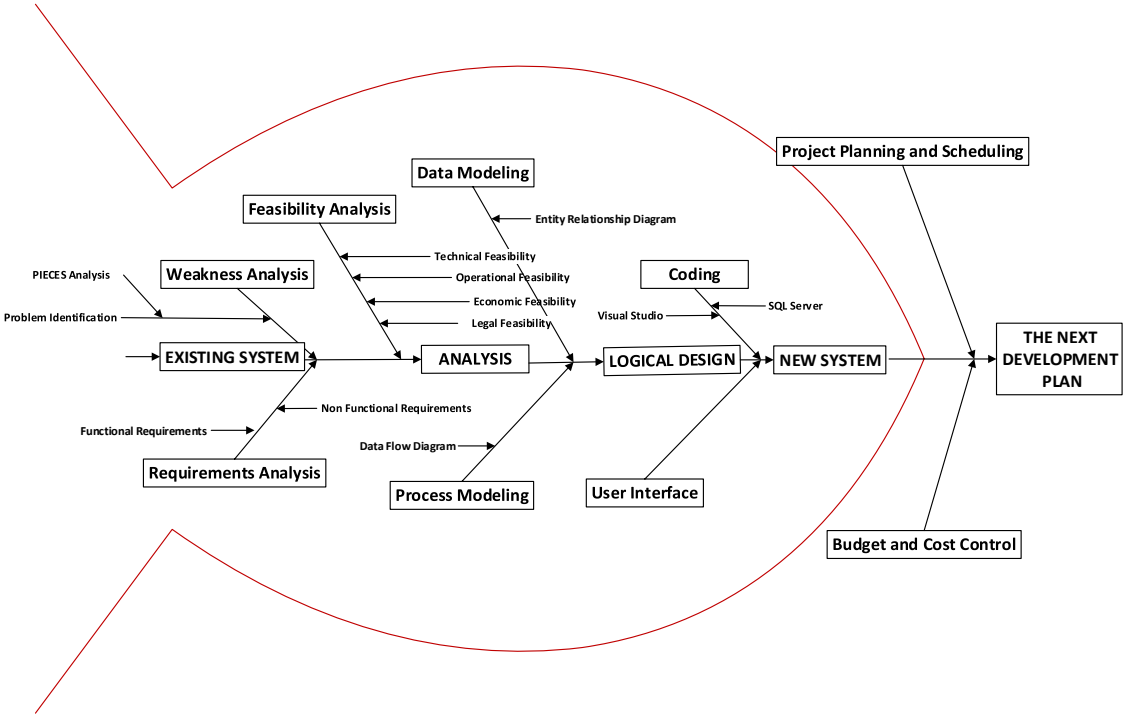

Figure-1. Fishbone Diagram: Research Methodology

3. Results and discussions

3.1. System Requirements

System requirement is the result of the analysis has been done on the existing system. This is an answer of question "what can be done by the system to be developed?" "what features are provided by the system?" From the weakness analysis we can identify problems on the existing system, from requirement analysis we can define users expectation of the system to be developed. The result are as follows:

1. The system must be able to estimate both conceptual and detailed estimate.
2. The system must be able to manage data hierarchically (Work, Resources)
3. The system must be able to simplify the process of Quantity Takeoff
4. The system can be used to optimize the success rate of competitive construction bidding.

3.2. Process Modeling

Process modeling is a formal way to describe how the business operates. There are many ways to represent a process model. Popular way is by using Data Flow Diagrams (DFD). Figure-2 below is a context diagram of the proposed system.

3.3. Data Modeling

Data modeling is a formal way to describe the data that will be used and created in a business system. One way to represent a data model is by using ERD (Entity Relationship Diagram). Figure-3 below is an ERD of the system being developed.

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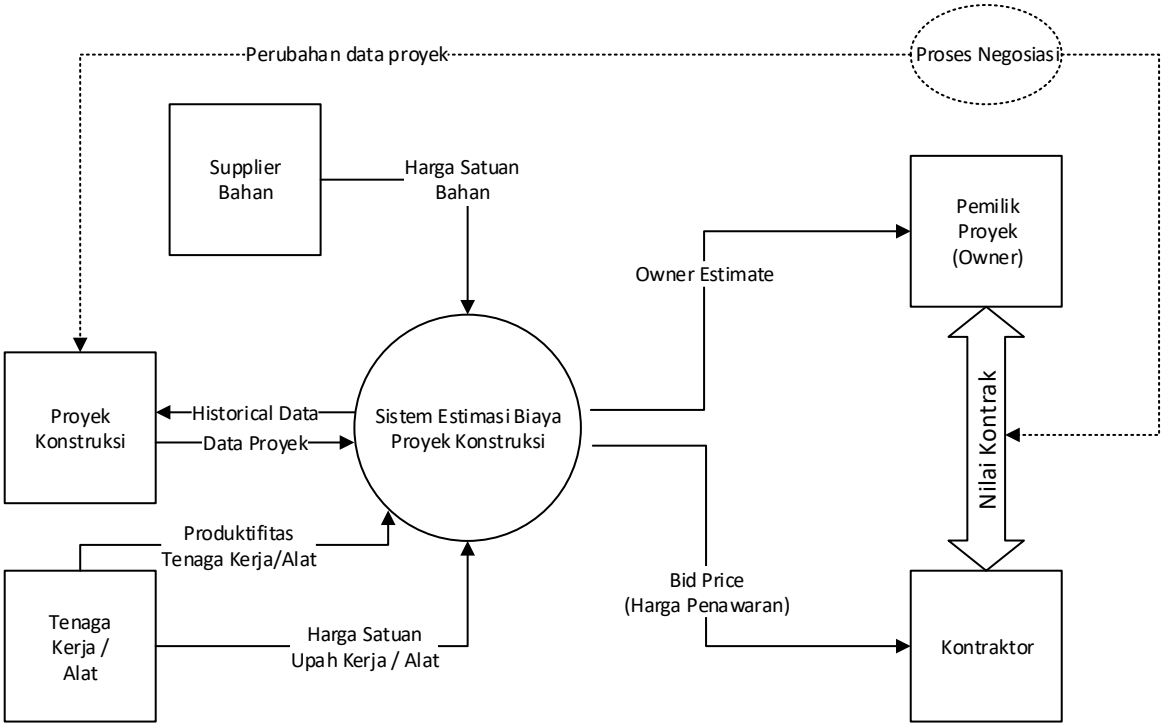

Figure-2. Context Diagram: Construction Project Cost Estimation System

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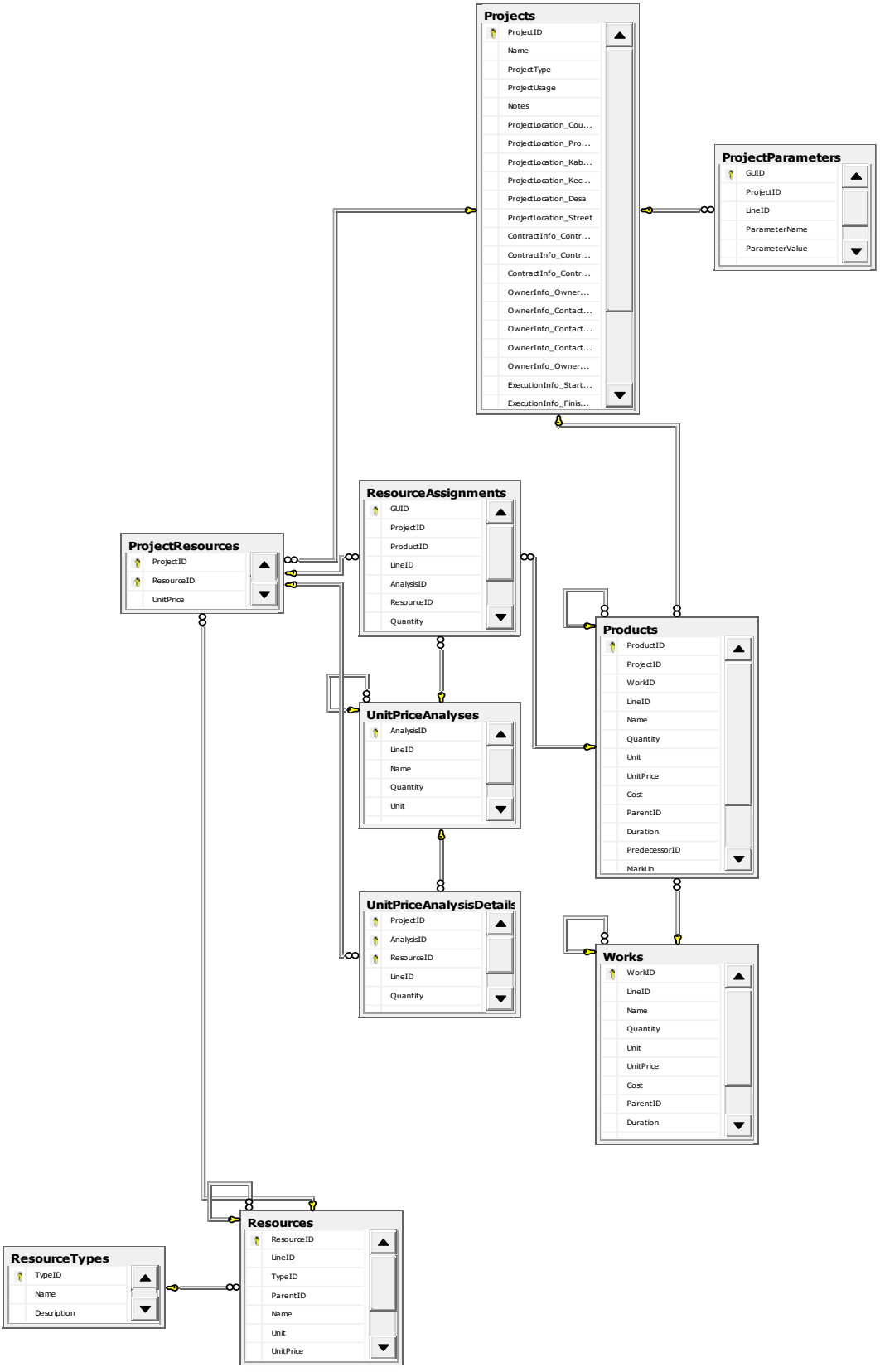

Figure-3. Data Modeling of the Project Construction Cost Estimation System

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3.4 Proposed solutions on system requirements

1. For the purposes of conceptual cost estimates, cost parameters are stored in a single table (named ProjectParameters), then it is related to the projects data table.

Table- 1. ProjectParameters Table Structure

ORDINAL POSITION	COLUMN NAME	DATA TYPE	CHARACTER MAXIMUM LENGTH
1	GUID	int	NULL
2	ProjectID	int	NULL
3	LineID	int	NULL
4	ParameterName	nvarchar	50
5	ParameterValue	float	NULL
6	ParameterUnit	nvarchar	25

2. To manage the data in a hierarchical manner, field named parentID was added to the work table and resource table.

Table- 2. Works Table Structure

ORDINAL POSITION	COLUMN NAME	DATA TYPE	CHARACTER MAXIMUM LENGTH
1	WorkID	int	NULL
2	LineID	int	NULL
3	Name	nvarchar	100
4	Quantity	decimal	NULL
5	Unit	nvarchar	25
6	UnitPrice	money	NULL
7	Cost	money	NULL
8	ParentID	int	NULL
9	Duration	float	NULL
10	PredecessorID	int	NULL
11	MarkUp	float	NULL

Table- 3. Resources Table Structure

ORDINAL POSITION	COLUMN NAME	DATA TYPE	CHARACTER MAXIMUM LENGTH
1	ResourceID	int	NULL
2	LineID	int	NULL
3	TypeID	int	NULL
4	ParentID	int	NULL
5	Name	nvarchar	100
6	Unit	nvarchar	25
7	UnitPrice	money	NULL
8	LastUpdate	datetime	NULL

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3. To calculate and document the Quantity Take-Off process, formula is stored in a vbscript format, which when executed will calculate the product quantity. This script was saved in QTO Field, and the output was saved in Quantity field.

Table- 4. Products Table Structure

ORDINAL POSITION	COLUMN NAME	DATA TYPE	CHARACTER MAXIMUM LENGTH
1	ProductID	int	NULL
2	ProjectID	int	NULL
3	WorkID	int	NULL
4	LineID	int	NULL
5	Name	nvarchar	100
6	Quantity	decimal	NULL
7	Unit	nvarchar	25
8	UnitPrice	money	NULL
9	Cost	money	NULL
10	ParentID	int	NULL
11	Duration	float	NULL
12	PredecessorID	int	NULL
13	MarkUp	float	NULL
14	Notes	nvarchar	100
15	QTO	nvarchar	-1

4. For the purposes of optimization the success rate of competitive construction bidding, some supporting fields were added to the Projects table.

Table- 5. Projects Table Structure

ORDINAL POSITION	COLUMN NAME	DATA TYPE	CHARACTER MAXIMUM LENGTH
1	ProjectID	int	NULL
2	Name	nvarchar	255
3	ProjectType	nvarchar	50
...			
23	BidInfo_HitTheBid	bit	NULL
24	BidInfo_MarkUp	float	NULL
25	BidInfo_BidWinner	nvarchar	50

5. Conclusions

From the weakness and requirements analysis of the existing system, can be identified 4 issues. The proposed solution later depicted in the diagram DFD for process modeling and ERD diagram for data modeling.

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References

[1] Arif A., and Karam A.,2001. Architectural practices and their use of IT in the western cape province, South Africa. Journal of Information Technology in Construction (ITcon), Vol. 6, No. 2, pp17-34.
[2] Attar G, and Sweiss R . 2010. The relationship between information technology adoption and job satisfaction in contracting companies in Jordan. Journal of Information Technology in Construction (ITcon), Vol. 15, pg. pp44-63, http://www.itcon.org/2010/3
[3] Doherty J. 1997. A survey of computer use in the New Zealand building and construction industry. Journal of Information Technology in Construction (ITcon), Vol. 2, No. 4, pp73-86.
[4] El-Mashaleh M.S. 2007. Benchmarking information technology utilization in the construction industry in Jordan. Journal of Information Technology in Construction (ITcon), Vol. 12, No. 19, pp279-291.
[5] Futcher, K. 2000. "Use of Information Technology within the Hong Kong Construction Industry". Proceedings, International Conference on Construction Information Technology, INCITE 2000, Hong Kong, pp119-131
[6] Goh B. 2005. IT barometer 2003: Survey of the Singapore construction industry and a comparison of results. Journal of Information Technology in Construction (ITcon), Vol. 10, No. 1, pp1-13.
[7] Howard R., Kiviniemi A., and Samuelson O. 1998. Surveys of IT in the construction industry and experience of the IT barometer in Scandinavia. Journal of Information Technology in Construction(ITcon), Vol. 3, No. 4,pp 45-56.
[8] Lim M., Rashid A., Ang N., Wong Y. and Wong L. 2002. A survey of internet usage in the Malaysian construction industry. Journal of Information Technology in Construction (ITcon), Vol.7, No. 17, pp259-269.
[9] Marosszeky M., et al. 2000. "Information Technology in the Building and Construction Industry: The Australian Experience". Proceedings, International Conference on Construction Information Technology, INCITE 2000, Hong Kong, pp183-196
[10] Oladapo A. 2007. An investigation into the use of ICT in the Nigerian construction industry".Journal of Information Technology in Construction (ITcon), Vol. 12, No. 18, pp261-277.
[11] Rivard H. 2000. A survey on the impact of information technology on the Canadian architecture, engineering and construction industry. Journal of Information Technology in Construction (ITcon), Vol. 5, No. 3, pp37-56.
[12] Rivard H., Froese T., Waugh L.M., El-Diraby T., Mora R., Torres H., Gill S.M. and O'Reilly T. 2004. "Case studies on the use of information technology in the Canadian construction industry".Journal of Information Technology in Construction (ITcon), Vol. 9, No. 2, pp19-34.
[13] Samuelson O. 1998. "IT-barometer design of a survey on the use of IT in construction". M.Sc thesis, Royal Institute of Technology, Dept. of Construction management and economics, Stockholm.
[14] Samuelsson O. 2002. "IT-Barometer 2000 - The use of IT in the Nordic construction industry". Journal of Information Technology in Construction (ITcon), Vol. 7, No. 1, pp1-26.
[15] Samuelsson O. 2008. The IT-barometer – A decade's development of IT use in the Swedish construction sector. Journal of Information Technology in Construction (ITcon), Vol. 13, No. 1, pp1-19.
[16] Sapri P. and Chandra B. 2004. Managing Information Tecnology in Construction Industry: The Indonesian Experience. CIB World Building Congress
[17] Scheer S., Leusin de Amorim S., Santos E., Ferreira R. and Caron A. 2007. The scenario and trends in the Brazilian IT construction applications' experience. Journal of Information Technology in Construction (ITcon), Vol. 12, No. 13, pp193-206.
[19] Tas E. and Irlayici F. 2007. A survey of the use of IT in building product information acquisition in Turkey. Journal of Information Technology in Construction (ITcon), Vol. 12, No. 22, pp323-335.
[20] Wicaksono, Irwan A. and Ardyansah, Digby F. 2008. "Analisis Penggunaan Software Estimasi Biaya Pada Proyek Konstruksi di Indonesia" (tugas akhir). Bandung: Institut Teknologi Bandung.

Acknowledgments

The authors would like to thank the Ministry of Research and Technology Indonesia and Higher Education Directorate for the funding of this research. We are grateful to State Polytechnic of Bali as the home institution of the researchers in providing the research facilities to us. We also wish to thank our colleagues and all those who have kindly helped in the completion of this paper.