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Application of factor analysis method to support the users acceptance model of ERP systems implementation

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Abstract. An e-Commerce company has been using an Enterprise Resource Planning (ERP) system for several years, but is still constrained in its implementation, this is reflected in the number of issue/change request tickets submitted by users who have not been able to reach ideal conditions. To overcome this problem, we need an appropriate reference model, the ERP system user acceptance model in companies. The study conducted factors that influence the level of acceptance of SAP ERP users in the XYZ group to then determine a model that is able to explain practically the level of ERP system user acceptance, which in turn can produce concrete proposals to increase ERP system user acceptance. Research is quantitative descriptive using factor analysis and regression analysis methods. The research method uses a questionnaire with a total of 107 valid respondents coming from 8 company names under the XYZ group in 6 Southeast Asian countries. The conclusion of the study is that there are 24 indicators and 4 factors that influence user acceptance of the SAP ERP system. These four factors are the low contribution of the ERP system, the quality of ERP systems and data, the development of ERP systems, and also the low quality of ERP system supporters. It is hoped that by optimizing the value of the 4 factors, the XYZ group can increase user acceptance of the SAP ERP system so that the system can provide benefits expected by the company to be competitive advantage.

1. Introduction

If in the past e-commerce was an additional function for companies engaged in the production of goods and services, now e-commerce has become one of the main new business models. Currently, companies producing goods and services are considered as companies with traditional business models. Fundamental differences from traditional business models and e-Commerce also underlie the information systems used by companies. In companies that implement the traditional business model



the majority will rely on one strategic information system, namely ERP. In e-Commerce companies, what happens is the opposite, the main information system is an e-Commerce related system and the ERP system is a supporting information system. The XYZ Group as one of the e-Commerce companies is an example of an e-Commerce company that has a primary information system related to e-Commerce as well as an ERP supporting information system. This group has been using an ERP system for 2 years, but the system still needs improvements and further developments to keep pace with changes in the company's business. This is reflected in the number of issue / change request tickets submitted by users who have not been able to reach ideal conditions. [1] argue that having a perspective of user acceptance in assessing the use of ERP, will help to understand ERP adoption from a user perspective. In order to analyze the problems of the ERP system in the XYZ group, an appropriate reference model is needed, namely the ERP system user acceptance model in e-commerce companies. Within 2 years the use of SAP ERP still requires improvements and further developments, especially related to business demands.

These improvements and developments are noted in the internal ticketing system, which is divided into the Change Request (CR) category and issues, where CR itself is divided into 2 further categories namely CR application feature improvement and business change CR. CR application feature improvement is an application or system change request because the application and or system cannot function in accordance with the business processes identified during implementation, while the business change CR is an application or system change that needs to be done in line with business development. The issue category is intended to record errors that occur on the SAP system, which can be in the form of mistakes made by the user or errors and or inconsistencies in the application and or system. In detail the number of Change Request (CR) tickets and issues recorded in 2015 and 2019 per year are as follows:

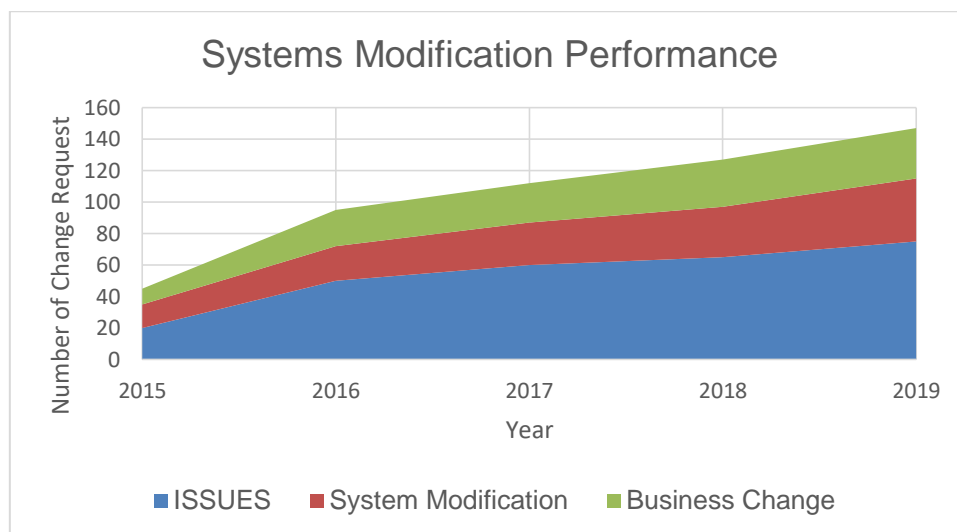


Figure 1. Systems modification performance.

From Systems Modification Performance in Figure 1 above it can be seen that the number of the two types of change requests (CR) submitted by SAP system end users to the Business Intelligence and SAP departments in 2015 is balanced, which means that during the system stabilization period, there are still SAP features that needs to be developed to meet existing business needs. On the other hand, rapid business development in the field of e-commerce also requires the SAP system to keep pace with these changes. In the second year (2016) the number of recorded CRs also had a number that was not much different, so it could be interpreted that the development of the SAP system was still very much needed to support the company's operations. On the other hand, the number of issues in 2016 doubled from 2015. The main purpose of this article is to describe how enterprise resource

planning has experienced a significant increase in the current era of the 4.0 industrial revolution, so that its contribution to the business world is also increasing due to the effectiveness and efficiency of business processes.

2. Literature Review

2.1 Enterprise Resource Planning (ERP)

The relationship between user reaction to ERP systems and ERP success and understanding user reactions to ERP systems can help assess why some ERP implementations are more successful than others [2]. ERP system users need to know and feel the benefits of the ERP system they use so they are not reluctant to use ERP [3]. These benefits are referred to as business value, which is defined as the added value obtained as the impact of automation, informational and transformation of ERP system capabilities on the company's operational and managerial processes [4].

2.2. User Acceptance of ERP Systems

Research on user acceptance of information systems has been carried out and gave birth to several models. Two of them are often used and blended in studies are the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM). Basically the theories mentioned above have the same opinion that user acceptance of information systems plays an important role because this factor influences behavior in using the system (use behavior). When the user has the correct or positive use behavior towards the information system, this also has a positive effect on the level of user acceptance.

2.3. Factor Analysis

Many studies use factor analysis methods to process data, such as social research related to human psychological problems, most of which are intangible data [5]. Through a process using factor analysis methods, data and information contained in the original variables can be summarized so that they become a new set of dimensions by determining the structure with data summarization and data reduction [6]. Next, the factor analysis method is used to identify the structure of the relationship between variables by paying attention to the correlation that exists between each of the independent variables. Figure 2.

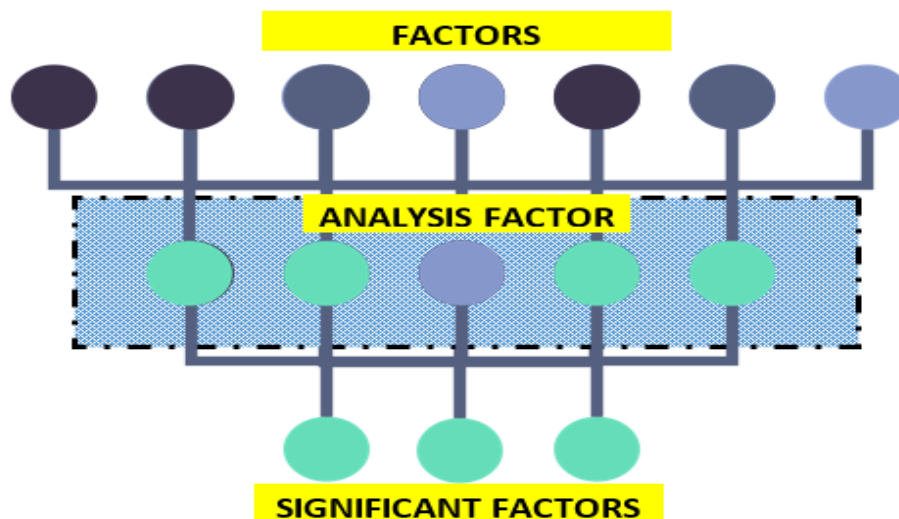


Figure 2. Factor analysis processes.

2.4. Information Technology Balanced Scorecard (IT BSC)

The four perspectives adjusted for the IT BSC include the following [7]:

1. *The Corporate Contribution Perspective*

The purpose of this perspective is to achieve business contributions to IT investment. Issues discussed in the company's contribution are synergistic performance strategic contributions, business value of IT projects and management of IT investments. Benchmarks used are based on available or determined objective standards and cases originating from external sources. The goal of the company's contribution perspective is controlling IT costs from new IT applications and the business value of the existing IT application functions.

2. *User Orientation Perspective*

The user orientation perspective is focused on evaluating IT performance from the view of customers and internal users (Company Employees) matters discussed in user orientation namely customer satisfaction, IT integration, or business, successful development and service success rate. There are three focuses that need to be considered: being the preferred application provider, working with users and ensuring user satisfaction. It aims to focus on developing business relationships and implementing new IT organizations and IT processes.

3. *Operational Excellence Perspective*

This perspective explains how effective and efficient IT processes are within a company. The IT function must provide high-quality services to users at the lowest possible cost. Operational excellence has an important contribution because it results in two things, namely: product quality and IT cost emphasis. If the above is not considered, the result will be that the workload of IT personnel will be high because the work procedures are chaotic, resulting in many misunderstandings and rework. The factors discussed in Operational Excellence are rapid response processes, guarantee management and protection and security.

4. *Future Orientation Perspectives*

The Future Orientation Perspective discusses the improvement of the ability, the effectiveness of the company's employee management, the development of the company's architecture and research on emerging technologies. The company's plans for the future must be prepared from now on. Companies must be able to read IT trends in the future and anticipate them first by mastering new technologies. Therefore, mastery of the latest IT is an absolute requirement to support future orientation. So the best solution is to always hold IT personnel training on a regular basis so as to improve IT expertise. This is supported by technological factors as well, including conducting information technology research that is always up to date is expected to answer challenges in the future.

3. Methodology

3.1. *Population, Analysis Tools and Research Instruments*

The population of this research is all employees of 8 companies spread across six countries under the XYZ group who use SAP ERP in their daily operations. The population is 112 respondents. Analysis tools and research instruments used were questionnaires through Google forms, IBM SPSS version 23.0 for statistical tests and Microsoft Excel [8].

3.2 *Operational Definitions*

One of the objectives of this research is to establish an ERP system user satisfaction model in e-commerce companies. Therefore, the dependent variable (Y) in this study is the satisfaction of SAP ERP system users in the e-commerce group company XYZ Indonesia. Indicators measuring user satisfaction in an ERP system are independent variables (X).

The independent variables are:

1. Accurate data (KD1)
2. Relevant data (KD2)
3. The system functions in accordance with business processes (FS1)

4. System functions that are easily adaptable to changes (FS2)
5. Stable system (FS3)
6. Easy-to-use system (FS4)
7. Reliable system performance (KS1)
8. Responsive system performance (KS2)
9. Compliance with information technology management practice standards (CC1)
10. Development of new features (SO1)
11. Issue tickets (SO2)
12. ERP communication support team with users (CM1)
13. A harmonious professional relationship between ERP support team and users (CM2)
14. User guide available (TR1)
15. Training program available (TR2)
16. Sufficient ERP support team (ST1) knowledge and expertise
17. The number of ERP support team personnel is adequate (ST2)
18. A cross-functional training program is available (KM1)
19. Documented business process changes (KM2)
20. Knowledge sharing between ERP support team and users (KM3)
21. Knowledge sharing between users (KM4)
22. The system supports the use of e-commerce (ES1)
23. The system supports the efficient use of e-commerce (ES2)
24. System data relevant in supporting e-commerce (ED1)
25. Complete system data in support of e-commerce (ED2)
26. Accurate system data in support of e-commerce (ED3)
27. Reliable data systems in support of e-commerce (ED4)
28. Responsive system in supporting e-commerce (EP1)

3.3. Factor analysis method

This study uses the factor analysis method with several stages as follows [9]

1. Primary Data, observation based on purposive-sampling and snow-balling method offering 1 dependent variable, and 28 independent variables as questionnaires using Likert scale. In addition, other primary data also collected as supporting data.
2. Exploratory Factor Analysis on 28 observed variables to construct latent variables using Principal Component Analysis after some series of validity and reliability test.
3. Linear Regression Analysis on dependent and independent variables to produce a equation model, and simulation in four scenarios: minimum, maximum, ideal, and extreme estimations of problem level. Ideal scenario is aimed to be target to lower project level of problem.

3.4 Data Analysis Methods

Data analysis begins after the data is collected through a questionnaire [10]. The steps of the analysis are as follows:

1. Testing of the questionnaire questions, using:
 - a. Validity test
 - b. Reliability Test
2. Testing of model indicators called the Factor Analysis method. This method consists of:
 - a. KMO and Bartlett's Test
 - b. Anti-Image Matrices Test
 - c. Factor Extraction
3. Testing the effect of the indicators with the Multiple Regression Analysis method. The result of this analysis is a prediction model of the regression equation that will explain the relationship between the independent variable (X) and the dependent variable (Y). This analysis is carried out by the steps:
 - a. Determine the regression equation

- b. The regression equation is measured by its effectiveness using R Square
- c. The independent variable and the dependent variable are tested in unison effect with the F Test.
- d. Each independent variable is tested for its effect on the dependent variable by t test

4. Results and Discussion

4.1. Profile of Respondents

Profile of respondents are young professionals who are characteristic of companies engaged in e-Commerce and depart from a start-up company. With this profile, employees do not have enough experience in using ERP systems in general and SAP ERP systems in particular, so that it becomes a challenge to increase acceptance of SAP ERP system users in the XYZ group.

4.2. Reliability Test Results, Test Validity-Factor Analysis and Regression Analysis

The reliability test results with a sample size of 107, the Cronbach's Alpha value obtained was 0.870 so it can be concluded that the questionnaire items have a high level of reliability. The results of the validity test with factor analysis produce 24 factors and 4 components, as follows:

1. Variable X_1 : The Low Contribution of the ERP System, consisting of 8 indicators, namely:

- ED3 : Accurate system data in support of e-commerce
- ED2 : Complete system data in support of e-commerce
- ED1 : System data relevant in supporting e-commerce
- ED4 : Reliable data systems in support of e-commerce
- ES2 : The system supports the efficient use of e-commerce
- EP1 : Responsive system in supporting e-commerce
- ES1 : The system supports the use of e-commerce
- KS2 : Responsive system performance

2. Variable X_2 : ERP System and Data Quality, consisting of 6 indicators, namely:

- KD1 : Accurate data
- KD2 : Relevant data
- KS2 : Responsive system performance
- FS1 : The system functions in accordance with business processes
- KS1 : Reliable system performance
- FS4 : Easy-to-use system

3. Variable X_3 : ERP System Development, consisting of 5 indicators, namely:

- TR2 : Training program available
- ST2 : The number of ERP support team personnel is adequate
- SO1 : Development of new features.
- SO2 : Issue tickets.
- KM2 : Documented business process changes

4. Variable X_4 : Low Quality of Supporting ERP Systems, consisting of 5 indicators, namely:

- ST1 : Sufficient ERP support team (ST1) knowledge and expertise
- CM2 : A harmonious professional relationship between ERP support team and users
- CM1 : ERP communication support team with users
- CC1 : Compliance with information technology management practice standards
- FS2 : System functions that are easily adaptable to changes

4.3. Managerial Implications

In order to increase user acceptance of the system by increasing the contribution of the ERP system, the quality of the ERP system and data, the development of ERP systems and the quality of supporting ERP systems, the researchers suggest practical steps: planning the development of SAP ERP systems, determining the structure of IT support organizations, equity and distribution SAP ERP system

knowledge, empowering key users, compliance with information technology management practice standards, continuous evaluation, joint performance measurement, management support for change. As an initial step in the initiative to carry out efficiency and automation of the SAP system, the internal support department of PT. XYZ Indonesia called the Business Intelligence and SAP department conducted interviews with key users. This interview is intended to get an overview of business processes and the use of SAP that has been running well, which needs to be improved or not yet running but is needed. It also analyzes the issue tickets and change requests received by the Business Intelligence and SAP departments. Key users are SAP users who take an active role when SAP is in the implementation period. The active role of key users in the implementation process is not only in training, but also in deciding business processes that will be used for day-to-day operations of the company. The Business Intelligence and SAP Department is a department that acts as internal support, which is tasked with resolving issues that occur as well as handling the development of SAP features. PT. XYZ Indonesia has an internal ticketing system that can be used to record and act on issues and improvements related to the SAP system proposed by key users.

From the results of interviews with key users and the analysis of issue tickets and Change Request (CR) obtained the following inputs:

1. SAP ERP is not fast enough to adapt to changes in business processes
2. Poor system performance where SAP ERP systems often experience down-time, especially when the use of the system is accessed by almost all users at the same time.
3. Lack of communication from the Business Intelligence and SAP departments on developments made related to SAP ERP to users.
4. The quality of data available in SAP ERP still has some shortcomings.
5. Some SAP ERP functionality that has not been fully implemented.
6. The use of SAP ERP is inappropriate because of lack of end-user knowledge and/or direction from more senior staff.
7. Some transaction detail processes are processed outside the SAP ERP system due to features that cannot be used or have not been customized to suit business needs,
8. Instructions for using SAP ERP that is not updated and/or unclear.
9. SAP ERP training is lacking, especially in new employees as well as inadequate training in new developments

5. Conclusion

There are 24 indicators and 4 factors that influence user acceptance of the SAP ERP system in the XYZ group. These factors are the low contribution of the ERP system (X_1), the quality of ERP systems and data (X_2), the development of ERP systems (X_3), and the low quality of supporting ERP systems (X_4). With the above model, the level of user acceptance of the SAP ERP system can be increased to an ideal condition where $Y = 9,400$ by optimizing the managerial implication steps that have been previously. Research on the level of ERP user acceptance in e-Commerce companies is expected to be further expanded by several research objects with e-Commerce business models and carried out from time to time. In addition, it is recommended that research add factors such as individual performance, personal characteristics and information literacy, a country's culture and organizational citizenship. Also includes moderator variables such as gender, age and length of work experience.

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