

# The Effect of Enterprise Resource Planning Sustainability on Operational Performance through Planning and Control Integration

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**Abstract**—The aim of this study is to analyze the relationship between enterprise resource planning (ERP) and its impacts on operational performance. The population is 98 manufacturing companies, ranging from medium to large size, domiciled in industrial area district of Sidoarjo East Java, Indonesia. Data collection used a questionnaire designed with a five-point Likert scale and each company represented by a middle manager. 38 questionnaires are considered correctly completed and valid for the data analysis. Data were then analyzed using partial least square (PLS) technique with smartPLS software. The result indicates that ERP sustainability results in improved operational process integration. The ERP sustainability has not strong enough influence to improve planning and control integration. Operation process integration affects planning and control integration. ERP sustainability has no effect on operational performance directly. And Operational process integration has no effect on operational performance directly. These findings contribute to the current research on the relationship between enterprise resource planning sustainability and operational performance with the inclusion of the operational process integration. The manufacturing company can adopt this finding to improve their operational performance.

**Keywords**—Enterprise resource planning; operational process integration; operational performance; manufacturing company

## I. INTRODUCTION

The requirement of automation system for the company is essential especially for the data connection between departments related to the company. Information obtained from customers goes directly into the company's enterprise resources planning (ERP) system and automatically integrates with all relevant departments in the company. ERP is an enterprise information technology system designed to coordinate and integrate company resources, required information between departments and all the company's operational activities in full. This system uses software and hardware that has been set by the company so that the physical archives that have been used by the company reduced and even allow companies not to use physical [1].

The physical data that the company used changes gradually into the digital system and stored the digital version on the company's servers and devices used for data storage. Data storage on a corporate ERP system eliminates geographic limitations in data access and changes data on enterprise systems. Data storage on enterprise systems also provides a history of data changes and who makes changes

and makes it easy for those who have responsibility for the data. Implementation of information technology in the form of ERP can provide efficiency and effectiveness in operational function of the company [2]. The use of ERP in the company gives the organization structure of the company is getting leaner, and the number of workers in the company is getting less, and the speed of data integration at the company is getting faster. All employees in the company rely on the ERP function as the primary substitute for the company's operational functions. The use of ERP is increasingly familiar to company employees it is possible to perform a monitoring function on the company's operational functions. This condition gives full authority to the employees on specific functions can perform monitoring on other functions that are integrated with each other. Monitoring conducted by company employees related to the data function it was called transparent communication [3].

The ERP system seeks to integrate all departmental and other functions into one computer database system [4]. Complexity in the application of ERP can take a long time and requires an outsider such as an expert consultant for preparation and implementation. The complexity of the ERP system becomes a problem that must be solved to create an ERP system that is compatible with the company in order to be able to improve competency and market performance in the company [5]. The medium-term planning may consist of the quarter sales planning, budget planning, and production planning. Furtherly, the medium-term planning breaks down into short-term planning, i.e., monthly and weekly planning. The short-term planning typically formulated in the form of material requirements planning, company production planning, corporate material use planning, and labor availability planning. Planning made the company will be shared with relevant departments and particularly with the operational functions. Hence, the results of data entry from the marketing department will be visible to the production and operational departments, and the firms top management irrespective of geographic location. In other words, top management level is able to monitor any planning of all function within the company.

Monitoring conducted by middle managers of the company's operations is used for operational control related to the work activities. While controls made by decision-makers are related to the use of human resources, material resources, supporting materials, the use of the production machines, the use of the number of transportation in the company, and the control of the company's inventory. Controls performed by top management can contribute well

to the relationships and communication between departments within the company. The ERP function and its role will directly determine the design or design of the organization structure, covering departments, division, and the lowest level units. The design of those function is related to the information system, business process, the interaction and communication, and the decision-making system. The number of functions owned by the company's ERP is essential to make sure the presence of system stability such that the system runs continuously in respect of corporate benefits [6]. ERP not only improves operational integration but is also capable of the function of planning and control integration against all departments in the company [7]. ERP can rapidly alter the system of data integration at a company so as to enhance operational integration to determine planning and control better. This is also supported by the statement Monostori et al., [8] ERP built by the company is one of the right solutions in conducting planning and control integration in order to define the schedule and operational system of the company.

Some of the previous studies discussed the benefits of ERP implementation for companies. Su and Yang [9] stated that the benefits of ERP include providing data integration to companies that reduce cycle time, improve the flow of corporate information systems, accelerate corporate financial statements, promote corporate business, as well as assisting in the development of corporate organizations. Nikookar et al., [4] stated that ERP benefits are integrated real-time data, improved corporate administration system, and results-based system management, accelerate customer response, assist in strategic decisions and reduced operational costs. ERP is indispensable to the current business arrangement in enhancing data integration in material flow, flow to the financial system and assisting corporate management in determining strategic policies [10]. ERP benefits tangibly can contribute to reducing the number of employees, reducing inventory levels, increasing company productivity, increasing customer satisfaction, reducing lead time production and purchasing, improving company cash flow, increasing revenue, reducing shipping costs and transportation. The benefits can be intangible in the form of improving corporate data settings, improved communication systems, better systems integration between departments, increased flexibility, sharing information between departments and employee on the company.

## II. THEORETICAL BACKGROUND

### A. ERP Sustainability

ERP is a tool in the form of a standard module which can integrate all business processes in respect of company resources used to enhance the operational efficiency [10]. Implementation of ERP system can bring a beneficial business impact directly, but the impact is not necessarily long-lasting due to changes in the environment, employees and customer demand. The ERP system should be able to adopt any changes that occur. Otherwise, the ERP system can reduce business performance [11]. The ERP system must be maintained in term of its availability and speed of data

information. The ERP system needs to be maintained covering the relationship with consultants who are at the beginning of ERP implementation, ERP key user capabilities, ERP system software and hardware development, and ongoing corporate training [12]. Post-implementation ERP must be maintained in respect of the quality to ascertain that the system runs appropriately for the operating system and provide financial benefits for the company. Success in implementing an ERP system has not guaranteed business performance over an extended period of time; there are several factors necessary to maintain the sustainability of the ERP system to make a profit [13].

The company uses ERP software that suits the needs of the organization, and the software owned is controlled from software stability and software function in integrating the system, so that the system reliability of the company is maintained [14]. ERP as a standard package solution in the form of software in integrating all business processes into unity and presents a business concept with a blend of business management and information technology. The completeness of the module used in the company determines the availability of information required by the management company in making the decision. Completeness of the module used can accommodate existing data and internal business structure of the company, and impact on the reports required by the user. Many ERP products used did not meet the expectations because many facilities are based on standard reports from ERP product makers. In other words, ERP system needs customization in term of the current organization needs. The stability of the ERP system in the company is evident from its proper functioning and efficient accounting-tools system in the company [15]. This can be seen from the function of the ability to perform data transactions, storage of data reports, reduction of duplication of data, accounting database, corporate financial information, and financial statements reports.

### B. Operational Process Integration

Operational process integration as an internal integration activity to combine multiple operations into one that has proper synchronization, a process involving multi-functional planning, sourcing, manufacturing, and delivery to achieve excellence coordination across the enterprise [9]. ERP can integrate the functions of the company, namely personnel function, production function, warehouse function, marketing function, and other functions [16].

These functions can be seen from the integration of functions in the application programs ERP modules include module planning production, material management module, sales and distribution module, module accounting, module warehouse management, finance module, quality management module, and other modules. Based on the definition of operational process integration above, it can be gathered that operational process integration is the ability of companies to obtain the information needed to be integrated in order to produce information that aligned to support internal activities of the company to be more efficient and effective. Grant et al., [17] states that the integration of the company built got six levels, the first is the integration done

on the ERP tool by designing the software and hardware so that the system used stable, the second is to integrate the user system graphically data, report data, keyboard, software and hardware for user friendly use of ERP technology. The third level is building data integration between one department and other departments to facilitate communication, coordination, collaboration and decision making. The fourth level is the integration of the organization that integrates all departments in the company so as to support the goals and strategies of the company. The fifth level is an integration that is built between the company that is integration with the suppliers and customers build partnerships with vendors, and integration with the government system. The sixth level is global integration. Samaranayake's research [18] states that the approach to process integration aims to connect the functions of sales and distribution applications, production planning, finance, material management systems, human resources management and data structures.

### C. Planning and Control Integration

Planning and control integration is the design of a system and information coordination to support purchasing, production, fulfillment of customer orders and raw material planning linked in one network to provide mutual information to the company's supply chain participants [9]. Managers can use ERP in planning and execution schedule and production control which is integrated with all departments in the internal company [16]. ERP can be a solution for companies when integrating planning and control of accounting, scheduling and production systems. ERP can integrate all departments in a company database in real-time [4]. Planning in the manufacturing, control and execution industries is part of the well-integrated ERP module production planning [18]. Based on the above definitions of planning and control integration, it can be concluded that planning and control integration is a series of connected systems of various divisions in order that they are able to control, support and plan each process of the company's production activities and orders fulfillment.

### D. Operational Performance

Advantages of information technology are to deliver information quickly, precisely and accurately through system integration. System integrity owned by ERP can provide an improvement of operational performance of the company. Integrated system integration which is an advantage possessed by ERP provides benefits for the company's operations first, reduce inventory costs for the company [4, 19]. Reduction of inventory costs in the company occurs when information data items in the warehouse can be known allotment of its products. Available inventory reporting at the warehouse is provided quickly; then the decision-making section can adjust the amount of material order from the supplier. The Company may also estimate the schedule of material receipt required so that the material ordering process is carried out in a planned manner.

Both cycle time reductions obtained by the company will give the company benefit in implementing ERP [8, 20]. The time it takes the company to fulfill the product order for its

customers can be easily identified from the ERP system. The use of ERP systems in controlling customer orders is easily recognized by users and top management of the company so as to provide strict supervision of order fulfillment for customers. Integration built ERP system in accepting company orders will be connected with all departments within the company. Third, increased flexibility owned by the company experienced an increase due to the company can run the system in an integrated manner so as to provide information in a timely manner. Processes and procedures that the company can provide the company can act quickly and precisely. Fourth, the improvement of product quality of manufacturing companies [20,21]. The quality of the products produced by the company is a perfect product that conforms to the detailed product specifications. With an enterprise ERP system can have an optimal product design data neatly and quickly found, and simplify the system's quality assurance and control functions. Fifth, increase customer satisfaction. ERP system can provide information about ordering customer goods, customer ordering process and product development of customer and product delivery [4, 8]. All operational activities of the company can be known from the ERP system, so in the marketing, the section can provide information the state of customer products.

### E. Research Model

The ERP system forms a single database and integration of the entire enterprise system under one standard application serving human resources, accounting, sales, manufacturing, distribution, and supply chain management. The advantages of ERP can speed up decision making, reduce costs and managers can control business operations simultaneously within a large area. The advantage of ERP, so it needs to be maintained continuity of the system so that the integration of data between departments within the ERP well maintained. Good data integration on ERP systems will provide more accurate product planning for customers, and control of production processes, inventory numbers and delivery of finished products can be appropriately monitored [22]. Based on this explanation it can be made in model (Figure 1).

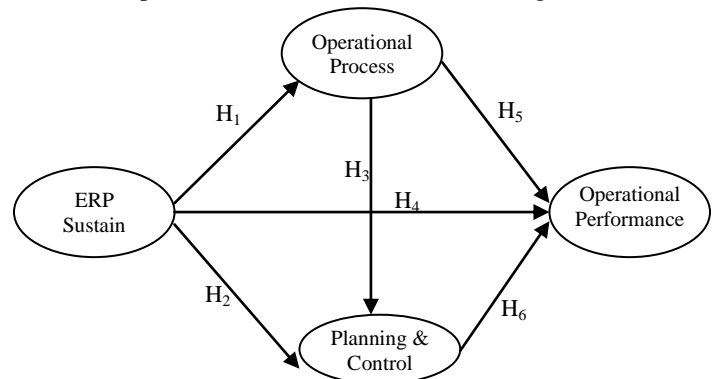


Figure 1. Research Model

Based on the research model, we propose six hypotheses as follows: H1: ERP sustainability has a significant influence on operational process integration. H2: ERP

sustainability has a significant influence on planning and control integration. H3: Operational process integration has a significant influence on Planning and control integration. H4: ERP sustainability has a significant influence on operational performance. H5: Operational process integration has a significant influence on operational performance. H6: Planning and control integration has a significant influence on operational performance.

### III. RESEARCH MODEL

The population of this study is the manufacturing companies domiciled in Sidoarjo, East Java, Indonesia. There are 98 companies covering medium and large size manufacturing registered in this region. These firms were supposed to have practiced ERP system in the daily operation at least 4 years. One respondent represents each company from the manager level which may have a position as senior supervisor, manager, or general manager. Hence, 98 questionnaires were distributed to all companies. The questionnaire was collected every week from the respondent, and during six months, 38 questionnaires have been completed which means the response rate is 38.78%. The author conducted interviews with several respondents to have an insight over the ERP practices by the enterprise and how the ERP integrates all department engaged in the business process. Data processing is performed by structural equation modeling technique by means of PLS program. Data processing is depicted with convergent validity value for each indicator. First construct is ERP sustainability with the cross loading value for each indicator as follows: security system indicator is 0,490; system quality of 0.759; customization system of 0.809; and system administration of 0.875. The second variable is operational process integration with the cross loading value of each indicator, i.e., the cross-functional system of 0.778; standardization of 0.753; compliance with 0,680, structural with a value equal to 0,783 and operational system with value 0,783. The third variable is planning and control integration with the value of cross loading for information management indicators of 0.704, internal communication of 0.760; connectivity of 0.784, and collaborative planning of 0.669. The fourth variable is an operational performance with cost reduction indicator 0,589, cycle time reduction equal to 0,693; increased flexibility of 0,572, improvement of product quality equal to 0,846, and customer satisfaction increase equal to 0,556. The reliability of each indicator is assessed by measuring if the value of composite reliability is above 0.7. The result obtained indicated that all construct are reliable. The composite reliability for ERP sustainability, operational process integration, planning and control integration, operational performance are 0.830, 0.869, 0.820, and 0.740 respectively. Thus, all indicators of each variable are reliable.

### IV. RESULT AND DISCUSSION

The magnitude of influence between construct as described on the proposed hypothesis is assessed by examining t-value from the analysis result. Table 1 demonstrated that three of six hypotheses are supported while the other three hypotheses are not supported. Based on

the results (Table 1), ERP sustainability influence the operational process integration with gamma coefficient value of 0.487 and T-statistic of 2.138 > T table of 1.96 for the significant level of 5%. It may be explained that ERP can be customized to fit the conditions of the company and administration system such as providing the reports required for the data integration between departments in the manufacturing companies. ERP systems built by manufacturing companies should be able to tailor with the company operational needs. Interestingly, the result from the inner model demonstrated that ERP sustainability did not influence the planning and control integration as indicated by the coefficient value of 0,091 and T-statistic equal to 0,489 < T table equal to 1,96.

Table 1. Hypothesis Result

Effect	original sample estimate	mean of subsamples	Standard deviation	T-Statistic
Sustain -> Process	0.487	0.477	0.260	2.138
Sustain -> PPC	0.091	0.118	0.186	0.489
Process -> PPC	0.643	0.610	0.106	6.058
Sustain -> Performa	0.111	0.115	0.130	0.860
Process -> Performa	0.153	0.137	0.147	1.042
PPC -> Performa	0.588	0.602	0.112	5.254

The second hypothesis is rejected which means that ERP sustainability has no influence on the planning and control integration. This may be explained that ERP used by the firm is not able to provide the data required by the planning department. Hence, the planning and control integration did not use only the data provided by the ERP but another resource of data as well. This implies that the ERP system needs the improvement on the data availability or the report output which is required by the planning and control department. The third hypotheses, the influence of ERP sustainability on the operational performance also rejected as indicated by the coefficient value of 0.111 and the t-value of 0.860 which less than 1.96 for the significant level of 5%. This means that there is no significant effect of ERP sustainability on operational performance. The interpretation of this result implies that ERP sustainability did not influence the operational performance of manufacturing companies. The ERP systems may not be used effectively through the entire department of the firm mainly on the operational aspect. Sustained ERP can provide information on existing data on the entire company.

Fourth hypotheses, the influence of operational process integration on the planning and control is supported. The result from the analysis as shown in Table 1 demonstrated the coefficient value of 0.643 and the t-value of 6.058. This means that there is a significant influence of operational process integration on the planning and control integration. The operational process integration influences the planning and control integration. In other words, the cross-functional system and the operational system ERP used in the company is able to provide data on the operational state of the company for top management so that the data transfer

between inter-department has taken place and helpful in decision making. The fifth hypotheses, the influence of operational process integration on the operational performance, is not supported as indicated by the coefficient value of 0.153 and t-statistic of 1.042 less than 1.96. This means that operational process integration has no direct impact on operational performance. The last hypotheses, the influence of planning and control integration on the operational performance is supported as indicated by the coefficient value equal to 0,588 and t-value equal to 5,254 higher than 1,96. There is a significant effect of planning and control integration on operational performance on the sustainability of ERP system with significant level 0,05. Integrated planning and control by top management can improve product quality in the company. One of the notable findings is that indirect impact of ERP sustainability on operational performance through intervening operational process integration variables, planning, and control integration with the indirect coefficient of 0.184.

## V. CONCLUSION

The primary aim of this study is to examine the influence of ERP sustainability on the operational performance through the operational process and planning and control. The ERP established by the firm needs to be maintained consistently so that the ERP system becomes sustainable all the time. ERP sustainability in manufacturing companies is able to provide an excellent operational process integration. This condition is achieved when the company to customize well with the culture of the company. However, sustainability ERP can not directly become a tool used for planning and control integration of company operations. This condition is formed first by making the process operational section well integrated. Operational process integration that has been well organized and used by companies need improvement to enhance the planning and control integration in the use of resources owned by the company. This condition will provide an improvement in company performance, especially in its operations. Completion of this research can be done by increasing the use of ERP into the operational activities of the company. Enterprise management must build an organizational culture to make the ERP as a system used for communication between departments, so some unintegrated and unused data can be minimized on the system.

## REFERENCES

- [1] R. Malhotra and C. Temponi, "Critical decisions for ERP integration: Small business issues," *International Journal of Information Management*, 30, 2010, pp. 28-37.
- [2] J. Park and J. Park, "Enterprise resource planning and efficiency evidence from the Korean Property/Casualty insurance companies," *Managerial Finance*, Vol. 41 Iss 4, 2015, pp.405-415.
- [3] R.G. Saade and H. Nijher, "Critical success factors in enterprise resource planning implementation A review of case studies," *Journal of Enterprise Information Management*, Vol. 29 Iss 1, 2016, pp.72-96.
- [4] G. Nikookar, S.Y.Safavi, A. Hakim, and A. Homayoun, "Competitive advantage of enterprise resources planning vendors in Iran," *Information Systems*, Vol. 35 Iss 3, 2010, pp. 271-277, doi.org/10.1016/j.is.2009.09.002.
- [5] E.E. Karsak and C.O. Özogul, "An integrated decision making approach for ERP system selection" *Expert System with Applications*, Vol. 36 iss 1, 2009, pp. 660-667.
- [6] M. Parhizkar and M. Comuzzi, "Impact analysis of ERP post-implementation modifications: Design, tool support and evaluation," *Computers in Industry*, Vol. 84, 2017, pp. 25-38.
- [7] Z. Irani, M.Themistocleous, P.E.D. Love, "The impact of enterprise application integration on information system lifecycles," *Information & Management*, Vol. 41 iss 2, 2003, pp. 177-187, doi.org/10.1016/S0378-7206(03)00046-6
- [8] L. Monostori, G. Erdős, B. Kádár, T. Kis, A. Kovács, A. Pfeiffer, and J. Váncza, "Digital enterprise solution for integrated production planning and control," *Computers in Industry*, Vol. 61 iss 2, 2010, pp.112-126, doi.org/10.1016/j.compind.2009.10.008.
- [9] Y. F. Su and C. Yang, "A structural equation model for analyzing the impact of ERP on SCM," *Expert Systems with Applications*, 37, 2010.
- [10] Y.C. Shen, P.S. Chen, and C.H. Wang, "A study of Enterprise Resource Planning (ERP) system performance measurement using the quantitative balanced scorecard approach," *Computers in Industry*, 75, 2016, 127–139, dx.doi.org/10.1016/j.compind.2015.05.006.
- [11] C. Sheu, B. Chae, and C-L. Yang, "National differences and ERP implementation: issues and challenges," *Omega*, Vol. 32, 2004, pp.361-371.
- [12] A. Nicolaou and S. Bhattacharya, "Sustainability of ERPS performance outcomes: The role of post-implementation review quality," *International Journal of Accounting Information Systems*, 9, 2008, pp. 43-60.
- [13] M-T. Tsai, E.Y. Li, K-W. Lee, and W-H. Tung, "Beyond ERP implementation: The moderating effect of knowledge management on business performance," *Total Quality Management & Business Excellence*, Vol. 22 iss 2, 2011, pp. 131-134.
- [14] J.H. Wu and Y.M. Wang, "Measuring ERP success: The key-users "viewpoint of the ERP to produce a viable IS in the organization," *Computer in Human Behavior*, 23, 2007, pp. 1582 – 1596.
- [15] E.L. Wagner, J. Moll, and S. Newell, "Accounting logics, reconfiguration of ERP systems and the emergence of new accounting practices: A sociomaterial perspective," *Management Accounting Research*, Vol. 22 iss 3, 2011, pp. 181-197.
- [16] I.V. Nieuwenhuysse, L.D. Boeck, M. Lambrecht, and N.J. Vandaele, "Advanced resource planning as a decision support module for ERP", *Computers in Industry*, 62, 2011, pp. 1–8.
- [17] D. Grant, Y. Hwang, and Q. Tu, "An empirical investigation of six levels of enterprise resource planning integration," *Computers in Human Behavior*, 29, 2013, pp. 2123–2133.
- [18] P. Samaranayake, "Business process integration, automation, and optimization in ERP: Integrated approach using enhanced process models," *Business Process Management Journal* Vol. 15 issue: 4, 2009, pp. 504-526, doi.org/10.1108/14637150910975516.
- [19] O.G. Kayas, R. McLean, T. Hines, and G.H. Wright, "The panoptic gaze: Analysing the interaction between enterprise resource planning technology and organisational culture," *International Journal of Information Management*, Vol. 28 iss 6, 2008, pp. 446–452.
- [20] W-W. Wu, "Segmenting and mining the ERP users' perceived benefits using the rough set approach," *Expert Systems with Applications* 38, 2011, pp. 6940–6948.
- [21] A. Leon, *Enterprise Resources Planning*, McGraw-Hill Publishing Company Limited, New Delhi, 2005.
- [22] W. Suppato, Z.J.H. Tarigan, and S. R. Basana, "The influence of ERP system to the company performance seen through innovation process, information quality, and information sharing as the intervening variables, Proc.of the 2017 International Conference on Education and Multimedia Technology (ICEMT' 17), July 2017, pp.87-91, doi>10.1145/3124116.3124131.