Empirical research of enterprise resource planning system implementation in Indonesia: a preliminary study

Wilson Kosasih*, Lithrone L. Salomon, Carla O. Doaly and R. Ryandi, S. Liman

Department of Industrial Engineering, Universitas Tarumanagara, Jakarta 11440

*wilsonk@ft.unutar.ac.id

Abstract. Enterprise resource planning (ERP) system highly affect industrial performance improvement. A number of factors of the ERP itself raise the difficulty in implementing the system. An empirical study discusses the implementation of ERP system based on end-user’s perspective was conducted. This study aims to investigate the critical success factors in influencing the adoption level of ERP system in an organization. Firstly, mapping of ERP system implementation was conducted in various industrial sectors for all industrial scales in Indonesia. Beside, this paper also describes the proposed research model complete with indicators of each variable. Eventually, a survey result on 444 end user respondents indicates that most industries in Indonesia have implemented ERP system, especially those had undergone digitalization transformation in a recent decade.

1. Introduction

In the digital economy era, the power of information is a vital aspect in transforming all resources to create added value for customers. By implementing an ERP system, it is expected that manufacturing or service companies can improve all aspects of the company with an integrated data system. In Indonesia, the implementation of an ERP system used by each company is not the same because of consideration of various aspects of the company. In fact, it is possible for companies to not or have not implemented an ERP system because if a failure occurs, the company will experience a significant impact on finance and provide an influence that disrupts daily operational activities.

Many factors influence the success and failure of ERP implementation in a company. A number of theories and developments in practice have been used to explain the implementation of ERP systems in organizations. The problem according to Chang, et.al. states that technological, organizational and user factors can influence ERP implementation [1]. ERP systems are different from innovations from other IT systems because of socio-technical challenges that are in line with the complexity of the system implementation and different types of user systems [2]. The success of ERP system implementation is influenced by the level of skills and knowledge of users of the ERP system [3]. Of course, this provides an understanding that some theories and metamorphosis of previous studies [4], [5], [6], [7], [8] who have found contextual factors that influence ERP system implementation are inconsistent (not convincing), inconsistent, and situational. Likewise, the practice of implementing ERP system in industries in Indonesia certainly has different characteristics.
2. Literature Review and Method

2.1. Previous Study of Successful and Failure in ERP Implementation
Various studies have conducted a critical study of the factors that influence the level of success and failure in ERP implementation, such as research using literature studies conducted by Nah et al. (2001) found that there were determinants of the success of ERP implementation including: teamwork, adaptability, top management support, plans and vision, business process management and development, project management, monitoring, effective communication, software development and testing, the role of project and the right business, and legacy IT systems [9]. In addition, ‘effective training’ is an important factor that must be considered in the implementation of an ERP system [10]. ERP system implementation involves more important efforts in understanding more complex organizational problems [11], [12]. The issues and challenges of ERP implementation can be summarized into three aspects, namely: 1) human resources, 2) technology, and 3) business (organization) [13]. There are several reasons why ERP system implementation fails, namely: 1) operating strategy does not encourage business process planning and development; 2) implementation time is longer than expected; 3) preparation or pre-implementation activities do not work well; 4) employees are not well prepared to receive and operate a new system; 5) implementation costs are greater than anticipated; 6) lack of management commitment for successful implementation so that not only technical aspects relating to software are considered; 7) mapping process is not done first so that it has a long-term effect on the selection of business processes used; 8) not ready for changes in organizational structure that occur due to changes in business processes and implementation of new systems [14]. In addition, there are several studies that reveal the failure of ERP system implementation, namely the lack of training from end users; ineffective communication; lack of full time commitment from project implementation; lack of sensitivity to user resistance; and failure to emphasize reporting [14], [15], [16], [17], [18], [19]. External succession factors, such as vendor support and consultant competence, are needed for the successful implementation of an ERP system [20]. The role of the consultant in ERP implementation was also identified by a number of researchers as an important factor for the successful implementation of ERP [21]. Top management support is considered a positive commitment, enthusiasm, and support from seniors for the ERP project [22]. The success of the application of this system is also influenced by the quality of the system, the quality of information, and benefits to individuals, organizations and society, this means that the perception of benefits affects user satisfaction [23]. Research from Everdingen & Waarts (2003) refers to the Hofstede Model (1983) examining the differences in the learning culture of innovation adoption, in the ERP system in particular, it was found that national culture had no impact on the implementation of ERP system [24], [25].

2.2. A Preliminary Study Method
This study aims to describe the facts that actually occur in the ERP system implementation as well as their development and changes. The whole study is an exploratory-descriptive study that uses a combination of primary and secondary data even direct observation to the location stated as a sample in the study. However, the mapping of ERP implementation in various industrial sectors in Indonesia was first carried out. The sample selection method is more of a purposive categorization method, such as categorization based on industrial sector, region, and the size of a particular industry.

The first stage of this research is conducted by using a research instrument (questionnaire) which distributed to companies both manufacturing and service industries, especially spread in the Greater Jakarta area (Jakarta, Bogor, Depok, Tangerang, and Bekasi), and partly in industrial estates in the Cilegon, Serang, Cikarang and Karawang regions, even outside Java, especially for the service industry. Next will be mapping the ERP implementation in various industrial sectors in Indonesia. Survey respondents focused on end users who work in companies that have implemented ERP system.

3. Results and Discussion
3.1. The Result of Preliminary Study

Table 1 shows the demographics of respondents, including gender, length of work, and field of work. The proportion of respondents considered eligible because it has a variance of data that are supposed to represent the end users of ERP system for manufacturing and service industries. Table 2 shows that the survey result is considered to represent various sectors of manufacturing and services industries. However, the majority are large scale industries. Meanwhile, Table 3 illustrates a comparison result of the adoption level of an ERP system between manufacturing and service industries, including the duration of its implementation.

### Table 1. The demography characteristics of respondents

| No | Attribute | Freq. | Perc. | No | Attribute | Freq. | Perc. |
|----|-----------|-------|-------|----|-----------|-------|-------|
| 1  | Gender:   |       |       |    |           |       |       |
|    | Male      | 263   | 59.23%|    | Supply Chain | 9    | 4.50% |
|    | Female    | 181   | 40.77%|    | PPIC      | 8    | 4.00% |
|    | Total     | 444   | 100%  |    | Quality Control | 8   | 4.00% |
| 2  | Length of work: | | | | | | |
|    | Less than 5 years | 267 | 60.13% | | General Affair | 7 | 3.50% |
|    | 5-10 years | 110  | 24.77% | | Maintenance | 7 | 3.50% |
|    | Greater than 10 years | 67  | 15.10% | | Others | 15 | 7.50% |
|    | Total     | 444   | 100%  |    | Total     | 200  | 100%  |
| 3  | Field of work: | | | | | | |
|    | Manufacturing Industry: | | | | | | |
|    | Production | 36 | 18.00% | | Accounting | 45 | 18.44% |
|    | Marketing | 22 | 11.00% | | Finance | 45 | 18.44% |
|    | Administration | 19 | 9.50% | | IT | 22 | 9.02% |
|    | IT | 15 | 7.50% | | Logistic | 20 | 8.20% |
|    | Human Resource | 14 | 7.00% | | Human Resource | 17 | 6.97% |
|    | Finance | 12 | 6.00% | | Administration | 7 | 2.87% |
|    | Logistic | 11 | 5.50% | | Others | 41 | 16.80% |
|    | Accounting | 10 | 5.00% | | Total | 244 | 100% |

### Table 2. The survey result of industrial characteristics

| No | Attribute | Freq. | Perc. | No | Attribute | Freq. | Perc. |
|----|-----------|-------|-------|----|-----------|-------|-------|
| 1  | Type of sector: |       |       |    | Type of sector: | | |
|    | Chemistry | 45 | 22.50% | | Restaurant, hotel and tourism | 31 | 12.70% |
|    | Wood and its processing | 33 | 16.50% | | Finance | 24 | 9.84% |
|    | Food and beverage | 23 | 11.50% | | Banking institution | 85 | 34.84% |
|    | Plastic and packaging | 11 | 5.50% | | Hospital | 17 | 6.97% |
|    | Cigarettes | 10 | 5.00% | | Insurance | 9 | 3.69% |
Table 3. A comparison result of ERP implementation between manufacturing and service industries in Indonesia

| Attribute                                      | Manufacturing Industry | Service Industry |
|------------------------------------------------|------------------------|------------------|
| a. Not implemented yet                        | 15                     | 39               |
| b. Implemented with the adoption level:       |                        |                  |
| • Very low                                     | 1                      | 3                |
| • Low                                          | 2                      | 14               |
| • Moderate                                     | 53                     | 56               |
| • High                                         | 116                    | 80               |
| • Very high                                    | 13                     | 52               |
| **Total**                                      | **200**                | **244**          |
| c. Duration of ERP implementation:            |                        |                  |
| (if already implemented)                      |                        |                  |
| • Less than 1 year                             | 21                     | 22               |
| • 1-5 years                                    | 98                     | 78               |
| • Greater than 5 years                         | 66                     | 105              |
| **Total**                                      | **185**                | **205**          |

3.2. The research model
The next study aims to investigate contextual factors comprehensively from various end user perspectives and the relationships between factors, which affect the level of implementation of the ERP system, including various obstacles/failures that arise when the ERP system is still relatively new adopted in both manufacturing and industrial industries service sector. At this stage, the development of structural equation modeling is formulated, which first develops and tests the confirmatory factor analysis model for all latent variables, namely; characteristics of human resources, top management support, organizational culture, industrial management, business process reengineering, industrial competition, information technology & system, organizational performance. The model developed was tested by using goodness of fit test, validity test, and reliability test. 

In this study, each variable uses a Likert scale. Each indicator in latent variables such as; characteristics of human resources, top management support, organizational culture, business process reengineering and information technology & system use a 1-5 Likert scale, where 1 = 'not good' to 5 = 'very good'. While each indicator of industry competition and industry performance variables uses a 1-5 Likert scale, where 1 = 'very low', up to 5 = 'very high'. Then, for industrial management and ERP system implementation using a 0-5 Likert scale, where 0 = 'has not been implemented', 1 = 'applied but still not good', up to 5 = 'very well implemented'. Simply, this research model can be illustrated on Figure 1. The model is developed from various previous studies.

| Variable(s)                        | Indicator(s)                        | References                        |
|------------------------------------|--------------------------------------|-----------------------------------|
| Human resource characteristics     | S1 Multi-skill workforce              | [1], [17], [26], [27]             |
|                                    | S2 Level of understanding of the system |                                  |
|                                    | S3 Management training               |                                  |
|                                    | S4 coaching/mentoring                |                                  |
| Top management support             | TM1 Top management support           | [14], [28], [29], [30], [31], [32] |
|                                    | TM2 Top management commitment        |                                  |
|                                    | TM3 Responsibility of top management |                                  |
|                                    | TM4 Top management leadership        |                                  |
|                                    | TM5 Top management policy            |                                  |
| Organizational culture             | B1 Job standardization               | [2], [24], [25], [26], [33]      |
|                                    | B2 Tolerance between employees       |                                  |
|                                    | B3 Award for work performance        |                                  |
|                                    | B4 Teamwork                          |                                  |
|                                    | B5 Communication between employees   |                                  |
|                                    | B6 Continuous improvement            |                                  |
|                                    | B7 Decision-making                   |                                  |
|                                    | B8 Cross function team               |                                  |
|                                    | B9 Innovation                        |                                  |
|                                    | B10 Empowerment of employees         |                                  |

| Variable(s)                        | Indicator(s)                        | References                        |
|------------------------------------|--------------------------------------|-----------------------------------|
| Industrial management              | I1 Strategic management              | [17], [30], [31], [34]           |
|                                    | I2 Project management                |                                  |
|                                    | I3 Process management                |                                  |
|                                    | I4 Vendor management                 |                                  |
|                                    | I5 Supply chain management           |                                  |
|                                    | I6 Lean management                   |                                  |
|                                    | I7 Total quality management          |                                  |
|                                    | I8 Activity-based management         |                                  |
### Business Process Reengineering

| BP1 | Setting new company goals and objectives | [14], [30], [31], [35] |
| BP2 | The company's ability to control implementation |
| BP3 | Company preparation for business processes |

### Industrial Competition

| PI1 | Price competition |
| PI2 | Competition in product development/customer goods/services |
| PI3 | Market growth |
| PI4 | Customer demands |

### Information Technology and System

| T1 | System sensitivity/response |
| T2 | The comfort level of using the system |
| T3 | The level of ease of use of the system |
| T4 | System flexibility |
| T5 | System reliability |
| T6 | System stability |
| T7 | Data integration |
| T8 | Integrated System |
| T9 | System flexibility |

### Industrial Performance

| P1 | Productivity level |
| P2 | Delivery on time |
| P3 | Response to customers |
| P4 | Sales growth |
| P5 | Work effectiveness |
| P6 | Market share |
| P7 | Operating profit |
| P8 | Cost effectiveness |
| P9 | Focus on customers |

### Figure 1. A research framework

4. **Conclusion**

In this study, the results of a survey of 444 respondents indicated that most industries in Indonesia had implemented ERP or digitalization transformation in the past decade. Only about 7.5% of respondent from the manufacturing industry have not implemented it as well as about 16% in the service industry. The survey results have not been able to infer that there is an influence of industry size towards ERP implementation, because its data distribution is disproportionate. The manufacturing industry sector, the majority of which have implemented ERP systems, include; chemical, wood and processing, food and beverage, plastic and packaging, cigarettes, metals, automotive and components, pulp and paper, cables, cosmetics and household goods, textiles and garments, pharmaceuticals, machinery and heavy equipment, electronics, tires, footwear. While around 32% of the service industries in Indonesia have implemented ERP. And, the service sector that the majority has implemented ERP, among others;
restaurants, hotels, & tourism, finance, banking, hospitals, insurance, construction & building, transportation & logistics, and investment companies. This research is still far from perfect in terms of the number of respondents and the variance of the data regarding the types of manufacturing and service industries. Furthermore, this research needs to be developed comprehensively using a perspective with a qualitative approach besides those that have been carried out using a quantitative approach.

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