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<b>H-INDEX</b> <b>44</b>	<b>PUBLICATION TYPE</b> Conferences and Proceedings	<b>ISSN</b> 17578981, 1757899X

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The conference program covered invited, oral, and poster presentations from scientists working in similar areas to establish platforms for collaborative research projects in this field. This conference will bring together leaders from industry and academia to exchange and share their experiences, present research results, explore collaborations and to spark new ideas, with the aim of developing new projects and exploiting new technology in this field.

The committee of AMMSE expresses their sincere thanks to all authors for their high-quality research papers and careful presentations. All reviewers are also thanked for their careful comments and advices. Thanks are finally given to IOP Publication as well for producing this volume.

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Zeplin Jiwa Husada Tarigan<sup>1</sup>, Hotlan Siagian<sup>1</sup> and Rick Richard Bua<sup>1</sup>

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# The Impact of Information System Implementation to the Integrated System for Increasing the Supply Chain Performance of Manufacturing Companies

Zeplin Jiwa Husada Tarigan<sup>1, a\*</sup>, Hotlan Siagian<sup>1, b</sup>, and Rick Richard Bua<sup>1, c</sup>

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**Abstract.** This study examines the impact of information system management implementation on the company performance with the mediating role of process innovation and process innovation. Data collection is conducted by distributing questionnaires to, and through interviews with the respondents engaged in the department of the information system of 41 companies in Surabaya, Indonesia. The questionnaire is designed using a five-point Likert scale ranging from 1: strongly disagree up to 5: strongly agree. The data analysis uses smart PLS software version 3.0. The study found that the implementation of a management information system directly affects the process of innovation. The implementation of a management information system also directly influences product innovation. The implementation of a management information system does not directly affect the supply chain performance. The process innovation improves product innovation. Process innovation does not provide a direct impact on supply chain performance. Product innovation directly gives an impact on the improvement of the performance. In total, the implementation of management information systems affects supply chain performance through the process innovation and product innovation by the coefficient of 0.526. This study contributes to the current research on supply chain management and paves the way for managers to improve the supply chain performance by implementing the management information system, product innovation, and process innovation.

## 1. Introduction

Today, the domestic farm industry is one of the sectors which support the Indonesian economy sustainability. This industry contributed 15.38% to the country's domestic product in the industry and trade sector [1]. This means that the farm industry is still growing, and the need for the farm products is consequently increasing as well. The Ministry of Agriculture has published the annual strategic plan with one of the primary targets is to achieve meat self-sufficiency. The fulfillment of meat demand becomes the priority. However, several factors have caused the inability of the farm industry to fulfill the increasing demand for meat and eggs in Indonesia [2]. In line with the current market demands, customer's needs are also rapidly changing. It requires support from all related partner such as suppliers, distributor, and retailer until the final customer [3]. The supply chain management practices could become a solution on this industry regarding how to manage the process of material from the supplier into finished products and then delivery to consumers. The extent to which those companies within a supply chain fulfill the customer demand is defined as the supply chain performance. The supply chain performance is assessed in term of efficiency (cost) and responsiveness of an internal business operation. According to Lai et al., [13] supply chain performance is measured regarding profit, cost, and environmental performance. Cho et al., [14] suggest the supply chain performance



measurement is based on the industry sector. Both studies revealed that supply chain management (SCM) is an essential competitive advantage for companies in providing fast service with high product variety and low cost. Al-Sa'di et al., [19] states that process innovation and product innovation have a positive and significant impact on company performance. The implementation of information technology in the farm's industry is still limited to administration only, and its enforcement is still done partially on the company operation. The information technology has not been integrated into all departments, especially in the operational section of the company's farm industry.

Meanwhile, research by Tarafdar and Gordon [4] mentions that information systems and information technology support business processes innovation. Information system and technology support the innovation of the process through the improvement and development of a better company's business processes [5]. Information technology supports the process of innovation in the company during the product design. Information technology supports the innovation of the process as information technology can provide the required data in real time. Research conducted by Ferneley and Bell [6] states that information technology can improve the innovation of corporate processes such as business rationalization and improvement. Another research conducted by Adamides and Karacapilidies [7] state that the information system can result in a process innovation in the form of the improved business process such as easy understanding of the procedure, an operational standard, which enable the transfer of knowledge among individuals. Roper et al., [8] state that the end of a knowledge process is a transformation of innovation to produce new products and processes. Company's innovation achievement is represented by applying industrial process practices in producing new products or processes. The company's product innovation meet the customers need and make the customer satisfied better than competitors, and increases its market share [9].

Basole et al., [10] suggest that the adoption of information technology is vital to process innovation for transforming organizations to adapt to changes. Product innovation in the company is derived from a new idea by doing an innovation process. Performing product innovation and process innovation requires substantial forward investment in many aspects from the development of specialized resources, new equipment, research and development (R&D), new technology and even new business units [11]. The innovation capability in the manufacturing industry is required to develop new technology by conducting R & D to produce a new product required by the customer [12]. The implementation of information technology in the farm's industry is still limited to administration only, and its enforcement is still done partially on the company operation. The information technology has not been integrated into all departments, especially in the operational section of the company's farm industry.

Based on the above description, this study examines the impact of information technology implementation on the company performance with the mediating role of the process innovation and product innovation in the farm industry.

## **2. Relationship Among Concepts**

The adoption of information and communication technology by the SME (small medium enterprise) contributes to the improvement of innovation including product innovation, process innovation and innovation in the overall enterprise system [15]. Process innovation by the company can be realized in the form of changes in work procedures and innovation procedure. Changes made through improvement in manufacturing processes, and using new technology will produce a new product (innovated product) for the company. Explorative learning and improvement creativity gained by the company enhance the ability to innovate [16]. Process innovation reflects the changes how the organizations produce the end products and services of a company. Process innovation is a tool for improving quality as well as cost saving. Product innovation allows the company to introduce a new product or service into the market to meet the customer's needs and market orientation [17]. Lukas & Farel [18] classify the product innovation into three basic types: 1) product line extensions, 2) tailor-made products, and 3) new products. Product line extensions are relatively new products on the market but not new to the company. The tailor-made product is a relatively new product for the company, but it is relatively well known in the market. New to the world products are new products both for the company and for the market. The research conducted by Al-Sa'di et al., [19] states that process

innovation and product innovation have a positive and significant impact on the company performance. The process innovation is undertaken at the company related to changes in the blueprint, especially on changes in the business processes, standard operating procedures and work instructions to achieve a shorter and faster process transformation. This concept emphasizes the integration of the flow of information and materials through business networks to support the process of corporate innovation to achieve increased corporate capabilities in meeting the needs and desires of the consumers. The company's built-in integration with partners to build collaboration will provide an effective and efficient process for the flow of products, services, and information [20]. Integration of the company's internal business processes in collaboration with providers, suppliers, customers, and supply chain partners will have an impact on supply chain performance [21]. This process involves the interconnection of various function within the organization to provide fast delivery of products to customers [22]. Implementation of ERP as an integrated information system at the company provides innovation to all business areas through business process re-engineering in improving organizational performance. The implementation of the ERP system as one of the integrated management information systems starting from material planning, material purchase, production planning, and production control improves supply chain performance [21]. Based on the above theoretical review, this study proposes six research hypotheses as follows:

- (H1) The information system management implementation influences the process innovation.
- (H2) The information system management implementation affects product innovation.
- (H3) The process innovation affects product innovation.
- (H4) The process innovation influences the supply chain performance.
- (H5) The product innovation affects the supply chain performance.
- (H6) The information management system implementation affects the supply chain performance.

### 3. Research Method

The unit of analysis of this study are the firms engaged in the farm industry and located in the region of East Java, Indonesia. Data collection is conducted using a questionnaire designed with a five-point Likert scale. A respondent is a person working for the company for more than two years, using the information system, and understanding the production process. This study used census research which involves all 41 companies consisting of 12 farm breeding companies, 17 poultry feed production, two egg hatching companies, and ten processed meat companies in East Java. Data collection was done in two stages, firstly, data collection through a self-administered survey by distributing the questionnaires to be filled by the respondents, and secondly, the researcher interviews several (by random) respondents to check their face validity [23]. The measurement uses a five-point Likert scale, with 5: strongly agree, 4: agree, 3: neutral, 2: disagree, and 1: strongly disagree.

In this study, the management information system is defined as the extent to which the company has implemented an information system and daily data transaction in decision making [24]. Five indicators are used to measure these variables, i.e., availability of software and hardware, information submitted on time, clear time limits for the information provided, accurate available information, available information according to user requirements and complete presented information. Process innovation is the process of using technology in the added value process of the product. Four indicators used to measure these variables are 1) easier technology upgrades, 2) faster processing time, 3) precise applied task specifications, 4) working mechanisms and simpler used information. Product innovation assesses the extent to which the product performs its function better than the one the competitor offers. Three indicators used to measure these variables are 1) new product development, 2) product variety development, and 3) development of product models and standards. Supply chain performance is the measurement of the extent to which the company adopted supply chain management principles in the pursuit of increased performance. Supply chain performance is a measure of process-oriented company performance, integration of purchasing, production and product delivery to consumers consisting of raw material management, information flow, and finance. This study is adapted to the conditions of SCM performance commonly used in all farm companies including which are on-time product delivery, product quality improvement, raw material availability, and better time flexibility. Data analysis method used in SEM is based on Partial Least Square (PLS).

#### 4. Discussion

Based on the analysis result using the PLS version 3.0 software, it is found that those indicators of the variable are valid in term of convergent and discriminant validity. The recommended minimum value of factor loading for convergent validity is 0.5, and the cross loading of each indicator with other variable is less than its factor loading for discriminant validity. The information system management implementation has six indicators with the factor loadings respectively as follows: software and hardware availability (0.803); information delivered on time (0.839); the information provided has a time limit (0.812); the accuracy of information (0.880); the available information is matching the requirements (0.755), and the information presented is complete (0.829).

The process innovation has four indicators with the loading factors respectively as follows: technology is easier to use (0.916); process cycle time is faster (0.753); the standard of the task performed is more precise (0.701); the working mechanism and information used are simpler (0.841). The product innovation is assessed using three indicators with the result of factor loading as follows: new product development (0.928); variation of product developed (0.815); and the model development and standard product size (0.864). The last construct is the supply chain performance which is composed of four indicators namely product delivery (0.855); improvement of product quality with (0.672); availability of raw materials (0.793); and better time flexibility (0.678). This finding implies that those indicators of each variable are valid in term of convergent and discriminant validity.

The result of the analysis with a structural equation modeling (SEM) PLS is detailed in table 1.

**Table 1.** The Result of Hypotheses Testing.

Hypotheses	Original Sample	Sample Mean	Standard Deviation	T - Statistics
(H1)Information system -> Process Innovation	0.649	0.652	0.044	14.719
(H2)Information system -> Product Innovation	0.174	0.167	0.066	2.642
(H3)Process Innovation -> Product Innovation	0.686	0.697	0.075	9.175
(H4)Process Innovation -> SCP	0.177	0.204	0.132	1.338
(H5)Product Innovation -> SCP	0.665	0.640	0.138	4.825
(H6)Information system-> SCP	-0.021	-0.020	0.093	0.230

Table 1 demonstrated the result of hypotheses testing. It is found that four hypotheses (H1, H2, H3, H5) were supported, and the rest two (H4, H6) were not supported. These findings are discussed in the following section. The first hypothesis (H1) is the influence of information system management implementation on process innovation. A good management information system, when applied to a company, will improve the quality of information that can give a significant impact on process innovation and product innovation. The innovation of these products and processes can be more effective and efficient when applied to information systems and technology, and the value of the company will increase, and at the end, will also improve competitiveness. Results of this study showed the value of the influence of management information system on process innovation is 0.649 with t-value of 15.380. This shows that the implementation of a management information system has a positive effect on process innovation. The result of the research is consistent with H1 stating that there is a definite influence of management information system implementation on process innovation. This shows that the accuracy of information is strongly influenced by the renewal of the technology used. Thus, the users will get the information they need more quickly, precisely, and accurately.

The second hypothesis (H2) is about the influence of information system management implementation on product innovation. Implementing a supply chain management enables the farm industry to meet the needs of most communities engaged in this industry to keep improving its

competitiveness. The collaboration in a business network is more emphasized on the integration of information and material flow through the business network to support the company's innovation process which is an important thing to enhance the company's capability in fulfilling the consumer's needs and desires. Providing better value to customers is reflected in the form of dependability, proactivity, flexibility, and delivery. Innovation and speed are central to the company and are the impact of the company's labor and information system. The results of data processing show the value of process innovation effect on supply chain performance of 0.172 with a critical ratio (t-value) of 1.229. The results of this study did not support the H4. There is no influence of process innovation on supply chain performance. In the farm industry itself, technology renewal is done by applying computerization and hi-tech equipment during operational activities. Delivery of the product to the customers is carried out according to their wishes.

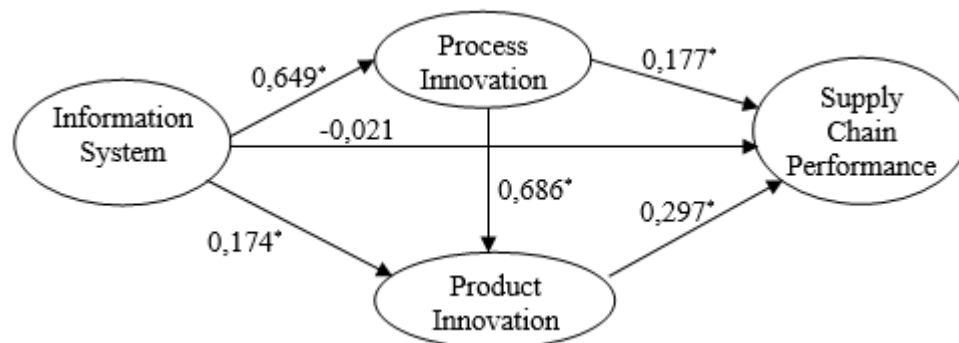
The third hypothesis (H3) is the influence of process innovation on product innovation. The main focus of innovation is the creation of new ideas, which will, in turn, be implemented into new products, and new processes as well. Process innovation is a suggestion to improve quality as well as cost saving. This reflects that adoption of an innovated process improves production efficiency and product quality. Results of data analysis show that process innovation affects to product innovation is with the path coefficient of 0.686 and the t-value 10.225. The finding proves that developing a new product require an updated technology in supporting product innovation. Given the increasing need for various animal products requirement, the farm industries in Indonesia are continuing to update their existing technologies and to use them to maximize their services to consumers. The renewal of the technology used is expected to develop the attributes used to support their operational activities such as repairing or replacing old production equipment with the new ones.

The fourth hypothesis (H4), the process innovation did not affect the supply chain performance. The results indicate that the t-value is 1.338, which is not acceptable at a 5% significance level. It seems that implementing a supply chain in the farm industry give no impact on the performance. The process innovation between the supply chain partner is not useful in improving the performance. This finding could mean that the collaboration in the supply chain does not work well because each supply chain partner just considering their benefit. It is essential to achieve the company's capability for improvement in meeting supply chain partners' needs.

The fifth hypothesis (H5) is the influence of product innovation on the supply chain performance. Along with the rapid development of the market, the customers need for animal products will be increasing. Therefore, it is necessary for the suppliers in the management and distribution of products to reach the end customers. This process involves the interconnection of various organizations, such as raw material suppliers, factories, distributors, retailers, and transportation services known as the supply chain. In order to be able to raise the value of a company, it is necessary to support the increased efficiency and effectiveness of internal business operations such as supply chain management (SCM). The results of the data analysis show that the value of product innovation influence to supply chain performance is 0.672 with a critical ratio of 4,801. The results of this study proved that product innovation has a positive effect on supply chain performance.

The sixth hypothesis (H6) states that the information system management implementation affects the supply chain performance. However, this study did not support this hypothesis. There is no direct influence of the information systems management implementation on the supply chain performance. The results of the data analysis show that the path coefficient is - 0.021 with t-value of 0.230. The fact-finding for this result indicated that the use of data provided by the information system is mostly for the administration and financial report purpose. The use of data from the system for integrating the operation is still limited. The companies need to capitalize on the information system in integrating all the system for either operational or nonoperational to improve the performance. The strategic roles of the information system management in the farm industry are to minimize the company weakness, to support business strategy, and to support competitive advantage. The implementation of the information system management will support the strategy pursuit by a company with the goal to enhance the performance of the supply chain, all of which will lead to customer satisfaction. In the farm industry, the accuracy of data related to operational activities such as production, distribution, and sales activities is crucial. It could happen that the quantity of purchased product does not match

the quantity of the product already stated in the delivery order due to sudden changes in demand. This event will disturb the sales process as the seller must confirm in advance to the market relating to the changes. However, the accurate data provided by the system could prevent the situation to happen. Based on the result found from table 1 and discussion the research model is presented in figure 1.



**Figure 1.** Research Model Result (\* Significant at level 0.01).

## 5. Conclusion

The primary purpose of this study is to examine the influence of the information system management implementation on the supply chain performance with the mediating roles of the process innovation and product innovation. Based on the results of data analysis and discussion above the conclusion are drawn as follow: first, the implementation of an information system management influences the process innovation. Second, the implementation of a management information system influences product innovation. Third, process innovation conducted affects product innovation. Fourth, the process innovations do not affect the supply chain performance. Fifth, the product innovations conducted by the farm industry in East Java give effect to supply chain performance. Sixth, the implementation of a management information system does not give effect to supply chain performance. This study contributes to the existing research in the field of supply chain management. This study could pave the way for the manager, how to improve the supply chain performance through the establishment of the information system management, process innovation and product innovation in the pursuit of the supply chain performance.

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