

Development and Validation of Instruments for Evaluation Enterprise Resource Planning on Human Resource Management in Higher Education Sector

Henry Antonius Eka Widjaja
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
haew@binus.edu

Meyliana*
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
*corresponding author :
meyliana@binus.edu

Erick Fernando
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
erick.fernando001@binus.ac.id

Surjandy
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
surjandy@binus.ac.id

Denardo Grady
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
denardograde@yahoo.com

Bellarika Liejaya
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
bellarika1703@gmail.com

Mareta Puspa Siwi
Information Systems Department
School of Information Systems
Bina Nusantara University
Jakarta, Indonesia 11480
maretapusasiwi@yahoo.co.id

Abstract— This study aims to develop models and indicators for evaluating ERP implementation in Human Capital Management (HCM) in higher education institutions. The development of the ERP Quality model is based on the IS success model of DeLone and Mclean and the ERP quality model developed by Deshmukh. This research model consists of variable 9, namely information quality, system quality, vendor quality, training, hardware and software, top management support, skill of workforce, project management, perceive ERP benefits and ERP system success. Analysis using SPSS software using questionnaires that are distributed directly to 32 respondents. The results of this study are in the form of ERP Quality models with 9 variables and 44 instruments that have been validated in accordance with the provisions of the Validity and reliability test. From this result can be used in research with respondents who are more appropriate or larger in a Higher Education sector who want to evaluate the performance of the use of ERP on HCM.

Keywords— HCM, ERP quality models, higher education sector

I. INTRODUCTION

Enterprise Resource Planning (ERP) systems have become one of the many popular systems in use today. Organizations implement ERP systems with the aim of increasing productivity, reducing costs and improving service to customers [1]. ERP systems can be applied into several business processes, one of which is a business

process for Human Capital Management (HCM). The Human Capital Management is a process that focuses on improving the performance of an organization and its employees [2]. The implementation of the HCM ERP system is illustrated in Table 1.

Integration of various information lines illustrated in Table 1, has led many companies to apply the ERP concept to their HCM systems. At least 682 companies have applied this concept, for example SAP AG, Northgate Arinso Inc., / N SPRO, EPI-USE and Sierra-Cedar Inc.[3]. In Indonesia alone, there are several fields of companies that apply this concept, one of which is the field of Education. All of these implementations are still running today and continue to meet needs[4]–[7].

However, there are several obstacles such as a display that is less user friendly, a browser that does not support, the development time process is quite time consuming, limited resources in the implementation process and tends to be more expensive[8], [9].

TABLE I. IMPLEMENTATION ERP HCM[2]

Application screening	Salary administration
Payroll	Work schedule
Planning	Travel expenses
Recruitment	Benefits administration
Compensation management	Personnel development
Funds and position management	Personnel time management
Time evaluation	Shift planning, training

This problem, it is important to evaluate the implementation of the HCM ERP system in higher education. It should be underlined that ERP systems are different from other information technology systems because ERP implementation includes technology, operational, managerial, strategic and organizational related components, so the success measurement model commonly used for information technology systems is not in accordance with the success measurement model for ERP systems[10]. The model that will be used in measuring the success of ERP systems in this study is developing the ERP Quality model. This model is the result of reviewing the literature that examines the same thing, so that the ERP Quality model is produced which is the result of modification and merging of the two models that have been used to examine the success of ERP systems. The basic model is a DeLone & McLean success model [11], while the second model is a conceptual model that is applied to measure the benefits of ERP quality in small and medium businesses in India [12]. With this model, providing something new in the measurement of ERP implementation in higher education is more targeted and guaranteed benefits.

II. METHODOLOGY

The development of models and instruments is taken from the literature in accordance with the study. Measurement instruments by measuring the validity and reliability, which aims to ensure the instrument used is feasible in accordance with the provisions. Measurement with questionnaire and respondent data accordingly. This research in the development of models and instruments uses the stages carried out and can be seen in Fig1.

III. RESULTS AND DISCUSSION

A. Development of research models

The process of developing the ERP Quality model is carried out with related literature and discovers the IS Success DeLone and McLean theory [11]. as the basis and the ERP quality model developed by Deshmukh[12] to enrich the conceptual model and the development of indicators. The ERP Quality Model Reconceptualization produced 9 variables, namely This model consists of 7 independent variables namely System Quality, Information Quality, Vendor / Consultant Quality, Training, Hardware and Software, Top Management Support, Skill of Workforce and Project Management which measures Perceived ERP Benefits and Perceived ERP Benefits measures ERP System Success. Measure the variable with 44 instruments used to measure variables. ERP Quality Model can see Fig 2.

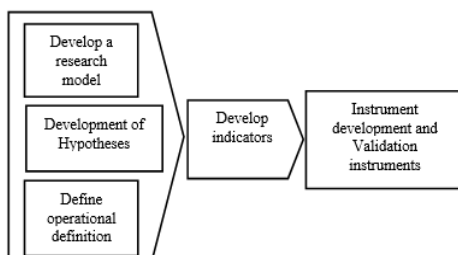


Fig. 1. Research methodology

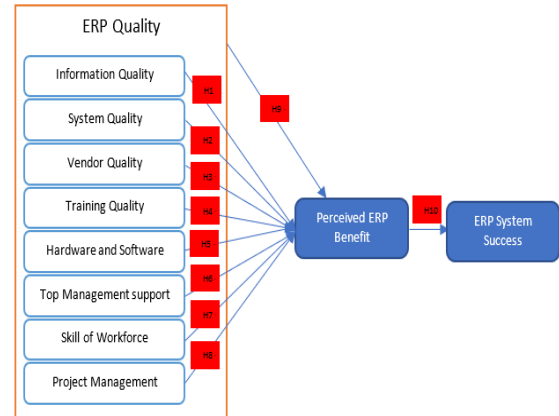


Fig. 2. Development ERP quality model

B. Development of Hypotheses

Development of hypotheses based on the research model there is 10 hypotheses can build, there are:

1. Influence information quality to Perceived ERP Benefit
2. Influence System quality to Perceived ERP Benefit
3. Influence Vendor quality to Perceived ERP Benefit
4. Influence Training quality to Perceived ERP Benefit
5. Influence hardware and software to Perceived ERP Benefit
6. Influence Top Management Support to Perceived ERP Benefit
7. Influence skill of world force to Perceived ERP Benefit
8. Influence Project Management to Perceived ERP Benefit
9. Influence ERP quality to Perceived ERP Benefit
10. Influence Perceived ERP Benefit to ERP System Success

C. Define operational variables and instruments

1) System quality (SQ)

The quality of the system is a desirable system characteristic of information systems and information quality that focuses on a system performance related to productivity, reliability, and ease of use [13]. The indicators describe on Table II.

2) Information quality (IQ)

Information quality is information that can be usable, concise, Comprehensible, pertinent, available, and in the correct format [13]. The indicators describe on Table III.

TABLE II. INFORMATION QUALITY

No	Dimension		Indicator
1	Productivity	SQ1	The use of the SAP HCM application has improved the quality of my work.
2	Portability	SQ2	I can use the SAP HCM application on several different computers (more than 1 computer).
3	Reliability	SQ3	I can only access all features that are my authority in the SAP HCM application.
4	Ease of use	SQ4	The SAP HCM application is easy for me to use.

TABLE III. INFORMATION QUALITY

No	Dimension	Indicator	
1	Usable	IQ1	The information generated by the SAP HCM application is useful for me.
2	Concise	IQ2	The information generated by the SAP HCM application is concise and clear.
3	Comprehensible	IQ3	The information generated by the SAP HCM application is sufficient and easy to understand.
4	Pertinent/ Relevance	IQ4	The information generated by the SAP HCM application is appropriate or relevant to my needs.
5	Available	IQ5	SAP HCM application information is available whenever I need.
6	Correct format	IQ6	The information obtained from the SAP HCM application has a format that suits my needs.

TABLE IV. VENDOR QUALITY

No	Dimension	Indicator	
1	Trustworthy	VQ1	SAP HCM application vendors have credibility and can be trusted.
2	Reliability	VQ2	The SAP HCM application vendor produces reliable software.
3	Responsiveness	VQ3	SAP HCM application vendors are responsible for providing fast and appropriate services.
4	Assurance	VQ4	SAP HCM application vendors provide a guarantee in the use of its products.
5	Experience	VQ5	ERP system vendors are experienced in executing, training, testing and handling problems in SAP HCM application projects.

3) Vendor quality (VQ)

Vendors quality/consultants represent external or external sources of organizational expertise related to ERP implementation [13]. The indicators describe the following:

4) Training (TR)

Training is a process in the system that can change business processes with reference to providing management and employees to increase skills and level of knowledge in an information[4], [14]

5) Hardware and software (HS)

Hardware is a computer that is powered by electricity which has mechanical and electronic components that can be used by humans. While software is a program that has a series of instructions that are arranged for a series of purposes so that it can give instructions to the computer to work. In measuring the impact, the researcher developed the following indicators:

TABLE V. TRAINING (TR)

No	Dimension	Indicator	
1	Logic and concepts of ERP	TR1	SAP HCM application training can improve my understanding of the use of this application.
2	Features of the ERP system software	TR2	SAP HCM application training increased my understanding of the features in it.
3	Functional training (hands-on training)	TR3	The SAP HCM application can help me get things done faster because of the automation process.

TABLE VI. HARDWARE AND SOFTWARE (HS)

No	Dimension	Indicator	
1	Software development, testing and troubleshooting	HS1	SAP HCM application has been integrated with other systems.
2	Appropriate business and IT legacy system	HS2	SAP HCM application is in accordance with existing business processes within Bina Nusantara.
3	IT infrastructure	HS3	IT architecture and capabilities are available and always up to date.
4	Data conversion and integrity	HS4	The process of converting and migrating data from the old system to the SAP HCM application runs smoothly.
5	System testing	HS5	The SAP HCM application is already running well because there are no errors when I use it.

TABLE VII. TOP MANAGEMENT SUPPORT (TM)

No	Dimension	Indicator	
1	Commitment	TM1	Higher education leadership is very committed in implementing the SAP HCM application by providing adequate resources and being able to integrate business strategies with IT strategies.
2	Steering committee	TM2	Higher education leadership manages policies and funding sources including funding very well for the implementation of the SAP HCM application.
3	Project champion	TM3	Higher education leadership has implemented change management very well in the implementation of the SAP HCM application.
4	Top priority	TM4	Higher education leadership ensures that the SAP HCM application project has a high priority.

TABLE VIII. SKILL OF WORKFORCE (SW)

No	Dimension	Indicator	
1	Knowledge	SW1	I understand how to work using the SAP HCM application.
2	Experience	SW2	I have experience using SAP HCM applications because I have and often use the same / similar applications.

6) Top management support (TM)

The important role in an organization is held by Top Management[12]. It can be said that all decisions made are driven by commitment in the organization. In this case the ERP system implementation so that it gets good results for the organization[12], [14].

7) Skill of workforce (SW)

Skill of workforce is an ability possessed by employees related to costs, knowledge and technology[12].

8) Project Management (PM)

Project management is a process that through plans, controls, coordination of complexity and different activities that clearly outlines milestones and critical paths with training, resource plans, including top level management of various business functions [12], [14]. The measured is the indicator developed as on Table IX.

9) Perceived ERP benefit (PB)

Perceived ERP Benefit is a benefit gained in implementing ERP so that it can increase business capacity within the organization and help the organization achieve its objectives [13]. The measured is the indicator developed as on Table X.

10) ERP system success

ERP system success is declared successful when all components in the system have a positive influence and benefit both individuals and organizations[5], [6], [8], [12]. The measured is the indicator developed as on Table IX.

D. Evaluation instrument

The process of evaluating instruments or indicators in an information system research that refers to social science by testing the validity and reliability[15]–[18]. Reliability tests can be performed using Cronbach's Alpha on each variable. The next test process is validity test by looking at the calculated r value (corrected item - total correlation (CI-TC)) is positive and greater than the value of r table, so the statement item on the questionnaire is said to be valid [19].

Evaluate instruments or indicators by distributing questionnaires to respondents for a sample. The sampling technique is a way to get a sample. The total population is less than 100 people, then the entire population will be sampled [20]. The sample is taken where one of the educational institutions that have human capital is and the number of employees there are 30 people.

TABLE IX. PROJECT MANAGEMENT (PM)

No	Dimension	Indicator
1	Project schedule/ plan	PM1 The stages and implementation schedule of the SAP HCM application run well and are completed according to the agreed schedule.
2	Technical task and trouble shooting	PM2 Project management implementation of SAP HCM application projects has good technical skills and can handle problems quickly.

TABLE X. PERCEIVED ERP BENEFIT (PB)

No	Dimension	Indicator
1	Operational benefit	PB1 Using the SAP HCM application can reduce operational costs such as reducing paper usage.
2		PB2 The use of the SAP HCM application helps improve service to the customers I serve (employees of all units in Bina Nusantara).
3	Managerial benefits	PB3 The use of the SAP HCM application improves my ability in work planning and decision making.
4		PB4 The use of the SAP HCM application improves my performance.
5	Strategic benefits	PB5 The use of the SAP HCM application enhances my creativity.
6		PB6 The use of the SAP HCM application builds good relationships with other units.
7	Organizational benefits	PB7 Using the SAP HCM application has changed my work patterns for the better.
8		PB8 The use of the SAP HCM application makes me always study.

TABLE XI. ERP SYSTEM SUCCESS

No	Dimension	Indicator
1	Productivity	ES1 Using the SAP HCM application increases my productivity at work.
2	Communication and collaboration	ES2 The SAP HCM application helps me communicate and collaborate with other employees in my unit or with other units.
3	Decision making	ES3 Decision making that I do is getting better with the SAP HCM application.
4	Customer satisfaction	ES4 I am very satisfied in using the SAP HCM application.
5	Management control	ES5 The SAP HCM application has helped me greatly in organizing work processes.

Evaluation using SPSS 24 software and using data of 32 respondents. The reliability according to Sekaran & Bougie [19], if the cronbach's alpha value is less than 0.6 the reliability of the measuring instrument is said to be bad, around the range of 0.7 the reliability of the measuring instrument is still accepted and more than 0.8 is considered good. The validity test results obtained r table for the number of samples of 32 (df = 30) with a significance of 0.05 (two tails) is **0.349**. the results of testing the validity and reliability for the statement of the questionnaire can be seen in the table XI.

IV. CONCLUSION

The results of this study are in the form of ERP Quality models with 9 variables and 44 instruments that have been validated in accordance with the provisions of the Validity and reliability test. Reliability tests can be performed using Cronbach's Alpha on each variable the biggest of 0.6, the reliability of the measuring instrument is still accepted. The validity test results calculated r value (corrected item - total correlation (CI-TC)) is positive and

greater than the value of r table, obtained r table for the number of samples of 32 (df = 30) with a significance of 0.05 (two tails) is 0.349. the results of testing the validity is accepted.

The ERP Quality Model Reconceptualization consist 9 variables, namely This model consists of 7 independent variables namely System Quality, Information Quality, Vendor / Consultant Quality, Training, Hardware and Software, Top Management Support, Skill of Workforce and Project Management which measures two depend variable namely Perceived ERP Benefits and Perceived ERP Benefits measures ERP System Success. Measure the variable with 44 instruments used to measure variables. From this result can be used in research with respondents who are more appropriate or larger in a Higher Education sector who want to evaluate the performance of the use of ERP on HCM.

TABLE XII. VALIDITY AND RELIABILITY TESTING

Variabel	Indicator	CI-TC	Cronbach's Alpha
System quality (SQ)	SQ1	0.653	0.972
	SQ2	0.351	0.974
	SQ3	0.409	0.973
	SQ4	0.522	0.972
Information quality (IQ)	IQ1	0.626	0.972
	IQ2	0.532	0.972
	IQ3	0.699	0.972
	IQ4	0.837	0.971
	IQ5	0.668	0.972
	IQ6	0.748	0.972
Vendor quality (VQ)	VQ1	0.774	0.972
	VQ2	0.800	0.971
	VQ3	0.754	0.972
	VQ4	0.717	0.972
	VQ5	0.730	0.972
Training (TR)	TR1	0.661	0.972
	TR2	0.629	0.972
	TR3	0.650	0.972
Hardware and software (HS)	HS1	0.583	0.972
	HS2	0.587	0.972
	HS3	0.696	0.972
	HS4	0.477	0.973
	HS5	0.680	0.972
Top management support (TM)	TM1	0.631	0.972
	TM2	0.692	0.972
	TM3	0.537	0.972
	TM4	0.678	0.972
Skill of Workforce (SW)	SW1	0.532	0.972
	SW2	0.531	0.973
Project management (PM)	PM1	0.794	0.971
	PM2	0.758	0.972
Perceived ERP benefit (PB)	PB1	0.536	0.972
	PB2	0.681	0.972
	PB3	0.634	0.972
	PB4	0.842	0.971
	PB5	0.766	0.972
	PB6	0.866	0.971
	PB7	0.856	0.971
	PB8	0.721	0.972
ERP system success	ES1	0.860	0.971
	ES2	0.780	0.972
	ES3	0.622	0.972
	ES4	0.805	0.971
	ES5	0.801	0.972

REFERENCES

- [1] T. H. Davenport, "Putting the Enterprise into the Enterprise System," *Harvard Bus. Rev.*, vol. 76, no. 4, pp. 121–131, Jul. 1998.
- [2] J. Bratton and J. Gold, *Human resource management: theory, practice, efficiency*. Palgrave macmillian, 2017.
- [3] Idatalabs, "Companies using SAP ERP Human Capital Management (HCM) and its marketshare," 2017. [Online]. Available: <https://enlyft.com/tech/products/sap-erp-human-capital-management-hcm>. [Accessed: 31-Aug-2019].
- [4] P. Garg and A. Garg, "An empirical study on critical failure factors for enterprise resource planning implementation in Indian retail sector," *Bus. Process Manag. J.*, vol. 19, no. 3, pp. 496–514, 2013.
- [5] A. Iqbal, F. Latif, F. Marimon, U. F. Sahibzada, and S. Hussain, "From knowledge management to organizational performance: Modelling the mediating role of innovation and intellectual capital in higher education," *J. Enterp. Inf. Manag.*, vol. 32, no. 1, pp. 36–59, 2019.
- [6] Y. M. Cheng, "A hybrid model for exploring the antecedents of cloud ERP continuance: Roles of quality determinants and task-technology fit," *Int. J. Web Inf. Syst.*, vol. 15, no. 2, pp. 215–235, 2019.
- [7] P. Kushwaha, P. Yadav, and J. Prasad, "Impact of enterprise resource planning on human resource management in automobile sector: Statistical analysis," *J. Stat. Manag. Syst.*, vol. 21, no. 4, pp. 601–615, 2018.
- [8] M. Ali and L. Miller, "ERP system implementation in large enterprises – a systematic literature review," *J. Enterp. Inf. Manag.*, vol. 30, no. 4, pp. 666–692, 2017.
- [9] M. Shahbazi, A. Farajpahlou, F. Osareh, and A. Rahimi, "Development of a scale for data quality assessment in automated library systems," *Libr. Inf. Sci. Res.*, vol. 41, no. 1, pp. 78–84, 2019.
- [10] C. S. Yu, "Causes influencing the effectiveness of the post-implementation ERP system," *Ind. Manag. Data Syst.*, vol. 105, no. 1, pp. 115–132, 2005.
- [11] W. H. DeLone and E. R. McLean, "The DeLone and McLean model of information systems success: A ten-year update," *J. Manag. Inf. Syst.*, vol. 19, no. 4, pp. 9–30, 2003.
- [12] P. D. Deshmukh, G. T. Thampi, and V. R. Kalamkar, "Investigation of quality benefits of ERP implementation in Indian SMEs," *Procedia Comput. Sci.*, vol. 49, no. 1, pp. 220–228, 2015.
- [13] K. Su Wei and A. C. Loong, "Measuring Erp System Success: A Respecification Of The Delone And Mclean's Is Success Model," in *Symposium on Progress in Information & Communication Technology 2009*, 2009, pp. 7–12.
- [14] L. Zhang, M. K. O. Lee, Z. Zhang, and P. Banerjee, "Critical success factors of enterprise resource planning systems implementation success in China," *Proc. 36th Annu. Hawaii Int. Conf. Syst. Sci. HICSS 2003*, 2003.
- [15] E. Fernando *et al.*, "User Behavior Adopt Utilizing Fin Tech Services on Online Transportation in Indonesia (Scale Validation and Developed Instrument)," in *Proceedings of 2018 International Conference on Information Management and Technology, ICIMTech 2018*, 2018, no. September, pp. 114–118.
- [16] E. Fernando, Surjandy, Meyliana, and D. Touriano, "Development and Validation of Instruments Adoption FinTech services in Indonesia (Perspective of Trust and Risk)," in *3rd International Conference on Sustainable Information Engineering and Technology, SIET 2018 - Proceedings*, 2019, pp. 283–287.
- [17] E. Fernando, D. Touriano, and Rico, "Impact of Service-Oriented Architecture adoption in information system," in *ICITACEE 2015 - 2nd International Conference on Information Technology, Computer, and Electrical Engineering: Green Technology Strengthening in Information Technology, Electrical and Computer Engineering Implementation, Proceedings*, 2016, pp. 52–55.
- [18] Meyliana, E. Fernando, and Surjandy, "The Influence of

Perceived Risk and Trust in Adoption of FinTech Services in Indonesia,” *J. CommIT (Communication Inf. Technol. (Communication Inf. Technol.*, vol. 13, no. 1, pp. 31–37, 2019.

- [19] U. Sekaran and R. Bougie, “Research Methods for Business A Skill-Building Approach,” in *Research Methods for Business A*

Skill-Building Approach, Seventh Ed., Dordrecht: John Wiley & Sons, 2016, pp. 3336–3336.

- [20] Sugiyono, *Metode Penelitian Bisnis (Pendekatan Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta, 2009.