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## **DESIGN AND BUILD PROJECT COST CONTROL INFORMATION SYSTEMS FOR CONSTRUCTION COMPANIES**

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### **ABSTRACT**

Cost control is an important instrument to support the success of a business engaged in construction. Work in the field of construction requires a time limit for the completion of work and obeys the provisions of the quality of each item of work and is fully supervised by various parties involved in the implementation of the work. Accuracy in completing the work according to the scheduled schedule and in accordance with the job specifications specified in the work contract is an important element in the assessment of construction work which has an impact on billing project costs. The existence of an information system is a tool for project cost control that is needed to monitor every progress of work that has been done so that data management can be done quickly and accurately. Therefore, this system was built in order to be able to overcome problems such as calculating work unit price analysis, Compiling a Cost Budget Plan, Implementation Budget Plan, Job Costing, Scheduling, Progressing to billing terms that can be done in one integrated information system. Tools used in making this system is Visual Basic. The application design method uses the Togaf method. The results of this study are outlined in the form of a blueprint which is used as a reference in the development of a project cost control information system at PT. Selo Adi Karto. the research results have been analyzed using the chain and TOGAF methods which produce a proposed portfolio of applications that will become data for implementation. The architecture designed which is the result of this research is in the form of an integrated project cost control information system in computer network technology.

Keywords: build project, construction companies, cost control information systems, design

### **INTRODUCTION**

The increasingly fierce competition among construction business players in Indonesia encourages contractors to think hard in winning tenders to obtain projects or jobs. The globalization of the construction world requires business people to be able to manage information well, so that the information needs of each interested party can be met quickly and accurately (Wijoyo, Sunarsi, Indrawan, & Cahyono, 2020). Information technology can automate the process of managing information from entering information, storing, and updating it at any time so that everyone can get the latest information and perform analysis easily (Esti, 2020).

One of the factors driving the use of information systems in organizations is the increasing need for business functions being carried out. The impact of it all, many organizations are competing to implement information systems with technology by only paying attention to temporary needs and allowing the application of overlapping information systems and the existence of several systems that differ from one another (Fiddin, Kamaliah, & Hardi, 2022). On the other hand, cost control is an important instrument to support the success of a business engaged in construction. Work in the field of construction requires a time limit for the completion of work and obeys the provisions of the quality of each item of work and is fully supervised by various parties involved in the implementation of the work. Accuracy in completing the work according to the scheduled schedule and in accordance with the job

specifications specified in the work contract is an important element in the assessment of construction work which has an impact on billing project costs. Controlled costs in the realization of project implementation will affect the profit gain from project work carried out without neglecting the quality and timeliness of completion of work. The work items in a construction project are very detailed and complex, so it requires data management that requires precision and accuracy (Kementerian Pekerjaan Umum Dan Perumahan Rakyat (PUPR), 2017).

PT. Selo Adi Karto is one of the Regional Owned Enterprises engaged in construction located in Hamlet RT 45 RW 15 Donomulyo Nanggulan Kulon Progo, Yogyakarta. Based on the results of observations and interviews with related parties, namely the head of the section and site manager, currently PT Selo Adi Karto has not implemented an integrated and centralized information system because the system has not been automated and is still done manually. The existing information system is experiencing obstacles in its development because the system is not in line with current business processes and is made to meet the needs of each part only. This has an impact on; it takes a long time to process organizational data, access to organizational data cannot be done in real-time, being an obstacle for management in data transparency, all users who have access to the system cannot see all the most up-to-date information whenever needed, even if the information is inputted by other users, in order to meet these needs, an integrated system is needed, and is able to keep up with changes in business processes that occur. The purpose of this research is to produce a desktop-based application program that can be used to facilitate business management in the construction sector using the Togaf method.

## **METHOD**

The research method used in this research is the action research method (Action Research) because it aims to make changes, improvements and increase the company's performance. Grundy (1995) explains that action research is an effort to improve understanding, methods and conditions that are carried out collaboratively. Stringer (2007) defines action research as a systematic approach in conducting investigations that allows people to find effective solutions to the problems at hand (Afiyanti & Rachmawati, 2014). Action research aims to solve practical problems encountered in organizations or communities by involving related parties (stakeholders) using a scientific approach to achieve the desired improvements and changes (Sharon Lufungulo, Mambwe, & Kalinde, 2021). To analyze and design this Information System, the TOGAF Architecture Development Method (ADM) method is used. The first step that needs to be considered when using TOGAF ADM is to define the preparations, namely by identifying the architectural context to be developed, the second is to define the strategy of the architecture and determine the parts of the architecture to be designed, starting from business architecture, information system architecture, technology architecture, and determine the capabilities of the architecture to be designed and developed (Zulfikri, 2021).

The stages of research carried out in compiling this research can be described as follows:

1. Formulation of research problems, which generate research questions (research questions) about the problems studied.
2. Literature study by studying various documents/references related to the company and theories related to the TOGAF framework, its components, and how to identify a function to be used as a service that can be shared or reused. The literature study was carried out both online and through books and printed documents.
3. Collecting data, both primary data and secondary data, according to the company's environment, namely:

- a. Primary data, in the form of interviews with PT. Perwita Construction related to research issues. The results of data collection through interviews will then be used as a basis for analyzing the business environment and information systems/information technology, so that the need for future information technology architecture can be identified.
  - b. Secondary data, in the form of documents/references related to research issues contained in the company, such as business processes through the Evaluation Report of PT. Construction Perwita, company profile, operational plan document, and company strategic plan document, in which these documents contain the company's vision and mission. The identification of the vision and mission is needed to determine what strategy will be taken next to support the smooth running of the company's activities.
4. If the data taken is not enough, then the data is taken again. However, if the data collected is sufficient, then the next step is to analyze the data that has been collected using the TOGAF Framework.
  5. The next stage is to analyze the results of data collection and literature study in the design process in accordance with the stages of the framework of thinking in the preparation of this research.

The last stage of the research methodology in the preparation of this research is drawing conclusions and suggestions from the research that has been done.

## **RESULTS**

The results of research conducted on the Activities Process PT. Selo Adi Karto which involved several sources from the company's internal parties covering all relevant organizational units, then the description of the problems found in enterprise operations are:

### **Income**

The process for withdrawing funds from the value of the work contract is still done manually, including payment terms, onsite materials and escalation activities.

### **Logistics**

The material procurement process is still carried out manually including the activities of Request for Goods, Purchase Orders, Receipt of Goods, Purchases, Use of Goods, Scheduling, and Authorization of Payment of Work Contracts.

### **Realization/Job Costing**

The actualization process is the implementation of the building construction process as a follow-up to the contract that has occurred in the sales process. This activity includes recording the financing of each physical work as well as the progress of the work. This activity is also still done manually so that the required information cannot be directly presented in real time.

### **Finance**

The thing that is most vulnerable and becomes more supervised is that the financial recording process, which is also still done manually, is very vulnerable to fraud. This process includes the activities of recording cash, recording bank transactions, accounts payable, receivables, employee receipts, employee receivables, payment of sub-contractor work contracts.

### **Accountancy**

This process presents accounting reports in the form of journals, ledgers, work sheets, income statements and balance sheets. This process is completely absent, which causes the company

to not be able to read reports in the form of a balance sheet and profit and loss in a general way that reflects a portrait of the company's development.

**Budget**

A useful process for monitoring the implementation of development both in terms of quantity and cost. This process is important for early monitoring of the progress of work and predicting the efficiency of work in detail. This process has also not been implemented by this company.

**Schedule**

This process presents a schedule of work plans from 0 percent to 100 percent as a guide in carrying out work so that there are no delays in completion. This process also does not exist. The definition of needs at the Architecture Vision stage is the vision, mission, goals, objectives and organizational structure.

Currently, there are 11 units of computer equipment (PCs and Laptops) that are used by organizational units. The computer equipment owned by the company can be seen in Table 3.9. The condition of the network is that it has not been connected between one unit and another. However, it already has a wireless network with an Access Point with infrastructure of 1 PC unit from a Server Computer with a wireless modem as well as an access point as shown in Figure 1

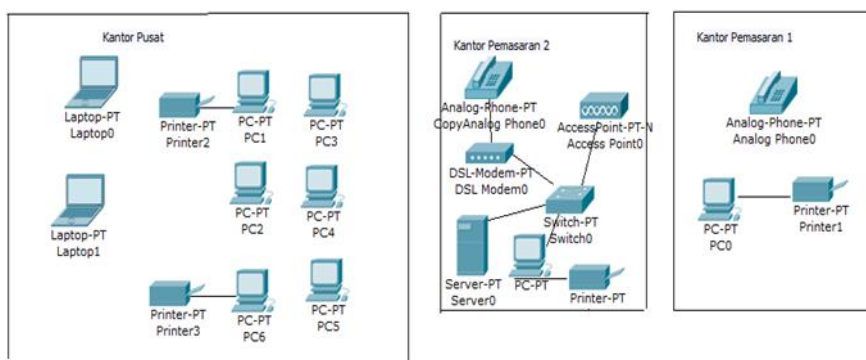


Figure 1. Current network topology

Overall the proposed technology platform can be described in detail on the network topology as shown in Figure 2

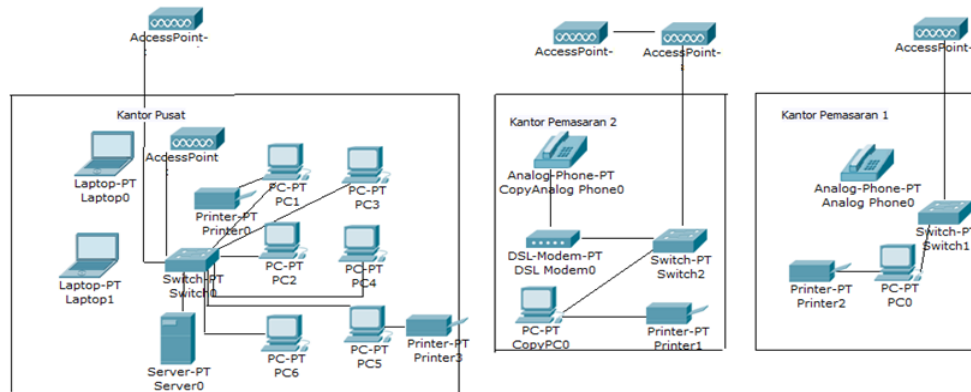


Figure 2. Network Topology Proposal

## **DISCUSSION**

The analysis conducted on the enterprise architecture of PT. Selo Adi Karto was carried out using the TOGAF-ADM approach on business architecture, data architecture, application architecture and technology architecture. The analyzed TOGAF-ADM iteration and system design will only be carried out in the Vision Phase, Business Architecture Phase, Information System Architecture Phase and Technology Architecture Phase. To map each functional activity, Value Chain Analysis is used (Zulfikri, 2021). Preliminary is the initial stage which is the preparation stage for enterprise architecture planning. This stage is carried out so that the architectural modeling process can be well directed. At this stage it is defined how the enterprise architecture will be created. The preliminary stage is to determine the scope of the enterprise organization, determine the framework and methodology that will be used in the development of the enterprise architecture (Murti, Prasetyo, & Fajrillah, 2017).

The architectural framework used in designing the enterprise architecture of the Project Cost Control Information System of PT. Selo Adi Karto is a TOGAF framework with ADM methodology. The ADM method has 8 iteration stages, including:

1. Phase A. Architecture Vision
2. Phase B. Business Architecture
3. Phase C. Information System Architecture
4. Phase D. Technologi Architecture
5. Phase E. Oppurtunities and Solution
6. Phase F. Migration Planing
7. Phase G. Implementation Governance
8. Phase H. Architecture Change Management.

These literacys must refer to the enterprise business strategy set in the Requirement Management iteration circle. Seeing the broad scope of the enterprise architecture of PT. Selo Adi Karto, so this research will only discuss the Phase A, B, C and D iterations. The purpose of this stage is to determine a process requirement for the enterprise architecture is identified, stored, and entered into and out of the appropriate ADM stages. Business scenarios are the main resources that must be developed at this stage. The business scenario must include functional activities, process activities and organizational issues. PT. Selo Adi Karto is a construction company engaged in the construction of roads and bridges as well as buildings. Functional activities consist of main functional activities (primary activities) consisting of sales, realization, logistics and support functional activities (support activities) consisting of funding, human resources, facilities and infrastructure. The above activity mapping is then translated into activities according to the enterprize strategy which includes supporting activities consisting of finance, accounting, budgeting, scheduling and the main activities consisting of income, realization, logistics. In accordance with the description above, the process activities at PT. Selo Adi Karto consists of:

1. Primary activities:
  - a. Income
  - b. Logistics
  - c. Realization/Job Costing
2. Support activities
  - a. Finance
  - b. Accounting
  - c. Budget
  - d. Schedule

The company's vision is to be the best by providing many benefits to the community and strives to always be at the forefront with full of continuous innovation in realizing the City of Yogyakarta as a Residential City that has a beautiful, green, safe, comfortable and religious environment. The company's mission is to realize a housing concept that combines quality physical development with a balanced greening environment and is committed to developing on your trust and togetherness. Stakeholders who have an interest in PT. Selo Adi Karto includes:

1. Owner consisting of Commissioner of PT. Selo Adi Karto
2. Organizational Unit of PT. Selo Adi Karto consists of Director, Site Manager, Quality Engineer, Head of Finance, Kabag. Accounting, Kabag. Marketing, Head of Administration, Coordinator of Implementation, Logistics, Executor.
3. The government consists of the Ministry of Public Works and Public Housing of the Republic of Indonesia, the Provincial Government and the Regency/City Government in Yogyakarta.
4. The community consists of housing residents and the surrounding community

The Business Architecture phase aims to understand the current conditions of organizing activities at PT. Selo Adi Karto and subsequently made a proposal for improvement by modeling the business architecture. Understanding business process conditions at PT. Selo Adi Karto is carried out by direct observation of the institution by involving the relevant organizational units in it. Observations are made by identifying business processes and administrative services. Operational Problems of PT. Selo Adi Karato in accordance with functional activities, defined 12 problems. Of the 7 activities with 12 problems, all of them are caused by the inadequate use of ICT or SI / IT in the operational activities of the organization. PT. Selo Adi Karto has utilized ICT in its administrative services but is still limited to recording using Office applications. The data owned belongs to certain parts only and is not integrated with other parts so that data incompatibility between parts may occur.

However, in addition to these problems, the resource that can support these activities is PT. Selo Adi Karto has ICT facilities including personal computers, laptops, printers, scanners, internet and hotspots. Computer network in the process of installation. The solutions that can be proposed based on the problems in as follows:

1. Operational Solutions  
Operational solutions are aimed at being able to solve problems faced by the organization from the point of view of operational activities
2. Information System Solutions  
Information System Solutions are all procurement applications that can be integrated both data and applications in an online-based integrated system.

The design of the data architecture aims to define the data needs that will be used in the application architecture. The definition of entity candidates is based on activities that have been defined using the previous Value Chain. Entity candidates are determined based on the needs of the data entity in each activity that can be shared according to the function of each section so that it is expected that there will be no duplication of data and each section does not have its own data. After the application system architecture is compiled, the next step is to carry out the mapping process of infrastructure components referring to the TOGAF Technical Reference Model (TRM), as follows:

- a. Infrastructure Application
- b. Business Application

The Tecnology Architecture phase aims to identify the current technology and propose a technology platform for the needs of PT. Selo Adi Karto.

#### 1. Present condiition

Utilization and use of information and communication technology in the current service, PT. Selo Adi Karto already owns and utilizes ICT in every operational activity, but it has not been optimally and has not been integrated between departments. These conditions can be defined as follows (details can be seen in Appendix 10):

- a. The operating systems used include Windows XP and Windows 7. This relates to the condition of the hardware owned and also the ability of personnel to operate the existing computer system.
- b. The data processing used is in the form of office applications from Microsoft Office (Word, Excel, Powerpoint) with various versions, including 2003, 2007 and 2010. There is no data processing that can share data as a shared resource between sections, and each the part that processes its own data, owns it and allows the data to be the same is also needed by other parts.
- c. Processors owned include Dual Core, Core i3, and Core i5. There are 5 Dual Cores used by Marketing 3 units, Adm. Finance and Technical Administration because this tool has been held earlier than the other tools. One computer device that has a Core i3 Processor is used by the Site Manager. . While the Core i5 Processor is a computer for the server that is used to accommodate all client data.
- d. Input devices used include keyboard, mouse and scanner.
- e. The output devices are printers (laserjet and inkjet), monitors (CRT, LCD, LED), LCD projectors.
- f. The communication equipment and network owned are telephone and facsimile networks as well as the Telkomnet Speedy internet network, but only in the form of a wireless network for local internet access needs. Between parts have not been connected via a wireless network or by cable.

Currently, there are 11 units of computer equipment (PCs and Laptops) that are used by organizational units. The computer equipment owned by the company can be seen in Table 3.9. The condition of the network is that it has not been connected between one unit and another. But already have a wireless network with an Access Point with infrastructure of 1 PC unit from a Server Computer with a wireless modem as well as an access point.

#### 2. Technology platform proposal

Based on the proposed data architecture and applications and network services to be provided, including internet, LAN network, database and application, the proposed technology platform is as follows:

##### a. Network services

- 1) Wireless network service for the access point plus 2 pieces adds to the service range.
- 2) Building a cable network system between sections
- 3) Increase the bandwidth of the internet network

##### b. Databases and application servers

Used to store and process applications and databases. The software needed to operate the software are:

- 1) Name: Microsoft Windows 7  
Source: Microsoft  
As a computer operating system
- 2) Name: Apache Web Server version 5.0.51b  
Source: GNU Public License  
As Server

- 3) Name: Microsoft Windows Server 2008  
Source: Microsoft  
As a Server
  - 4) Name: PHP Programming  
Source: open source
  - 5) Visual Basic: P emplograms  
Source: Microsoft  
As a programming language needed in running software
  - 6) Name: Mozilla Firefox  
Source: Mozilla  
As an internet browser where the software is run.
  - 7) Name: MsSQL Server 2008  
Source: Microsoft  
As a Database required in operating the software.
- c. Hardware availability
- 1) For the hardware is sufficient
  - 2) Need to add 1 PC unit to Marketing for Catalog application
  - 3) Need to upgrade a Dual Core PC device to a better device
  - 4) Procurement of finger prints and magnetic card readers for attendance applications both in the lobby for employee attendance
  - 5) The printer owned can be maximized by sharing its use together in each unit and between units
- d. Person in charge of infrastructure
- 1) It is necessary to establish a unit responsible for the infrastructure that has been implemented to maintain the continuity of the use of information and communication technology.
  - 2) Addition of personnel and attend training periodically. Overall the proposed technology platform can be described in detail on the network topology as shown figure 2.

## CONCLUSION

The results of this study are outlined in the form of a blueprint which is used as a reference in the development of a project cost control information system at PT. Selo Adi Karto. the research results have been analyzed using the chain and TOGAF methods which produce a proposed portfolio of applications that will become data for implementation. The architecture designed which is the result of this research is in the form of an integrated project cost control information system in computer network technology.

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