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Build a Construction Management Application Based on PHP, JavaScript, CSS, MySQL, and Bootstrap

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***Abstract*—** *By utilizing the fast developing information technology these days the researchers try to build a construction management application which simplify people in accessing application to make implementers only need to send data about the project location, type of work, work volume and number of workers in real time where automatically being recorded directly in the database because the application is online based. Therefore, it is possible to know and control multiple projects. Construction management applications based on JavaScript, PHP, MySQL and Boostrap can be built through several stages of research, namely: 1) Potential and Problems; 2) Field Observation; 3) System Analysis; 4) System Design; 5) Application Design; and 6) Application Testing. The assessment of the construction management application was carried out at the validation stage by 3 (three) respondents and the trial stage was carried out by 10 (ten) respondents consisting of administrators, field implementers and directors. The final product built is a construction management application based on PHP, JavaScript, MySQL and Boostrap.*

***Keywords*—** *Construction Management, Construction Management Application*.

I. INTRODUCTION

One from many development targets of Regional Government in order to achieve its vision and mission is an acceleration of regional infrastructure development, stated in annual working program and activities of Bima Regency Public Work Office (*Dinas Pekerjaan Umum)* in the form of construction project implementation. Project managers often dealing with problems about construction project work packages that sometimes amounted into more than 5 (five) packages which termed here as "Multi Construction Projects" in 1 (one) current budgeting year. According to Irawan & Syairudin (2015) multiple projects have more than one goal even though carried out at the same or different locations. While Aritua, Smith, & Bower (2009) stated that most projects are parts of a multi-project environment. The management of multiple projects presents challenges that fundamentally different from single project management. Recent theoretical developments provide a foundation for gaining insight into the proposition that multi-project management is not an extension of single project management. In an essence, a multi-project environment is showing characteristic when offering a new approach to its project managers.

According to Gray & Larson (2011) evaluation and control are part of the job of every project manager. Taking from a wide scope perspective, a management of multi construction projects with a limited time only 1 (one) budgeting year in a run, it is obvious very difficult for project managers to monitor and control the above projects. Gray & Larson (2011) also stated that for effective control, project managers need a single information system to collect good data and information.

In general, poor quality information will lead to poor decision making as well (Blichfeldt and Eskerod, 2008; Elonen and Artto, 2003; Engwall and Jerbrant, 2003). Construction project management information system applications must provide a support to project managers or company directors in making decisions for planning, organizing and controlling projects (Caniëls and Ralph, 2011). The use of project management information system applications is considered to be beneficial to project managers because of its assumed contributions regarding to precise decision making and the fruitfulness of the project. (Raymond and Bergeron, 2008). Implementation of a construction project management information system application in a multi-project scope can help in completing realistic project tasks, one effective strategy when managing various projects (Patanakul and Milosevic, 2008a). A construction management information system application makes *it easy for teams in companies to finish construction work on a project activity in accurate an relevant ways wherever they are located*.

II. LITERATURE REVIEW

A. Construction Project Management

In general, construction project management is defined as follows: project management is the art and real act of desire through a series of predetermined efforts to achieve the desired results that leads to a surprising profit achievement. Project management plans, organizes, directs and controls company resources for a relatively short time objective in order to achieve specific goals and targets. Project management is a systems approach method of arranging/managing the functions of each personnel either through a vertical or a horizontal hierarchy. The product goal of holding a project is to complete several goals by together or individually. The reason for organizing project tasks is to put a focus on responsibility and authority for completing the project objectives. (Oetomo, 2014).

B. Project Management Information System

One responsible aspect for the success of project management is determined by the availability of information needed for management team when making decisions. The right decision is influenced by the availability of accurate, punctual and complete information regarding schedules, costs and performance. Thus, there is a need to create a system that is able to provide the information requirements (Santosa,

2009). In general, the project management information system is expected to be able to:

1. Provides the necessary information for planning, controlling and summarizing documents,
2. Separates the data from other computer information systems into the related project database,
3. Integrates work, cost, labor and schedule information to produce planning, control and summary reports for project managers, functionaries and also the higher management.

C. Project Monitoring Pattern

In discussing project monitoring that exceeding other discussions there are aspects must be considered, what pattern will be applied for project control, how is it possible to understand the provisions of the project control system, how is it possible to understand the provisions of the project control system without understanding the aspects of the project objectives, and how to complete the project measurements.

The primary approach in project evaluation and project control is emphasizing on project work activities besides the project selection and planning. Logically, in project selection, it is determined by amount of components to be evaluated and a detailed planning of these evaluated elements that must be controlled and also the ability to measure it based on a well-structured sequence of activities. To find out the valid differences between the realization of the progress of activities against the planned project activities, a project monitoring must be carried out at all times.

D. Work Evaluation and Work Measurement

According to Gray & Larson (2011) evaluation and control are part of the job of every project manager. Controls with "frequent inspection" and/or "involvement" can address the problem in more detail for small projects. However, large projects require some forms of formal control. The control perfomed by the person in charge is needed to prevent small problems erupted into big problems and also for maintaining focus.

Control is one of the most neglected aspects of project management. Unfortunately, it is common to find resistance to process control. On the basis, those who minimize the importance of control will miss a great opportunity to become effective managers and disabling organization to gain a competitive advantage. Ignoring control in organizations with multiple projects is even more serious. For effective control, project managers need a single information system to collect data and report progress on costs, schedules, and specifications aspects.

III. Research Methodology

A. Data Collection Technique

Data collection technique is the main activity in a study to achieve quality research results. The data collection technique applied in making construction management applications based on PHP, Javascript, MySql and Boostrap are as follows:

1. Literature study is an attempt to collect all information relevant to the topic or problem to be studied. The type of literature study is finding and collecting sources of information in the form of scientific books, research reports, and other related sources both written and digital forms.

2. Interview is a data collection technique applied when the researcher wants to conduct a preliminary study to gather information and analyze problems. The type of interviews conducted in this study is using direct question and answer session with the respondents (sources) related to the needs and problems that occurred during its field implementation.

The questionnaire for this study is used to collect data on respondents which contains of several questions aimed at knowing the practicality of the construction management applications (apps)

B. Population and Sampling

The population of this study was taken from 15 respondents where divided into 3 (three) user levels (administrator, field implementer and director), and the sample selection was carried out by purposive sampling selected as research samples which have certain criterias (Sugiyono:2004, in Puka:2019). The criteria for respondents are those who are competent in operating computers and processing data and have served as field surveyors and leaders in the bureaucracy as directors.

C. Variable Measurement Scale

The type of interval scale applied in this study is a Likert scale. This is a measurement scale that shows how strong the level of agreeing or disagreeing from a statement (McDaniel and Gates:2013, in Puka, 2019). There are three reasons why researchers use a Likert scale. First, the Likert scale makes it easier for respondents to answer the questionnaire whether they agree or disagree (Malhotra:2012, in Puka, 2019). Second, it easy to use and understand by respondents (McDaniel and Gates:2013, in Puka, 2019). Third, from visual perspective, a Likert scale is more attractive and easy to fill for the respondents (Sugiyono:2017, in Puka, 2019). Measurement with Likert scale is held by dividing the answer into several qualifications:

TABLE 1. Variable Measurement Scale

Scales	Qualification
1	Very Good
2	Good / Fair
3	Quite Good
4	Poor
5	Very Poor

TABLE 2. Five Scales Achievement Level Conversion

Achievement Level	Qualification
90 % - 100%	Very Good
75 % - 89%	Good/Fair
65%-74%	Quite Good
55% - 64%	Poor
0%-54%	Very Poor

Source: Tegeh et al., 2014:82

The indicator of research variables used in this study is applied to determine the level of practicality and efficiency of results from the Construction Management Application. The value given levels and decision making are using conversion provisions of achievement with a scale of 5. The list of

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conversion levels of achievement with a scale of 5 is displayed in table 2.

D. Research Instrument Test

Arikunto (2010: in Puka: 2019), explains "whether good or bad the instrument is, will affect the accuracy of the data obtained, while whether true or false the instrument is, really determines the quality of the research results". To test the feasibility and validity of the data obtained, it is necessary to conduct a pilot study or preliminary study as an initial test or an experiment to the research instruments to prove whether the questionnaire is reliable and valid for use in actual research (Puka, 2019).

The test instrument is composed on the basis of practicality and efficiency while applying the construction management applications. For the test instrument in this study is using the rating scale method, by providing numbers based on the indicators that have been evaluated. The test instrument validation will be carried out by 3 respondents who then provide an assessment of the test instrument which later will be used in the process of testing project management applications based on PHP, Javascript, MySQL and Boostrap. The test instrument will be distributed to research subjects who will be assessed to determine whether it is feasible or not to put in this study.

TABLE 3. Variabel Measurement Scale

Scales	Qualification
1	Very Valid
2	Valid
3	Quite Valid
4	Less Valid
5	Not Valid

E. Data Analysis

The data analysis technique for this study is a quantitative descriptive analysis, which is used to process data obtained from the questionnaire above in the form of a percentage descriptive trial questionnaire. The formula used to calculate the percentage is as follows (Tegeh et al., 2014: 82):

$$P = \frac{\sum x}{\text{SMI}} x100\%$$

Where :
P = Percentage
$\sum x$ = Total scores
SMI = Maximum Ideal Score

Next, to calculate the percentage of all subjects, the following formula is applied (Tegeh et al., 2014: 82):

$$P = \frac{F}{N}$$

Where :
P = Percentage
F = Total Percentage of Overall Subjects
N = Number of Subject

IV. Research and Discussion

A. The Result of Instrument Testing

The testing of construction management applications were carried out by involving several users of three respondents who were validators at the Public Work Office in Bima Regency, while decision making on the validity testing of construction management applications based on Javascript, PHP, MySQL and Bootstrap was using the Rating Scale method based on the provision of indicators that will be evaluated later. In collecting sample results, there are several stages were applied in these orders: educating respondents about the use of application, the method in using the application and distributing questionnaries that would be used in taking result in this conducted study.

TABLE 4. Table of Validator Instrument Assessment Test

No	Components/Indicator	V 1	V 2	V 3
1	I am satisfied with the appearance of construction management applications based on Javascript, PHP, MySql and Boostrap.	5	4	4
2	I can easily access construction management application based applications using Smartphones, Laptops and Tablets.	4	4	5
3	Construction management application is easy to understand	5	4	4
4	I am satisfied in accessing information about the construction project that is being done	4	5	4
5	I can easily get information about job criteria	4	5	4
6	I am satisfied with the construction budget plan directory	4	4	4
7	I am satisfied with the feature for filling in the Daily Report section	4	4	4
8	I am comfortable with the responsive display of construction management applications	4	5	5
9	I can save time, effort and money to do job planning.	5	5	4
10	I can save time, effort and cost in reporting work progress	5	4	5
11	I am very satisfied with the accuracy in the calculations	4	4	5
12	Requires an online based construction management application	5	5	5
Total Score		**53**	**53**	**53**
Percentage		88%	88%	88%
Overall Percentage		**88%**		

Based upon the test result assessment of construction management application instruments from administrator as shown in table 1, administrator's obtained scores is 88 %. While for scale achievement that displayed on Table 4, it can be concluded that the construction management application based on Javascript, PHP, MySQL and Boostrap is in a valid qualification state to be implemented and used.

B. Data Analysis Result

The population in this study was 10 respondents divided into 3 (three) user levels (Administrator, Field Implementer and Director), and the sample selection was carried out through purposive sampling which selected as the research sample that owned certain criteria (Sugiyono:2004, in Puka, 2019). The criteria for respondents are respondents who are competent in operating computers and processing data, who have served as surveyors in the field and leaders in the bureaucracy as directors.

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1. Result analysis of user interface test on administrator

TABLE 5. The Result Analysis of User Interface Test From Administrator

No	Components/Indicator	A1	A2	A3
1	I am satisfied with the appearance of construction management applications based on Javascript, PHP, MySql and Boostrap.	5	3	4
2	I can easily access construction management application based applications using Smartphones, Laptops and Tablets.	4	4	5
3	Construction management application is easy to understand	5	5	5
4	I am satisfied in accessing information about the construction project that is being done	4	5	3
5	I can easily get information about job criteria	5	5	4
6	I am satisfied with the construction budget plan directory	4	4	4
7	I am satisfied with the feature for filling in the Daily Report section	5	4	4
8	I am comfortable with the responsive display of construction management applications	4	5	5
9	I can save time, effort and money to do job planning.	4	5	4
10	I can save time, effort and cost in reporting work progress	5	5	5
11	I am very satisfied with the accuracy in the calculations	4	4	5
12	Requires an online based construction management application	5	5	5
Total Scores		**56**	**54**	**53**
Percentage		**93%**	**90%**	**88%**
Overall Percentage		**89%**		

Based upon the result assessment of the construction management user interface test from the Administrator shown in table 1, the obtained score can be concluded as percentage score from administrator is 89%. While for scale achievement that displayed in Table 5, it can be concluded that the construction management application based on Javascript, PHP, MySql and Boostrap is in a good qualification state to be implemented and used.

2. Result analysis of user interface test on field implementer

Based upon the result assessment of construction management user interface test from administrator shown in table 1, the obtained scores can be concluded as percentage score from the field implementer is 91 %. While for scale achievement that displayed in Table 6, it can be concluded that the construction management application based on Javascript, PHP, MySql and Boostrap is in very good qualification state to be implemented and used.

3. Result analysis of user interface test on directors

Based upon the result assessment of the construction management user interface test from the Director shown in table 1, the obtained score can be concluded as percentage score from the field implementer is 93%. While for scale achievement that displayed in Table 7, it can be concluded that the construction management application based on Javascript, PHP, MySql and Boostrap is in very good qualification state to be implemented and used.

TABLE 6. The Result Analysis of User Interface Test from Field Implementer

No	Components/Indicator	P1	P2	P3	P4	P5
1	I am satisfied with the appearance of construction management applications based on Javascript, PHP, MySql and Boostrap.	5	5	4	5	4
2	I can easily access construction management application based applications using Smartphones, Laptops and Tablets.	4	4	5	4	5
3	Construction management application is easy to understand	5	5	5	5	5
4	I am satisfied in accessing information about the construction project that is being done	5	4	4	4	4
5	I can easily get information about job criteria	5	5	5	5	5
6	I am satisfied with the construction budget plan directory	4	4	5	4	5
7	I am satisfied with the feature for filling in the Daily Report section	5	4	4	4	4
8	I am comfortable with the responsive display of construction management applications	5	5	5	5	5
9	I can save time, effort and money to do job planning.	4	5	4	5	4
10	I can save time, effort and cost in reporting work progress	5	4	5	4	4
11	I am very satisfied with the accuracy in the calculations	4	4	5	4	4
12	Requires an online based construction management application	5	5	5	5	5
Total Scores		**56**	**54**	**56**	**54**	**54**
Percentage		**93 %**	**90 %**	**93 %**	**90%**	**90%**
Overall Percentage		**91%**				

TABLE 7. The Result Anaysis of User Interface Test from Director

No	Components / Indicators	D1	D2
1	I am satisfied with the appearance of construction management applications based on Javascript, PHP, MySql and Boostrap.	5	4
2	I can easily access construction management application based applications using Smartphones, Laptops and Tablets.	4	4
3	Construction management application is easy to understand	5	5
4	I am satisfied in accessing information about the construction project that is being done	4	5
5	I can easily get information about job criteria	5	5
6	I am satisfied with the construction budget plan directory	4	4
7	I am satisfied with the feature for filling in the Daily Report section	5	4
8	I am comfortable with the responsive display of construction management applications	5	5
9	I can save time, effort and money to do job planning.	5	4
10	I can save time, effort and cost in reporting work progress	5	5
11	I am very satisfied with the accuracy in the calculations	5	4
12	Requires an online based construction management application	5	5
Total Score		**57**	**54**
Percentage		**95%**	**90%**
Overall Percentage		**93%**	

V. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

According to the result of the study conducted here, there are some conclutions from several things found from the study which stated below:

1. The Construction Management Applications based on Javascript, PHP, MySql and Boostrap can be built through several stages of research, namely: 1) Potential and Problems; 2) Field Observation; 3) System Analysis; 4) System Design; 5) Application Design; and 6) Application Testing. While assessment of the construction management application was carried out at the validation stage by 3 respondents and the trial stage was carried out by 15 respondents consisting of administrators, field implementer and directors. The final product built is a construction management application based on PHP, Javascript, MySql and Boostrap.
2. Field implementers can send the project location data, type of work, work volume and number of workers in real time, where these data will be recorded directly in the database by accessing the jmark.tech page in the browser application on each of the supporting devices used, such as smartphones, tablets, tabs and personal computers responsively.
3. According to the respondent's assessment from the administrator, field implementer and director are stated that the construction management application is practical in use.

B. Suggestions

Based on the results of the conducted study, there are some suggestions as follows:

1. Construction management applications based on Javascript, php, MySql and Boostrap can be used and maximized in a company as an instrument to improve the quality of implementation, time management, cost management, faster pace, and easy accessed from everywhere.
2. This study also can be used as a reference material for further researchers to build or develop a construction management based-application by research steps, where certainly with different research method, research subjects and research locations so it will appear a more integrated construction management application and able to develop a better (well-built/mature) construction management application.
3. This study serves as a reference for future researchers due to its effectiveness and easy understandable material.

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