Web-Based Project Management Information System in Construction Projects

M R Fachrizal, J C Wibawa, Z Afifah
1,2,3Department of Information System, Universitas Komputer Indonesia, Indonesia

Email: *rajab@email.unikom.ac.id

Abstract. The current problem is that the process of managing data about the progress of project work and managing project financial data cannot be done properly because the data recording is done on paper media and is not well coordinated. This has an impact on the difficulty of project owners and project consultants in controlling project work. The purpose of this research is to analyse how the current project work control process is and to design an information system to optimize project work control. In developing this system, researchers used the prototype method, starting with gathering system requirements, building mock-up, and testing by users. The results of this research are web-based project management information system design that can manage and control project work and project financial data. All documents can be directly uploaded to the information system thereby minimizing document loss. The process of financial control both project expenses and revenue is much better because it can be monitored more closely and thoroughly so as to reduce fraud. Project activities can work better because of computerized working time monitoring and better control if there are delays in work. This research provides an overview of project management information systems that can be used to manage construction projects.

1. Introduction
CV Bumi Pustaka Emas is a company engaged in the construction of buildings and roads that refer to the construction of office, education and hospital buildings, and road construction. The current problem at CV Bumi Pustaka Emas is that the process of managing data about the progress of project work and managing project financial data cannot be done properly because the data recording is done on paper media and is not well coordinated. This has an impact on the difficulty of project owners and project consultants in controlling project work. Based on these problems, an information system is needed to facilitate the project management process. Project Management Information System is an information system consisting of the tools and techniques used to gather, integrate, and disseminate the outputs of project management processes [1].

Application of information systems has advantages in the project management process. As in research [2], project management information systems can help project managers to make decisions. Whereas research [3] explains how the positive effects of web technology on project management information systems can help facilitate communication and expansion of access between project teams. Project management information systems can be used to monitor the quality of costs in projects as in research [4]. Some previous research on design and development project management information systems is research [5] that discusses about how to design project data management information systems at PT XYZ. In this research, the system design is described in the use case diagram. In research [6], discusses how to design a project management system based on a service oriented architecture (SOA) approach to IT consultants. In research [7], discussing about the design...
and development of web-based project management information systems for software developer. In the case of construction projects, research [8] describes the development of information systems that are focused on the project planning process using the Probability Impact Matrix and the Precedence Diagramming method. In this paper, we designed a web-based project management information system for a construction project that could automate the process of ordering construction services, project planning, controlling costs and project activities, and project reporting.

The purpose of this research is to analyse how the current project work control process by observing, interviewing, and collecting the required documents, and to design an information system to optimize project work control using prototype method.

2. Method
2.1. Prototype Method
The stages in building a project management information system used the prototype method. The prototype method begins by gathering user needs. The collection of user needs is done by observing, interviewing, and collecting the required documents. The next stage is to analyse and gather information systems about the needs of users that have been collected. In this process, we used UML diagrams to facilitate the depiction of prototype systems to be built. The next stage is building a prototype system. The prototype is then trailed for users to find out the deficiencies. If there are deficiencies, then the prototype will be repaired that already meets the user's needs [9]. (Figure 1).

![Prototype Method](image)

Figure 1. Prototype Method [10]

3. Result and Discussion
3.1. Evaluation on Current System
Based on the results of the current system analysis, there are several problems in the project management process as shown in Table 1. In Table 1, it is describing the problems that occur and solving those problems.

| No | Current System | Solution |
|----|----------------|----------|
| 1  | There is no system that can make it easier for consumers to order construction services. Consumers order construction services by telephone or have to come to the office | Build module to construction project order on web-based project management information system. This module will make it easier for consumers to order the services they need without having to go far to the office first |
| 2  | Purchases of materials are not controlled properly resulting in frequent loss of material and purchases that are not in accordance with needs | Build modules to control project finance on web-based project management information systems |
| 3  | Project data and progress are not well | Build modules to control progress and be |
3.2. Design of Information System

This project management information system is described as a facility that provides project ordering services in the field of building construction and maintenance, provides facilities for project planning starting from the budget and material costs needed, provides control facilities for controlling expenses, as well as controlling the progress of the project being used in CV Bumi Pustaka Emas. In the ordering section, which includes facilities to facilitate consumers to place an order, starting from filling data and selecting services, the prices are according to the needs of each consumer so that it makes it easier for consumers to order services. Besides, for the auction facility itself is useful as data collection of all projects originating from the official auction through LPSE, which is the official project auction system from the government. This auction facility was held because of the many cases of the loss project documents that came from winning the project tender. Therefore, in order to minimize the loss of these documents, we proposed making this auction facility. There is also a proposal. Moreover, the reason why we built this auction facility is because the company got a project or a job not only through a personal order but also through an official auction held by the government. Then the planning system is also built to plan the budget used in a project, plan the duration of project work by making a time schedule, and to make plans to use building materials.

This system also supports the project control process in terms of controlling expenses during project activities as to minimize fraud when purchasing material materials and controlling what materials have been purchased so that when there is a discrepancy in spending can be directly checked at the beginning and controlling the progress of the project being worked on.

The use case diagram shows us the relationships that occur between actors with use cases in the system. Figure 1 is the use case diagram of the proposed project management information system.

![Use Case Diagram of Information System](image)

Figure 2. Use Case Diagram of Information System

In Figure 2, there are several actors involved, namely Consumer, Comanditaire, and Consultant. Consumer conducts the order process for construction project services to Comanditaire. Comanditaire manages booking data, then passes on to the consultant for project planning. The consultant is responsible for controlling each project. All project work activities are summarized in the form of...
reports. Consumer, Comanditaire, and Consultants can access every report related to the project being worked on. The description of each actor can be seen in Table 2.

### Table 2. Actor Description

| Actor          | Description                                                                 |
|----------------|-----------------------------------------------------------------------------|
| Consumer       | People who will order construction services through the system.              |
| Commanditaire  | People who are fully responsible for all activities in the company          |
| Consultant     | Planner technical drawings, development plans, budget                        |

Descriptions of each use case can be seen in Table 3.

### Table 3. Use Case Description

| Use Case | Description                                                                                                                                 |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Order    | The process of ordering construction services. Consumers (apart from the government) can also order the construction services they need. |
| Auction  | Project auction process. The company obtained a project tender through an official tender process held by the government through the LPSE official website |
| Planning | The process of planning project activities. After conducting a field survey, the consultant will start making plans for the project activities to be carried out. |
| Controlling | The process of controlling project activities. This process is the process by which all relevant officials work together in monitoring the project. |
| Report   | The process of making reports of project activities that have been carried out both planning and control in order to be checked again by the limited commission |

3.3. *Design of Interface*

The interface of the information system is useful as a medium of communication between the user and the information system. The design of the interface serves to provide an overview to the user how the user interacts with the system. Figure 3 is one of the interface designs in the project planning module.
3.4. Software Testing

Software testing on this information system is carried out using the Black Box method, where testing is carried out directly to the user experience of the software including by inputting it to produce the expected output. Table 4 is one of the information system testing plans in the ordering module:

| Test Description                  | Expected Result                                                                 | Actual Result                                                                 | Status   |
|-----------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------|
| Fill in the Order Form Data, Send Orders | Can access the main form in accordance with the access rights                  | Access the main order form according to the access rights and the system displays the message “Order Sent” | [✓] Accepted [ ] Rejected |
| Order Data not sent               | The system displays a message that the Order failed to send                     | The system displays the message “Order failed to send”                       | [✓] Accepted [ ] Rejected |
| Order by emptying the email column| The system displays messages to fill in email data                              | The system displays the message “Please fill out this field”                 | [✓] Accepted [ ] Rejected |

4. Conclusion

From the results of this study, it can be concluded that with the development of this system, consumers can more easily make the process of ordering construction services according to their needs. All important document storage processes can be done more easily because it can be directly uploaded to the system that has been created and minimize the document loss. The process of financial control both project expenses and income is much better because it can be monitored more closely and thoroughly so as to reduce fraud. Project activities can run more timely than before because of the monitoring of the computerized working time and more controlled if there is a delay in work.

Acknowledgments

Thank you to the Rector of the Universitas Komputer Indonesia and all INCITEST committees for this conference. Then, all members of the Information Systems Department who have supported the INCITEST 2020.
References

[1] Drob, C., & Zichil, V. 2013. Overview regarding the main guidelines, standards and methodologies used in project management. *Journal of Engineering Studies and Research, 19*(3), pp. 26.

[2] Caniëls, M. C., & Bakens, R. J. 2012. The effects of Project Management Information Systems on decision making in a multi project environment. *International journal of project management, 30*(2), pp. 162-175.

[3] A. Lupasc. 2016. Project Management Information System Based on Web Technologies. in *The European Proceedings of Social & Behavioural Sciences*, Pitești.

[4] Dhawale, P. Z. A. INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY PROJECT MANAGEMENT INFORMATION SYSTEM IN CONSTRUCTION INDUSTRY.

[5] Fadillah, A. P., & Fitriana, D. 2019. Design of Project Data Management Information System. In *IOP Conference Series: Materials Science and Engineering, 662*(2), pp. 022014.

[6] Girsang, A. S., Jafar, F., & Fajar, A. N. 2018. Design Project Management System Based on SOA Approach. In *Journal of Physics: Conference Series, 1090*(1), pp. 012079.

[7] Ratnasari, T., Ambarwati, A., & Al Azam, M. N. 2017. Rancang Bangun Sistem Informasi Manajemen Proyek Untuk Pengembang Perangkat Lunak Pada PT. Quantum Leap. In *Seminar Nasional Sistem Informasi (SENASIF), 1*(1), pp. 525-532.

[8] Mardiani, G. T. 2018. Construction industry project planning information system. In *IOP Conference Series: Materials Science and Engineering, 407*(1), pp. 012093.

[9] Sidorova, A. 2013. Business Analysis as an Opportunity for IS Programs in Business Schools. *Communications of the Association for information Systems, 33*(1), pp. 31.

[10] Pressman, R. S. 2005. *Software engineering: a practitioner's approach*. Palgrave macmillan.