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Barriers and Opportunities for the Use of ICT based on Mobile Apps in the Performing And Monitoring Phase of High Rise Building Construction in ABC Projects

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ABSTRACT: The construction industry is one industry that is still lagging behind compared to other industries, especially in the field of technology. Therefore the construction industry is trying to improve itself so that it is not too far behind other industries by trying to continue to utilize the development of information technology. The use of Information and Communication Technology (ICT) is expected to reduce time in processing data and increase productivity. Applications and software for ICT products are also expected to help improve operational activities through communication from construction information to effective and coordinated decisionmaking. Based on this, in the process there are barriers and opportunities that occur in the utilization of ICT in construction project management, so it is necessary to evaluate the use of ICT in the use of mobile-based applications called CIS in the performance and monitoring

phase of the PT "ABC" project. The ICT system evaluation method in this study uses the PIECES method which has 5 indicators as opportunity with each result and its classification as follows; Performance: 84.26% (Opportunity to be Successful), Information: 84.26% (Opportunity to be Successful), Information: 83.58% (Opportunity to be Very Successful), Control and Security: 82.98% (Opportunity to be Successful), Efficiency: 78.30% (Opportunity to be quite Successful), Service: 82.51% (Opportunity to be Successful). And the Economy indicator: 65.96% (Opportunity to be Not Successful) is the only one that is included as an indicator of the barriers that exist in the use of the use of ICT progress, related to the Reusability of only 65.53% and supporting resources of 66.38%..

KEYWORDS: sistem evaluation, construction apps, PIECES, ICT.

I. INTRODUCTION

The construction industry has a very important role in a developing country like Indonesia, especially in the development process to produce infrastructure and buildings such as dams, irrigation buildings, highways, schools and residences. The ability of the construction sector can not only improve living standards but can also obtain cost, time and quality work efficiency.

The construction industry strives to continuously improve itself and take advantage of developments in information technology. The use of Information and Communication Technology (ICT) is expected to reduce the time to process data and information communication and increase productivity. ICT applications and software products are also expected to help improve operations through communication from construction information to effective and coordinated decision making. There it is ICT can reduce the time for processing and communicating information that

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makes possible and construction productivity increases (Peansupap, 2004)¹. The McKinsey Global Institute (MGI) (2017)² journal explain in less than a decade over 10 billion dollars have been spent to invest in technology companies that are expected to produce integrated solutions that to reach out the three groups of cases of fundamental identified in the construction industry, namely: the execution process (field), digital collaboration (team), and back-office and the relationship (work). The phenomenon occurs due to the companies involved in the construction industry is expecting much and believe that the advances in technology and the information it can solve the problems that exist in the construction industry. Based on MGI (2017)², as far as this period there is 1000 application and software that under developed or has been released in construction phase project (design, pre construction, and construction and operation and management).

Efforts undertaken the construction industry to absorb and utilize ICT development so that the construction industry can continue to grow and go hand in hand with other industries keep pace with the times. But the effort is not easy, a lot of challenges that must be faced in the process. Under these conditions, challenges and opportunities for the utilization of information and communication technology in construction project management becomes interesting to discuss.

II. LITERATURE REVIEW

The process of construction projects should be undertaken management or good management to achieve that functional purpose, for the successful implementation of a construction project is not only seen from the result of the physical construction. Therefore each individual element and required a good working relationship between the elements involved in the process of construction projects. PMI (Project Management Institute)³ proposed construction project management is a science and an art related to lead and coordinate the resources that consists of people and material using management techniques modern to achieve the goals that have been determined, the scope, quality, schedule, and cost and satisfy the desire of stakeholders.

The basic aim of the phase of implementation, monitoring and controlling of this to create a building that is required by the project owner and that has been designed by consultant planners within the constraints of cost and time has been agreed upon, and with the quality that has been required and ensure that the building has been completed, in accordance with contract documents and all facilities worked properly.

ICT developments began widely used in construction projects, particularly in project management. Project management is all the planning, execution, control and coordination of a project from the beginning (the idea) until completion of the projects to ensure the projects are carried out on time, on cost, right quality. In a construction project, the presence of ICT products have an important role, especially computers, the internet, and the device has long been exploited by developed countries, for example, to process scheduling, accounting, building design, structural analysis, simulation models, and so on.

In this utilized ICT products required good management for database management and information so that the data quickly when needed for the purpose of evaluation of the activities that have been or are being worked on able to be obtained immediately. In the construction project, the information is not timely and not accurate may affect the project implementation. In fact, according Weipert et al (2003)⁴, important information is missing and can not be found again to lead such information must be regenerated. This would be hinder the development of construction projects. In addition, manual data storage and image that still use paper must be considered because the workers who work outside of the office is expected to access the information needed to do their jobs.

CIS is a mobile based application developed by the ICT department in a building construction company named “PT ABC”. CIS is made by the company to facilitate the construction management processes are expected to ease in the implementation, monitoring and decision-making in every construction process.

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In the present study the analysis methods used to evaluate the whole opportunities and what obstacles exist utilized of the application system is a method PIECES developed by Wetherbe (1984)⁵ and introduced in his book entitled System Analysis and Design: Traditional, Best Practices 2nd Ed. James Wetherbe states that the purpose of this analysis is to correct PIECES, repair and map out weaknessss of a system that is constructed in terms of performance, information, economic, control, effiency, and service. This guide is known PIECES analysis (Performance, Information, Economic, Control, Efficiency, Service). PIECES method has become one of the framework system evaluation methods used to classify a problem, barriers, opportunities, and directives contained in the definition of the scope of the analysis and evaluation of the system. This framework can be generated things-new things that can be considered in the development of the system.

III.RESEARCH METHODOLOGY

In this study aims to describe the opportunities and constraints of any in information system and technology applications CIS, to see directly description and circumstances of an objectives so that the type of research that is used in an intensive search was a descriptive study evaluative with cross sectional approach with quantitative research methods.

To analyze the data obtained by the research design using metohds PIECES where in this method can be easily analyzed from a wide range of areas from using six variables ranging from the performances (performances), information (information), economic (the economy), control (control), efficiency (efficiency) and service (service). PIECES methods used to evaluate and map out and what the opportunities are there in the use of mobile-based ICT system in construction projects with the six indicators.

IV.RESEARCH ANALYSIS

The description of the data in this study are 1 agreed variable and 1 independent variable. Following are the research variables used:

1. The successful variable (Y) consists of the level of opportunity and obstacle of application.
2. The independent variable (X) consists of a system evaluation method that is useful for knowing the weaknesses / weaknesses of the system from the user's point of view, the PIECES Method. The independent variable PIECES Method has 6 sub-variables, namely Performance, Information, Efficiency, Control, Economy, and Service.

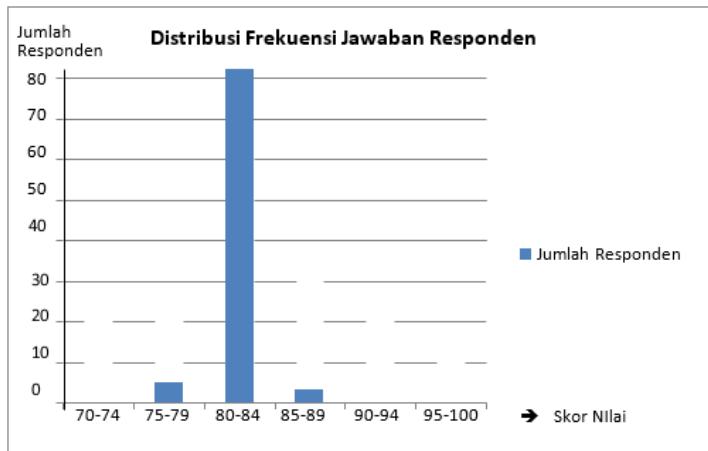
This study uses documentation or observation techniques with the application development team and a questionnaire that has been tested for validity and reliability. Questionnaires that have been proven valid and reliable are then distributed to a predetermined sample, namely all individual staff from PT ABC involved in the X, Y, Z projects. The results of questionnaire answers distributed to respondents can be seen in the following frequency distribution:

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Graph IV. 1 Frequency Distribution of Respondents Answers

The maximum score that can be obtained by each respondent is 100. Based on Table IV.1 it is known that most of the respondents have an answer score between 80-84. The above data processing obtained data description as follow:

- a. The highest score : 85,6
- b. The lowest value : 76
- c. Average value : 81.413
- d. Median : 81.60
- e. Standard deviation : 1.58

And the following data are taken based on documentation and observations made together with the CIS application development team with the help of Black Box Testing after the application has been running for the past three months.

Table IV. 1 Documentation and Observation Data Results

No	Indicator	Prospect	Result
1	<i>Performance</i>	CIS successful performance measurement system and generate reports the measurements results	From the analysis based on records, the system is recorded in one week gain system disorders (crash) by the average number of 2.7 x with the loading time has been categorized as good, namely to have been received the grade B
2	<i>Information</i>	Measurement Information System CIS succeed and generate reports the measurement results	From the analysis based on records and recording existing CIS system is in one week had an average of 3.34 times the misinformation between one phase to another phase and included in the category of good in the renewal of existing information is grade B
3	<i>Economics</i>	Measurements Economic CIS system successfully and generate reports the measurement results	From the analysis based on records and recording existing CIS system until now has been developed by about less than 30 staff, and requires

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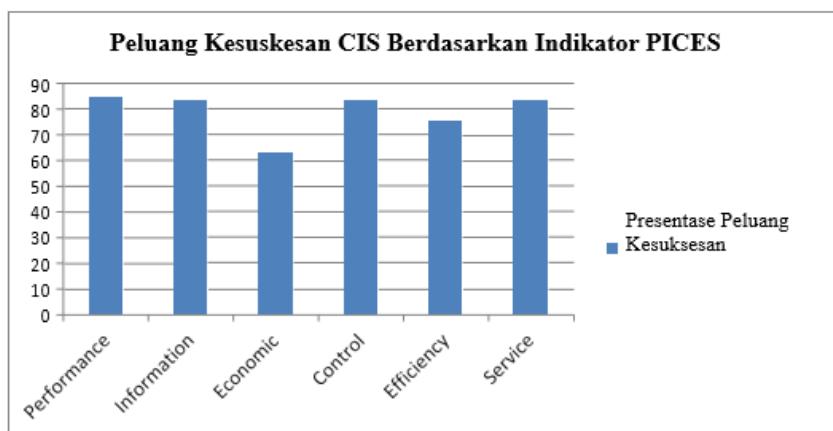
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				new technological equipment as a supporter. It signifies in the process of developing these system requires a resources that looks quite large, although due to the limited powers and secrets of the company, the uncertain value of these resources can not be obtained
4	<i>Control and Security</i>	Measurement Control system succesfully generate reports measurement results	CIS and the	From the analysis based on records and recording existing CIS system never experienced a system failure in terms of security because it is the primary concern in the development process of the system
5	<i>Efficiency</i>	Efficiency measurement system succesfully generate reports measurement results	CIS and the	From the analysis based on records and recording , because around about 71.3% are users aged over 40 years, so a lot of users feel this system instead become full obstacle job
6	<i>Service</i>	Measurement service system succesfully generate reports measurements	CIS and the	From the analysis based on records and recording, in a week on average there are about 32.8 times for the requested report in this operation system. This means in the new system guidance service utilized is still less than the maximum

Source: Results of analysis

Research data will be classified based on 6 PIECES indicators. More detailed information about the results of the CIS evaluation is needed to identify the system more deeply. Specifically, the classification of the chances of success of the CIS can be presented based on each PIECES indicator as follows:



Graph IV.2 Percentage Indicator Based PIECES CIS opportunities

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Based on Graph IV.2, the percentage of each indicator PIECES can be grouped according to criteria of the chances of success in the following table:

Table IV.2 Classification of the success rate of each indicator

Indikator	Presentase	Klasifikasi Peluang Kesuksesan
1. Performance	84,26 %	Chance of success
2. Information	83,58 %	Chance of success
3. Economic	65,96 %	No chance of success
4. Control	82,98 %	Chance of success
5. Efficiency	78,30 %	Quite likely success
6. Service	82,51 %	Chance of success

Each indicator has a classification chance of success, so it will be able know which indicators had the most successful classification or not. Here are the details of each of the indicators::

1. Performance, got a chance of success with a value classification of 84.26%.
 - a. Thorough put or the amount of work (output) CIS valued at 81.49%. This means that the output of the CIS has been very fulfilling the needs of users of all the module studied.
 - b. Response time rated at 82.55%. This means that the CIS is very fast doing the work process. Manual reporting is quite time-consuming because each process accounting must be made in accordance with the SOP stage which quite long but the CIS is done by one time step of inputting data.
 - c. Audibility rated at 84.04%. This means that the CIS is very fit and aligned with the PMBOK standard project management process from PT ABC, that compliance with existing standards have been good.
 - d. The prevalence of communicating or the user interface of the CIS valued at 85.11%. This means that the CIS is easy to understand and according to need. This is because the process of data input is done by filling in the selection and some column there stuffing. It is certainly easier for users to fill in data and do process work closely and easily.
 - e. Completeness or work function CIS rated 84.89%. This means that the work function is seemed complete output and complete many of each module is provided.
 - f. Consistency or uniformity of design and engineering documentation is rated at 87.45%. This means that the consistency of the CIS is very helpful in order to facilitate understanding of the users.
 - g. Fault tolerance is rated at 84%. This means that the damage occurs when a program has been error is not error a lot, so it does not interfere with the implementation of the work. The most common error associated with the report format as in print out but this can be overcome by most respondents.
2. InformationData, got chance of success with a value classification of 83,58%.
 - a. Accuracy or information on the results of the evaluation is rated at 87.02%. This means that the accuracy/precision of the CIS very high. CIS as a big system would have a good standard of accuracy, the possibility of error is very little system.
 - b. The relevance of information is rated at 83.62%. This means that the information is in accordance with the needs of the CIS. Output generated by the CIS from all the modules have been very in line with expectations, requirements, and standards set.
 - c. Presentation of information is rated at 81.49%. This means that the form of presentation of information is in accordance with needs. The results of the processing of each process activity with CIS can be printed

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immediately after completion of data input. This makes the user does not need to give special attention to the grain report because the results are in accordance with established standards.

- d. Information accessibility or availability of information is rated at 86.17%. This means that the CIS information can be accessed at any time when needed. The information is already stored in the CIS can be opened and printed back when needed. When the user wants the editing data, the editing data can also be done.
3. Economics, received the classification likely not succeed with the value 65,96%.
 - a. Reusability or the flexibility of the program /part of the CIS rated at 65.53%. This means that the program/part of the CIS pretty reusable in other applications. Sub-indicators reusability is a sub-indicators that are known by management of the CIS developer or someone who knows a minimum of technological knowledge in depth so that it can be determine the flexibility of the program, while the average respondent has no such criteria. This has an impact on the assessment of the respondent, ignorance makes some of the respondents to vacate the answer.
 - b. Resources include human resources and economic resources rated at 66.38%. This means that the amount of resources used in the development of economic systems adequately assessed. The same thing occurred in the sub-indicators of resources. Respondents are end very concerned about the information resources needed in the development of the CIS so that only very few respondents know about resources used.
4. Control and Security, got a chance of success with a value classifications of 82.98%.
 - a. Integrity or control CIS is rated at 84%. This means that the data/ information is difficult to be accessed by unauthorized people. CIS have a username and password in order to be able to enter and access information. Username and password known only to each individual where the individual access fit to the proportion of office and authority so that data security is guaranteed.
 - b. Security or the security mechanism of the CIS rated at 83%. This means that the protection of programs and data in the information system rated by users. Protection of the centralized program at the department of the CIS, so that when the user has forgotten their username and password then the CIS department still can help restore the data as usual. In addition, when suddenly the power goes out your internet connection broken, then the last data already stored remain accessible again.
5. Efficiency, got a chance to reasonably successful classification with a rated of 78.30%.
 - a. Reusability is rated at 78%. This means that the effort to learn, operate, prepare input and interpret output CIS rated easily by the user. Easy to whether the user acceptance is influenced by age, IT experience, training has been followed and experience in their respective positions. Efforts, training and diligent guidance could support to facilitate the use of CIS. Some of the positions of the individuals who are aged youth do not prefer to remain in the conventional system and asked for help from colleagues or subordinate to enter the process in the CIS.
 - b. Maintanability or search and rectification of errors in the CIS rated by 72%. This means that the error correction is to be done is done gradually. Some respondents did not have a problem with it, but some respondents expect that editing error can be more practical back.
6. Service got the successful classification with a value of 82,51%.
 - a. Accuracy or thoroughness of the CIS finance valued at 79.57%. This means that the computing and control thoroughness CIS are in accordance with user needs
 - b. Reliability is rated at 82.34%. This means that the CIS has a level of trust and reliability to perform the requested function very well
 - c. Simplicity is valued at 85.32%. This means that the CIS easy to understand without difficulty that means. A simple display makes the user motivated to try use.

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V. CONCLUSION

Based on data analysis and hypothesis testing, it can be concluded that the “existence of opportunities in the application mobile based information system called CIS in the world of construction in the phase of implementation and control”, is about 81.13%

The evaluation results for each opportunity indicators are as follows:

A. Indicators into opportunities.

1. Indicators of the performance (performance), was classified as a likely to succeed. CIS can or are able to do a number of commands in a predetermined period of time both with and without a hitch
2. Indicator information (information/data), was classified as a likely to succeed. Respondents assess the information produced by the information system CIS application has been actually has a value that is useful for decision making.
3. Indicators of control (control) and security (security) was classified as likely to succeed. Respondents assess cloud-based information system the data is included into the sector that drives the opportunities of information system can be developed in the construction industry, because of all the activities on the ground can be seen and the data flow activities as well as safety
4. Indicators of efficiency (efficiency) was classified as a pretty even chance in the category that is likely quite successful in the use of the CIS system. This is one of sector constraints to be reckoned again because most of the respondents are people who are quite old with a percentage of 56.8% over 40 years old who are less quick to accept new habits of development of information technology that considers the process of inputting the data in this CIS data system little difficult
5. Indicators of service (service) included in the classification of respondents rate the chance of success and accuracy thoroughness CIS system is reliable in processing the data helps the respondents to perform their respective duties. This reflects that the utilization of the information system of the CIS in the service sector opportunities.

B. Indicators are the obstacles

1. Economic indicators (economic) was classified as not likely to be successful. This indicator has the lowest ranking with the lowest percentage value and the only one of the six indicators that fall into the category that is likely not very successful in the use of the CIS system. Respondents judged that the economic value of the company incurred in running these systems is quite large and become one of the obstacles that must be evaluated more using this CIS information system.

Based on the discussion, it can be made the conclusion of research , in accordance with the evaluation method PIECES implementation of information system based mobile application called CIS in the world of construction in the phase of implementation and control has a huge opportunity in the sector performance indicators with the highest odds than another indicator that is equal to 84.26%. Indicator is related to the accuracy, relevance of information, the presentation of information and the accessibility of information. Economic indicators related to the reusability and resources required in system development.

But it also has disadvantages or barriers to economic indicators (economic) with value of 65.96%. Indicators of efficiency (efficiency) even successful enough to receive a percentage of 78.30%, but this quite low when compared with other indicators. Indicators of efficiency (efficiency) related to the reusability and maintainability of a system.

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