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Development of Information System and Knowledge Management in Integrated Management System to Improve Organizations Performance of Construction Company in Construction Management Projects

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Abstract

Purpose: Develop integrated management models and systems in construction companies to improve the performance of their organizations.

Methodology: quantitative research method using SEM-PLS (Structural Equation Model-Partial Least Square)

Results: Model SEM-PLS path diagram that show development of information system and knowledge management in integrated management system to improve organizations performance of construction company in management of construction projects

Applications/Originality/Value: This research will produce a model development of information system and knowledge management in integrated management system to improve organizations performance of construction company in management of construction projects.

Keywords: information system, ntegrated management system, organisation performance, construction management project.

I. INTRODUCTION

In improving organizational performance in infrastructure construction projects, one of the efforts made by an organization to improve competitiveness in this globalization era is through the application of management systems [14]. Organizations need management in managing their complex organizations and dealing with rapid and continuous changes in the global market [20][16]. Organizations must identify the activities that are most important for achieving business goals, and be aware of how disruption from critical activities will negatively impact their goals [1][2]. In this view, organizations must manage or manage their resources in the form of money, energy and time effectively and efficiently to optimize return on investment, especially in complex construction activities [3][4].

Through an integrated management system each organization tries to improve product quality, the environment, worker safety, and other management practices [34]. The development of construction construction which is increasingly rapid at this time to make increasingly fierce competition between construction companies both in Indonesia and in the world. Every effort is made to be the best. As the development of construction continues to progress, construction companies are also required to provide the best quality, both in products and services produced, but do not forget the environmental impacts that occur from all company activities .

Integrated management system is a necessity, where every company must be able to carry out a quality management system, safety management, occupational health and the environment simultaneously. This situation will certainly complicate the construction company in its implementation. Most of the integrated management system research is done not in construction companies, but in the manufacturing sector and also does not ensure knowledge management. Whereas to improve organizational performance, it is necessary to consider knowledge management in a practical information system. Practical web-based information systems are important for the successful implementation of integrated management systems. The development of Information Systems and knowledge management in this integrated management system is to be able to improve organizational performance in construction companies [5][6].

Table1. Results of Monitoring and Evaluation of Management Systems in Construction Companies in Indonesia

Satminkal	Implementation of Management Systems
Sumber Daya Air	32.08%
Bina Marga	44.85%
Cipta Karya	32.80%
Penyediaan Perumahan	26.42%

The implementation of the management system at the Ministry of Public Works as seen in Table 1, especially related to the practice of construction projects at the agency is based on the laws and regulations that have been issued by the government of the Unitary State of the Republic of Indonesia. Indonesian laws and regulations that discuss management systems in the field of quality and environment have been issued since 2009, while regulations on occupational health and safety were issued in 2012. These regulations are

Government of Republic of Indonesia Regulation No.50 of 2012 concerning Quality Management Systems (QMS), Minister of the Environment Regulation No.31 of 2009 concerning the Environmental Management System (SML), and Minister of Public Works Regulation No. 5 of 2014 concerning the implementation of the Occupational Safety and Health Management System (OHSAS).

II. LITERATURE REVIEW

II.1 Organisation Performance

The dependent variable is the variable that is the main focus of the researcher. The aim of the researcher is to understand and make the dependent variable, explain its variability, or predict it. The dependent variable is the main variable that is the factor that applies in the investigation. Through analysis of the dependent variable (ie finding the variables that influence it) it is possible to find answers or solutions to problems [36]. The Y variable in this study is the organizational efficiency described in table 2.

Table 2. Organisation Performance Variable

Code	Organisation Performance Variable	Reference
OP01	Creating time and cost efficiency.	Dwiyanto (dalam Pasolong, 2006)
OP02	Creating, process efficiency, documents, and documentation in the audit process	Abdullah, 2014
OP03	Optimizing the use of resources	Moeheriono, 2012
OP04	Creating synergy in the organization	Mustapha et al.(2017), Silvius et al.(2017)
OP05	Helping organizations meet the needs of stakeholders	Mourougan, 2015; Bernando et al., 2010; Bernando et al., 2015;
OP06	Establish employee competence and employee motivation	Foley et al., 2014; Bernando et al., 2010; Bernando et al., 2014
OP07	Forms top management commitment and collaboration between departments	Foley et al., 2014; Simon et al., 2012; Bernando et al., 2010;
OP08	Helping organizations improve the image of the organization	Rebelo et al.,2014; Riberio 2015
OP09	Facilitating continuous improvement	Silvius et al.2017; Mustapha et al.2017
OP10	Creating environmental awareness arising from company activities	Paraschivescu, 2016

II.2 Information System

The integrated management system that will be formed requires a space to integrate the system, namely through the information system so that it can provide added value to the organization as a whole [36][34].[51][52]. Information systems are a series of integrated components for collecting, storing, and processing data and for distributing information and knowledge [30], whereas according to O'Brien in the Introduction to Information Systems, 2005 information systems are a any combination of people, hardware, software, computer networks and data communications, and databases that collect, change and disseminate information in an organizational form. Variable used in information system as shown in table 3.

Table3. Information System Variable

Code	Information system Variable	Reference
IS01	The company organization plans integrated database management system management through planning and data collection, monitoring systems with actual time and monitoring processes	Mourougan (2015)
IS02	Corporate organizations integrate technology through communication network integration, software integration, hardware integration and user interface	Mourougan (2015)
IS03	Corporate organizations integrate technical systems through communication between systems and data exchange procedures and protocols	Mourougan (2015)
IS04	Company organizations process data through data identification, measurement	Mourougan (2015)

II.3 Knowledge Management

Science is believed to be the basis of sustainability for companies to have a competitive advantage. Therefore, in order to increase effectiveness in the process of creating, sharing, and applying knowledge, more and more companies are implementing KM in their organizations [18], defines KM as a process of creating, sharing, and applying knowledge with the aim of improving company performance and getting better competitive opportunities [16][17] add that KM is a tool that is able to improve company efficiency and innovation, because KM consists of the process of creating, sharing, and applying knowledge, which leads to the effective use of organizational resources. However, in line with the process, KM also has obstacles that limit its effectiveness. According to Ranjbarfard, Aghdasi, López-Sáez, and López (2014), poor management and leadership support is one of KM's obstacles, because managers have a very significant role in creating an environment that supports the effective KM process, by

increasing coordination, motivating employees, and facilitating relationships between coworkers. Through his research, Qasrawi, Almahamid, and Qasrawi (2017) concluded that teamwork is the factor that has the most positive impact on the KM process. In the course and development of KM, the experts then divided KM into 3 stages of the process, namely the creation of knowledge, sharing of knowledge, and application of knowledge. Variable used in knowledge management as shown in table 4.

Table 4. Knowledge Management Variable

Code	Knowledge Management Variable	Reference
KM01	The company organization implements knowledge creation through information acquisition, information dissemination, mutual interpretation	Wibowo et.al., 2015 Kanapeckiene et.al., 2010 Grover et.al., 2016
KM02	Company organizations share knowledge through knowledge storage and knowledge transfer	Wibowo et.al., 2015 Kanapeckiene et.al., 2010 Grover et.al., 2016
KM03	Company organizations apply the application of science through group collaboration, empowerment, and commitment to science	Wibowo et.al., 2015 Kanapeckiene et.al., 2010 Grover et.al., 2016

II.4 Integrated Management System

In complex and large-scale organizations, it is considered that implement integration management system is important [5]. In the organization, humans are the main factor that is most considered in managing an organization has been a lot of research [9].

Integration of the new management system demonstrates that IMS can enable companies to benefit from the creation of synergies that are not only achieved to reduce time and costs associated with their implementation but also to improve efficiency. The complexity occurring in construction companies is not only the case of technological and process uncertainties, but also from the increasing influence of organizational factors [40][41].

Therefore, IMS is becoming more and more popular as companies find it more sensible to integrate their MS rather than managing them individually [15]. In addition, empirical studies of the scope of integration confirm the idea that companies prefer integration rather than disintegration {14]. Variable used in integrated management system as shown in table 5.

Table 5. Integrated Management System Variable

IMS	integrated management system Variable	Reference
IM01	Company organizations establish work procedures and instructions that are integrated in aspects of quality, safety, health, and the environment.	ISO :2015
IM02	The corporate organization establishes an integrated organizational structure that ensures a coherent activity relationship .	ISO:2015
IM03	The company organization already has a certificate of SMM, SML, and SMK3.	ISO:2015
IM04	The company organization guarantees that the establishment of Works Breakdown Structure (WBS) has considered aspects of quality, safety, health and environment.	Paraschivescu (2016)
IM05	Company organizations ensure the scope of the system takes into account internal and external interests.	Candel &Biesbroek (2016)
IM06	Company organizations have established policies that are oriented towards change management	Muzaimi et al. (2016), Mourougan (2015)
IM07	The company organization is committed to implementing management system integration	Candel &Biesbroek (2016)
IM08	The company organization has established life cycle oriented personnel, responsibilities and authority in the company's AD / ART.	Muzaimi et al. (2016), Mourougan (2015)
IM09	Top management ensures the implementation of management system integration .	Mourougan (2015)
IM10	The company organization implements a leadership development program about sustainable construction	Mourougan (2015)
IM11	Increased involvement of workers in safety, occupational health and environmental committees .	Rebelo et al.(2017), Mourougan (2015)
IM12	The company organization plans actions to reduce hazards and control risks in each construction project management process.	Mourougan (2015)
IM13	The company organization establishes an evaluation plan for quality, safety, occupational health and environment goals and objectives.	Rebelo et al.(2017), Mourougan (2015)

IMS	integrated management system Variable	Reference
1M14	The organization of the company establishes a plan for changing the management system including the allocation and reallocation of responsibilities and authority.	Rebelo et al.(2017), Mourougan (2015)
IM15	The materials / tools / products used must be legal, certified, and environmentally friendly.	ISO:2015
1M16	The company organization has a program to improve the competence of sustainable construction experts.	Mourougan (2015)
IM17	Company organizations impose mandatory medical check-up (MCU) for high-risk workers before, during and after doing the work (work at high altitude, extreme weather, limited space, or using heavy equipment)	ISO:2015, Rafika et al. (2016)
IM18	The company organization implements a periodic communication program to ensure the implementation of a Quality, Safety, Occupational Health and Environmental Management System.	Mourougan (2015)
IM19	Company organizations utilize online and offline information and communication technology to support the criteria or requirements for implementing Good Corporate Governance .	Mourougan (2015)
IM20	The company organization ensures the implementation of management review results.	Mourougan (2015)
IM21	Company organizations ensure that processes, products, and services are in accordance with the requirements of the Quality Management System, Occupational Safety, Health, and Environment.	Mourougan (2015)
IM22	The company organization implements fire and other emergency prevention and protection programs.	Mourougan (2015)
IM23	The company organization applies a hierarchy of control to the process of managing quality, safety, health and the environment.	Chiarini et al. (2017)
IM24	The company organization ensures that each supplier of goods and services takes into account quality, safety, health and environmental requirements in the bidding document .	Mourougan (2015)
IM25	The company organization implements monitoring and evaluation of the planning and operational processes.	Mourougan (2015)
IM26	Company organizations have procedures for reporting, investigating and correcting incidents related to safety, occupational health and the environment.	Mourougan (2015)
IM27	The company organization implements internal audits that are carried out in stages and are scheduled .	Mourougan (2015)
IM28	The company organization ensures that management reviews are conducted on the results of internal audits .	Mourougan (2015)
IM29	The company organization has a product incompatibility management program .	Mourougan (2015)
IM30	The company organization ensures corrective action for product incompatibility .	Mourougan (2015)
IM31	The company organization has a program of continuous improvement .	Mourougan (2015)

III. CONCEPTUAL MODEL

The conceptual model of this study uses a theoretical foundation covering theories regarding organizational theory, knowledge management theory, management information systems theory and systems management integration theory. These theories are embodied in the research variables, namely integrated management systems as the main variables and as antecedent variables are knowledge management and management information systems. Research on integrated management systems (integrated management systems) is still lacking in the relationship between integrated management systems (integrated management systems) with knowledge management and information systems, especially to improve organizational performance. Knowledge management and information systems are needed because the greatest difficulty in implementing this integrated management system is the difficulty in the application of integrated management system standards and the lack of knowledge that integration might be applied at the company level (Karapetrovic et al., 2010).

In fact, related to the difficulties of integration is the low participation of organizations in dealing with these difficulties and inadequate implementation of integrated management systems [22] then "lack of time for integration". The most difficult are "differences between the models that underlie standards" [24][25][51] and the lack of support from organizational policies [35]

Research on this integrated management system is most discuss in a manufacturing industry company that is used to reduce industrial waste. integrated management system that is done by combining a quality management system and an environmental management system [21][41][42]. The results

showed that there were several aspects related to the Integrated management system, namely integration process, integration risk and integration audit.

The conceptual model of this research will include the variables of knowledge management, information systems, as well as the main variable integrated management system with the aim of achieving organizational performance. This distinguishes the conceptual model in this study from the general model because it examines integrated management systems, knowledge management and information systems in improving organizational performance. In addition, general conceptual models in integrated management systems have not been tested simultaneously or together using empirical and applicable evidence as will be done in this study [44][45]. An overview of the constructs on the model with a theoretical basis is shown in Figure 1.

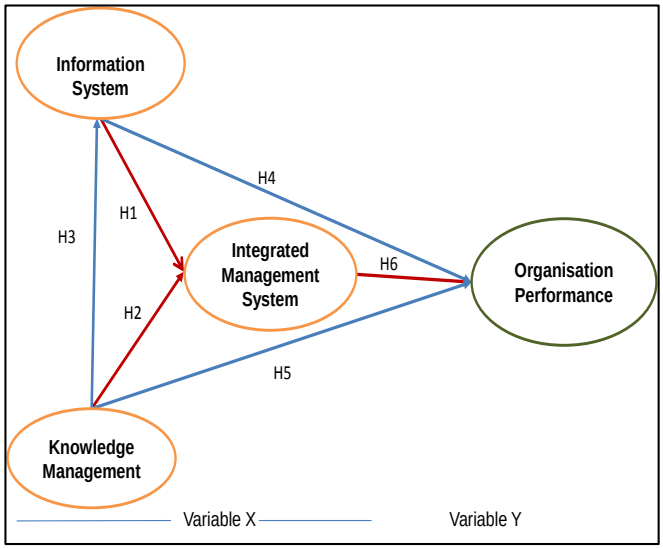

Fig. 1. Constructs on the model with a theoretical basis

This conceptual framework will examine the relationships among information system, knowledge management, integrated management system and organisation performance. The integrated management system consist of integration process, integration risk and integration audit. To prove this concept, each relationship can be formed as a hypothesis as shown below:

HI : Information system has a impact on integrated management system

H2 : Knowledge management has a impact on integrated management system

H3 : Knowledge management has a positive impact on information system

H4 : Information system has a impact on organisation performance

H5 : Knowledge management has a impact on organisation performance

H6 : Integrated management system has a impact on organisational performance.

III. METHOD

This study uses quantitative research method that is research method based on Partial Least Square-Structural Equation Model (PLS-SEM) to explain construct of integrated management system to achieve sustainable construction.

This research process using the following stages:

- Identification of issues contained in the object of research.
- The outline of the issue as a question of research that further spelled out in the research objectives. This research question is developing integration process models to achieve sustainable improvement
- A study of literature on the phenomenon of the object of research.
- Variable assignment of research based on the study of literature.
- Validation of the construct and the content of the draft instrument using the delphi method by asking the opinions of nine experts in the field of implementation management systems of quality, safety, occupation health and environment on the management of construction project.
- Data collection of the pilot survey to ten respondent to find out whether the questionnaires made easy to understand respondent in final survey.
- Data collection of the final survey to 82 respondents from 61 construction companies and analyzed by PLS-SEM (Partial Least Squares – Structural Equation Model).
- Finding the result of study and discusing the result.
- Determine research conclusions.
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IV. RESULT

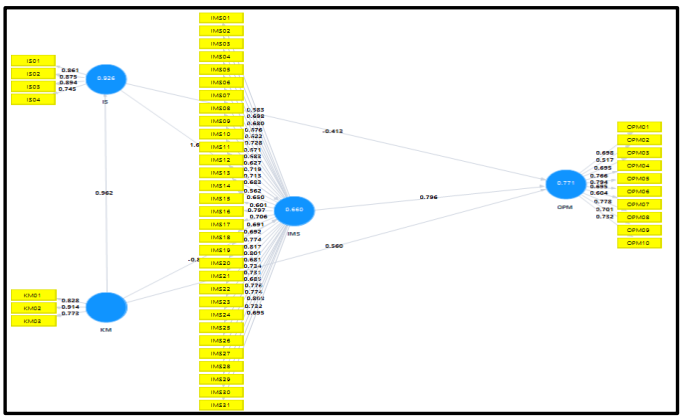
In many social studies, the measurement of a construct is very often done indirectly through its indicators. Indicators with high loading factors have a higher contribution to explain the latent construct. Conversely, indicators with low loading factors have weak contributions to explain the latent construct. In most references a factor weight of 0.50 or more is considered to have validation that is strong enough to explain latent constructs [48]. Even though some other references explain that the weakest loading factor that can be accepted is 0.40 with the distribution of values in table 6.

Table 6. Outer Loading

	IMS	IS	KM	OPM
IMS01	0.583			
IMS02	0.698			
IMS03	0.680			
IMS04	0.676			
IMS05	0.622			
IMS06	0.728			
IMS07	0.671			
IMS08	0.683			
IMS09	0.627			
IMS10	0.719			
IMS11	0.713			
IMS12	0.683			
IMS13	0.562			
IMS14	0.650			
IMS15	0.601			
IMS16	0.797			
IMS17	0.706			
IMS18	0.691			
IMS19	0.692			
IMS20	0.774			
IMS21	0.817			
IMS22	0.801			
IMS23	0.681			
IMS24	0.734			
IMS25	0.731			
IMS26	0.685			
IMS27	0.776			
IMS28	0.774			
IMS29	0.808			
IMS30	0.732			
IS01		0.861		
IS02		0.875		
IS03		0.894		
IS04		0.745		
KM01			0.828	
KM02			0.914	
KM03			0.773	
OPM01	0.683			0.698
OPM02	0.627			0.517
OPM03	0.719			0.695
OPM04	0.713			0.766
OPM05	0.683			0.794
OPM06	0.562			0.695
OPM07	0.650			0.604
OPM08	0.601			0.778
OPM09	0.797			0.701
OPM10	0.706			0.732
IMS31	0.695			

Table 6 shown data reliability test (reliability test) is carried out to measure the consistency and stability of the score (measurement scale) of an instrument in measuring certain concepts and helps the goodness value of a measurement instrument. Data quality testing is done by looking at the composite reliability value generated by calculating the PLS of the existing variables namely; IS, KM, IMS and OPM. To determine composite reliability, if the composite reliability value ρc > 0.8 can be said that the construct has a high reliability or reliable and ρc > 0.6 is said to be quite reliable (Ghozali, 2011).

Figure 2 is an outer loading diagram by definition loading factor is a large correlation between the indicator and its latent construct.



. **Fig 2**. Outer Loading Diagram.

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Model Equation with composite reliability in table 7:

OPM = -0,413*IMS - 0,413*IS + 0,560*KM + error

Table 7. Composite Reliability

	Composite Reliability
IMS	0.968
IS	0.909
KM	0.878
OPM	0.906

V. DISCUSSION

It appears that the model PLS-SEM will produce hypothesis as follow in fig.3.

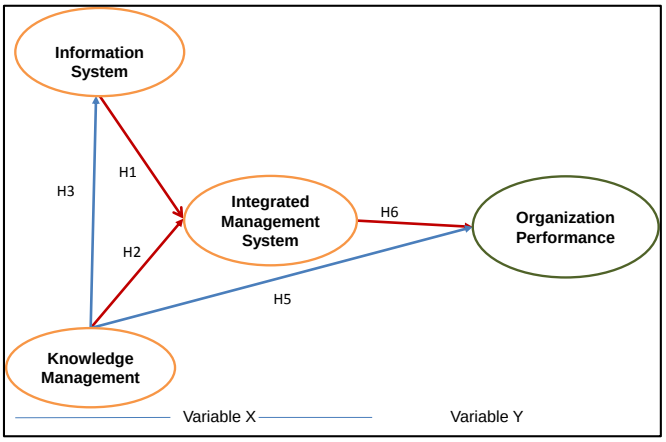

Fig 3. Model PLS-SEM

Hypothesis as shown in fig.3 consist of:

1. The first hypothesis: there is the effect of IS on STIs, the results of the statistical t value is 6.494> 1.96 or p value 0.00 <0.05, so it is concluded there is an effect of IS on STI.

2. The second hypothesis: there is the influence of KM on IMS, the results of the statistical t value is 3.323> 1.96 or p value 0.000 <0.05, so it is concluded that there is an influence of KM on IMS.

3. Third hypothesis: there is the influence of KM on IS, the results of the statistical t value is 92,794> 1.96 or p value 0,000 <0.05, so it is concluded that there is an effect of IS on KM.

4. The fourth hypothesis: there is no effect of IS on OPM, the results of the statistical t value is 1.264 <1.96 or p value 0.207> 0.05, so it is concluded that there is no effect of IS on OPM.

5. Fifth Hypothesis: there is the influence of KM on OPM, the results of the statistical t value is 2.052> 1.96 or p value 0.041 <0.05, so it is concluded that there is an influence of KM on OPM.

6. Sixth hypothesis: there is an effect of STI on OPM, the results of the statistical t value is 6.759> 1.96 or p value 0.000 <0.05, so it is concluded there is an effect of STI on OPM.

VI. CONCLUSION

This paper aims to develop integrated management models and systems in construction companies to improve the performance of their organizations in management project.

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