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SUBJECT AREA AND CATEGORY

Engineering
└ Engineering (miscellaneous)

Materials Science
└ Materials Science (miscellaneous)

PUBLISHER

IOP Publishing Ltd.

H-INDEX

44

PUBLICATION TYPE

Conferences and Proceedings

ISSN

17578981, 1757899X

IOP Conference Series: Materials Science and Engineering

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2021

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The 2nd International Conference on Advanced Engineering and Technology (ICATECH 2020) 26 September 2020, Surabaya, Indonesia

Accepted papers received: 23 November 2020
Published online: 15 January 2021

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Preface

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PREFACE

It is with great pleasure that I introduce the proceedings of the **2nd International Conference on Advance Engineering and Technology (ICATECH 2020)** is an international seminar organized by Institut Teknologi Adhi Tama Surabaya (ITATS). ITATS is private university located in Surabaya, East Java, Indonesia. The conference is held on September 26th 2020.

This seminar has the main purpose to bring researcher and scholar to share their knowledge and experience in Material, Metallurgy, Energy, Design, Engineering, Applied Science, Information System and Technology area. The conference serves as an excellent opportunity to meet each other and to exchange ideas with theme of **"Empowering Research and Innovation for Sustainable Technology"**.

The conference is initially planned to be an offline meeting in the venue, but within the outbreak of COVID-19, it is changed into a virtual conference instead of being postponed. The conference is organized through online virtual mode using Internet Communication Technologies (ICT) via Zoom. Authors shared the screen and attendees could discuss their work via online platform. Overall, the conference was held successfully through the platform. Our conference committee and authors were dedicated to support the success of the seminar.

The conference program is consisted of keynote speaker session and oral presentation session. The Distinguished Professor from Taiwan and Korea were invited to be our keynote speaker regarding their latest research in their respective areas of expertise in 45 minutes of presentation. After keynote speaker session was done, it continued to oral presentation session for selected paper. The participants were divided into 3 room of Zoom with respect to topic areas and were given 15 minutes time to present their work, following by questions and answers. One excellent presenter will be chosen among them, depending on the technical merit, presentation file, Language fluency, and application etc for the best paper award. It is worth the option of virtual participation that allows expanding the geography significantly and increasing the number of participants. More than 200 participants participated in the conference and 66 papers from different countries are selected for presentation during the conference sessions.

We thank all of reviewers for their time and effort in reviewing the papers even in the COVID-19 pandemic situation, as well as the authors, who took into account recommendations of reviewers and improved their papers to ensure the publication high quality in IOP Conference Series: Materials Science and Engineering Series.

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Peer review declaration

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Peer review declaration

All papers published in this volume of *IOP Conference Series: Materials Science and Engineering* have been peer reviewed through processes administered by the Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

- **Type of peer review:** Single-blind with two level review system
  - **i.** The conference editor reviewed the submitted papers relevance to the conference topics, checked whether the papers meet the IOP format requirements, and doing similarity check to ensure the percentage of similarity is not greater than 25%.
  - **ii.** The independent reviewers evaluated the submitted papers according to the following criteria as the relevance to meet the substance of study, novelty of work, quality and scientific knowledge, and adequate references etc.
- **Conference submission management system:**

  All the papers were submitted via EasyChair link and conference Email.

- **Number of submissions received:** 73 submissions received

- **Number of submissions sent for review:** 73 submissions were sent for review

- **Number of submissions accepted:** 66 papers accepted

- **Acceptance Rate (Number of Submissions Accepted / Number of Submissions**

- **Received X 100):** 90

- **Average number of reviews per paper:** 2

- **Total number of reviewers involved:** 16

- **Any additional info on review process:** -Nil-

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ERP compatibility on business performance through the inventory system and internal integration

P Sebayang[1], Z J H Tarigan[2] and T W S Panjaitan[3]

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ERP compatibility on business performance through the inventory system and internal integration

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ERP compatibility on business performance through the inventory system and internal integration

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Abstract. The information technology used by companies today is ERP (Enterprise Resources Planning) technology. This study aims to examine the role of ERP compatibility in improving the performance of MM-2100 manufacturing companies. Data is collected at manufacturing companies that have made ERP system adjustments. Data collection was carried out through questionnaires distributed to manufacturing companies, and as many as 78 questionnaires were obtained, which could be further processed. Retrieval of data using questionnaires submitted to the relevant section that has access to company inventory data. Data analysis was performed using the SEM-PLS technique using smart PLS software version 2.0. The results of the study show that ERP compatibility can increase internal information integration and inventory system continuously. However, ERP compatibility has no direct effect on manufacturing performance. Internal integration affects inventory systems and manufacturing performance with coefficients of 0.346 and 0.378, respectively. Internal integration allows other functions to be able to access inventory in the company. The company's inventory system that is controlled can perform efficiency and effectiveness for the company so that it has an impact on manufacturing performance with a coefficient of 0.766.

1. Introduction

Globalization is indeed not a new phenomenon because globalization has developed in recent years, but lately, it has experienced very rapid progress and is affecting life in various aspects. The global competition enables companies to reach international markets with business models, less capital intensive. This globalization increases the risks and challenges for various countries in formulating new policies to keep abreast of this global phenomenon. Increasing competition has forced companies to improve their business performance operations so they can survive [1]. Operation performance is one of the measurements used in assessing the performance of an organization [2]. The measure includes reliability, inventory turnover, lead time, and cycle time. Operation business performance is an essential aspect because it affects customer satisfaction and market share. The company is necessary to implement supply chain management practices to maintain and improve business performance operations [3].   Another factor is that Supply chain management also is critical to help company performance more effectively and efficiently. The company can maintain the stability of the

procurement of raw materials by building communication and collaboration integrated with suppliers on an ongoing basis. Then, the company carries out an internal integration of processes with integration between functions within the company [4]. Furthermore, the company serves the demands of customers by building customer relationship management. The company carries out supply chain practices by managing the process from beginning to end by involving various functions in the company. Controlling internal and external processes can be carried out in an integrated manner through the implementation of ERP (enterprise resources planning) technology. ERP implementation enables companies to produce efficient and effective processes and fast coordination [5]. ERP is an integrated technology between functions in an organization which functions automatically and in real-time. ERP can integrate the main business functions and support of manufacturing companies well. The main business functions of manufacturing consist of marketing, procurement, production, warehouse functions. Supporting functions consist of administrative, human resources, accounting, and finance functions [6]. ERP technology can build transparency in the company so that all department data can be accessed by personal employees who have access rights. ERP is also able to integrate data and be accessed in a multinational company. ERP systems build company competitiveness by integrating processes and data with partners and optimizing the use of company resources. ERP capability is related to how ERP systems can run correctly and according to the needs of manufacturing companies. ERP adoption is related to ICT infrastructure, Technical availability, perceived compatibility, perceived value, and ERP system security. ERP success is affected by several factors. Those factors are associated with ERP compatibility, which includes such as user involvement, business process reengineering, business plan and vision, knowledge integration, information technology legacy systems, data accuracy, software testing, and development and customization. ERP system can provide increased business performance for companies [7].

The ability of ERP to integrate business functions includes sharing data inside and outside the company, sharing information, and collaborating with external parties, and accessing data information in real-time. ERP systems that are in line with company conditions can provide significant added value in carrying out business practices and supporting management decision making [8]. ERP practice does not have a significant impact on the operational performance of manufacturing companies in Turkey. The reason is due to the utility and module in the ERP system are customized made to the company and does not directly have an impact on the size of the company's inventory level and on-time delivery. But it needs real action in the company's operations [2]. An exemplary ERP implementation provides good performance improvement and will be different if the company runs the implementation incorrectly. Inappropriate ERP interferes with data integration in the company and results in data in the form of reports generated by ERP that cannot help management in making decisions. ERP compatibility in manufacturing companies can be upgraded continuously to be able to adjust to the needs of the company [9]. Adjustment of ERP with company conditions in the form of software and hardware needs to be done continuously under internal processes in the company. The company's ERP system can build all business processes into a single unit in the form of an integrated database between functions. Internal integration can create effective and efficient systems for companies. ERP systems enable companies to integrate with suppliers and customer integration and integrate within the company.

Internal integration allows the company to establish good cooperation between functions in the company, reducing conflicts related to differences in data or reports between functions so that coordination between the activities of operations is well established [4]. ERP companies can build an inventory system that can be controlled precisely in determining inventory levels. ERP system can be set to determine the minimum stock level and maximum stock level and can calculate the optimal stock and adjust the warehouse capacity. The inventory system is an essential function for a company regardless of the size of the business. The more inventory the company stores in the warehouse, the higher the costs the company will incur. Therefore, a company needs to be able to formulate a policy so that inventory investment can be optimal and can reduce costs. Companies that can control inventory levels can maintain a balance between inventory cost risk and stock out inventory risk. The

use of information technology can reduce the company's level of inventory efficiency [10]. Internal integration enables companies to integrate business functions so that relevant departments can access the company's inventory data. Thus, other functions can monitor and control business processes by adjusting inventory availability in the warehouse. Internal integration between marketing functions with the inventory section can help marketing flexibly meet customer demands according to inventory availability. The inventory level mediates the link between the material procurement department, and the company's shipping department increases the level of efficiency in transportation costs [11]. ERP implementation can improve company business performance. ERP implementation is determined by top management to be able to provide improved performance for the company hardware [9]. Research conducted by States that ERP can improve business performance on an ongoing basis. Based on the explanation above, the ERP compatibility set by the company and updated on an ongoing basis will be able to build a system of integration between functions within the company properly. This condition results in all functions being able to access inventory data properly and accurately to make the right decisions according to the external conditions of the company in order to improve performance.

1.1. Enterprise Resources Planning

Enterprise resource planning is a software package that can integrate functions within the company and become an operating system used by the company. ERP is also able to provide condition reports in real-time to top management when decisions are needed [6]. ERP resources in the company are investments made by companies related to application software, application hardware, and skills from the information technology department that focuses on the company's performance on an ongoing basis. ERP can describe the company's processes for all functions in the company from the process of procurement of materials to the delivery of products in support of the company's business [12]. ERP system implementation can bring added value to companies through best business practices, which are provided through various functional applications that are supported by comprehensive processes and data integration between functions in the company [8]. Indicators measure ERP system upgrades in manufacturing companies to maintain compatibility in the form of data integration, ERP system stability, ERP system continuous upgrades, and ERP technology utilization [9].

The ERP stage has been implemented, called the post-implementation, where users develop ERP features following company needs. ERP users' perceptions related to ERP capability, ERP value, ERP timing, and ERP acceptance. ERP capability with indicators measuring the sustainability of the current ERP system, data can be accessed at any time, accurate data, ease of using ERP systems, and ease to do customization. The ERP provides an added value which is measured by the indicator of ease of moving the old system to the ERP system, the benefits of ERP are more significant than the costs incurred, understanding the value of the ERP system, able to provide coordination in company activities. The ERP system can support my career in the company. ERP implementation can give support to supplier capability, and measurements made in ERP implementation are data integration, data configuration following company needs, ERP systems can adapt to user training according to ERP implementation needs [21, 22]. This study uses indicators in measuring ERP compatibility is software according to the needs of corporate organizations, hardware according to the needs of ERP users, easy to customize ERP and ERP capability.

1.2. The Internal Integration

Company has integrated data as a whole with a single database, but previously the company used data integration only departmentally. Previous data integration was still limited to the integration of two or three departmental functions, but after the company used ERP, data integration between functions could be done throughout the company. Internal integration aims at synchronizing between processes and carrying out procedures for each internal function [4]. Supply chain integration is carried out between the company's internal and external functions. Internal integration can be measured by an integrated inventory management system, an integrated logistics system, sharing data between functions, forming cross-functional teams. Besides, internal integration also aims to improve

processes, periodically meet functions, connections in real-time, and inventory level information. Internal integration is related to operation integration within the company, which is sharing information between departments, joint activities, interface activities, working together in achieving company goals [5]. In addition, internal integration also includes the determination of production plans and collaborative decision making between functions in the company. Internal integration can be achieved well if the position is willing and able to commit and cooperate in integrating business functions in the company's internal [5]. This research stipulates that internal integration is an integration between business functions within a company, starting from the process of procuring raw materials of the company to the operation of shipping the company's finished products. The indicators used in measuring research variables are the existence of data sharing between company functions, data integration in real-time, intensive coordination between tasks in the company, and joint decision making within the company

1.3. Inventory System

Inventory manufacturing companies can be classified in the form of corporate raw materials, the company supporting materials, office stationery materials, company spare part materials, machete work in process, materials in the form of components, and company finish products. Material acceptance from suppliers and delivery of products to customers in the company is often determined by intermediaries in the company in the form of inventory and work in process, so it needs to be controlled appropriately by directly integrating with the production and transportation system [11]. Demand with product variance and product volume increases have an impact on increasing the level of company inventory rising company inventory costs. This condition will weaken the company's competitiveness because it has a high level of stock, resulting in inefficient companies. In contrast, companies are required to be efficient to be more flexible and able to be adaptive [13]. Inventory level reduction can be made by using computer technology in providing real-time inventory levels, repeated order approaches by shortening the lead time value, and the reorder point value. Hence lowering or eliminate the company's safety stock.

ERP system can provide facilities related to implementation in real-time and can be set according to company needs [11]. Internal integration in the company can provide fast information to the warehouse in the procurement of materials, and relevant departments can access the availability of the material in real-time according to the needs of other departments. The company's ability to utilize ERP will be able to provide efficiency and reduce inventory levels in the company [12]. The company's inventory has an essential role in the company and has implications for the company's shareholders. The ability to use information technology can increase the efficiency of a company's inventory and have an impact on the company's stock price and restore the stock market increase [10]. The indicators used to measure the inventory system are the determination of lead time of material orders, determination of quantity reorder points, determination of safety stock, and material input-output procedures that are easy to implement.

1.4. Manufacturing Performance

Companies always try to produce products that can compete. The company always strives to improve its operational performance to be able to make these products. Manufacturing performance is the result achieved by the company in a certain period. Company performance results obtained from secondary data in the form of data recorded in company reports that are objective related to the confidentiality of the company compared to data conducted subjectively related to the perception of the company represented by user. Business performance shows the results of manufacturing performance as a whole when associated with the object of the company that produces the product. Performance measurement of manufacturing industry management that is non-financial performance is on-time delivery, work productivity, and customer satisfaction. The indicators used in the measurement of manufacturing operational performance in manufacturing industry companies in Turkey are on-time delivery, accuracy in forecasting, lead time production, service after sales, and the value of inventory levels [2].

Research conducted by Truong et al. [1] states that operational performance measured by the management cost, lead time, order time, damaged material, and late delivery. Tarigan Research [14] states that operational performance in the small and medium business industry in Surabaya is measured by meeting demand management, delivery speed according to the promise of product delivery flexibility, and flexibility in changing order quantities. Indicator,s used to measure Jordanian manufacturing firm performance are market share performance and financial performance, while indicators for measurement supply chain performance are flexibility, integration, customer responsiveness and supplier performance [3]. The indicators used to measure manufacturing performance in this research are on-time delivery, the accuracy of predicting demand, lead time production, and flexibility product delivery.

2. Methodology
This study aims to examine the effect of ERP compatibility on manufacturing performance with internal integration and inventory systems as intervening variables in manufacturing companies located at MM 2100. This research was conducted by examining related literature, making research measurement tools through questionnaires, and distributing questionnaires to manufacturing companies in the region. Based on the results of the literature obtained research model Figure 1. The study population is a manufacturing company engaged in producing products in the MM 2100 area located in the industrial estate town area Cikarang Bekasi area totaling 178 manufacturing industries based on the data list. This study took 78 manufacturing companies that have implemented ERP and have made ERP system adjustments. The sampling technique used judgmental sampling which has the criteria is to have upgraded ERP software or hardware as an adjustment to the company's system, the company produces finished products in the form of pure goods or core goods, respondents are in the middle management up position. The distribution of questionnaires was collected by field officers and submitted to researchers during the 3-month data collection process.
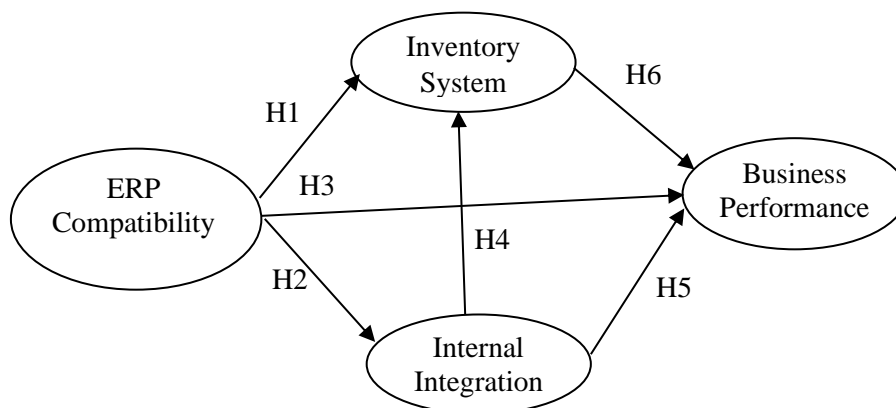
Figure 1. ERP Compatibility to Business Performance Manufacture

Based on Figure 1, it can be determined six research hypotheses are as follows:
    (H1): ERP compatibility affects the inventory system
    (H2): ERP compatibility influences internal integration
    (H3): ERP compatibility influences business performance
    (H4): Internal integration influences inventory system
    (H5): Internal integration influences business performance.
    (H6): Inventory system influences business performance.
   The process of data retrieval with the questionnaire technique asks questions to the respondents of manufacturing industry practitioners. Data collection used a closed questionnaire namely questions made in such a way that respondents were limited in giving answers to only a few alternatives or just one answer [15]. Analisa PLS is to predict the effect of variable and describes the theoretical

relationship between these two variables; this study uses PLS software. Assessment of the measuring instrument used to test the validity of research with composite discriminant validity and reliability.

3. Research Analysis and Discussion

The distribution of questionnaires conducted to companies in MM-2100 was 88 questionnaires, and researchers submitted all questionnaires, then conducted the first category by paying attention to the face validity of the requirements that had been set to fill the questionnaire. Of the 88 questionnaires, four questionnaires were filled out by company staff; three questionnaires were not completely filled in. Researchers can process further data by 78 questionnaires using PLS. Assessment of the research instruments in terms of validity and the reliability was conducted. A validity test is performed by assessing if the factor loading of each indicator greater than 0.5 as the acceptable minimum value. The reliability test is conducted by assessing if the reliability value greater than 0.7 as the acceptable minimum value (Table 1), shows the result of the assessment in terms of the values of factor loading and reliability. Factor loading assessed the validity of those indicators.

Table 1. Result of Validity and Reliability Test

Variables / Indicators Research	Value of Validity / Reliability	Decision
ERP compatibility	0.863	Reliable
Software according to the needs of the organization	0.782	Valid
Hardware according to the needs of ERP users,	0.768	Valid
Easy to customize ERP	0.854	Valid
ERP capability	0.721	Valid
Internal Integration	0.835	Reliable
Data sharing between company functions	0.800	Valid
Data integration in real-time	0.756	Valid
Intensive coordination between functions	0.727	Valid
Joint decisions in the company's internal	0.513	Valid
Inventory system	0.797	Reliable
Determination of lead time material orders	0.790	Valid
Determination of quantity reorder points	0.717	Valid
Determination of safety stock	0.852	Valid
Material procedures are easy to implement	0.620	Valid
Manufacturing performance	0.894	Reliable
Timeliness of delivery	0.773	Valid
accuracy of predicting demand	0.880	Valid
Lead time production	0.794	Valid
The flexibility of shipping product	0.845	Valid

Table 1 that the lowest value of factor loading from all the indicators is 0.513 is respect to one of the indicators of the inventory system. This lowest value is greater than 0.500 as the acceptable minimum value of factor loading. This result means that those indicators of the four variables are considered valid. The next assessment is regarding the reliability of the block indicators of each variable. As it can be seen in Table 1, the lowest value of reliability is 0.797 in respect to the inventory system. The result means that those indicators of each variable are considered reliable. Based on this finding, further analysis can be pursued. The research hypothesis was obtained by conducting the PLS test in Table 3.

Table 2. Sixth Hypothesis of the Research Test

The hypothesis of Research	Original sample estimate	Mean of subsamples	Standard deviation	t-statistic
ERP Compatibility -> Internal Integration	0.404	0.429	0.138	2.931
ERP Compatibility -> Inventory System	0.248	0.284	0.131	1.988
ERP Compatibility -> Manufacturing performance	0.034	0.049	0.495	0.294
Internal Integration -> Inventory System	0.346	0.370	0.137	2.023
Inventory System -> Manufacturing performance	0.766	0.775	0.066	11.647
Internal Integration -> Manufacturing performance	0.378	0.395	0.123	2.069

Note: Significant if t-statistic ≥ 1.96

Based on the first hypothesis test that ERP compatibility has an effect on the internal integration of 0.404, the standard deviation value is 0.138, and the t-statistic is 2.931. This shows that the first hypothesis is accepted, and it can be concluded that ERP compatibility in manufacturing companies in MM-2100 has an impact on internal integration. Companies that have implemented ERP well in a manufacturing company can provide data integration between right departments, report integration that can be used by related departments in decision making and hardware that is used according to the needs of the company represented by the user. ERP technology can build transparency in the company so that all department data can be accessed. The data can be assessed by the employees who have access rights and can be accessed multinationally and can also integrate data in multinational companies. The second hypothesis is that ERP compatibility influences the inventory system by 0.248, the standard deviation value is 0.131, and the t-statistic is 1.988. This condition illustrates that the second hypothesis can be accepted, that ERP compatibility affects the inventory system in MM-2100 manufacturing companies. Companies that have implemented ERP and can manage the level of company inventory, due to the company being able to use existing software and hardware and ease of customization so that it can be implemented in the company's warehouse. ERP that has been implemented can automatically report data in the warehouse regarding the amount of the company's inventory level, the lead time of the company's material procurement, and the safety stock of each product in the warehouse. This situation has an impact on the relevant parts of material control. This research is in line with a study conducted by Mishra et al. [10], which states the use of integrated information technology (ERP) can reduce the level of company inventory.

The third hypothesis that ERP compatibility influences manufacturing performance are 0.034, the standard deviation value is 0.115, and the t-statistic value is 0.294. It can be said that ERP compatibility has no direct effect on manufacturing performance. Software and hardware that is updated in manufacturing companies and ease of customization are not able to give effect to the increased flexibility in shipping products to customers. The company's ability to control the level of inventory in the company will have an impact on shipping flexibility. ERP practice does not have a significant impact on the operational performance of manufacturing companies in Turkey [2]. The fourth hypothesis is that internal integration has an impact on the inventory system of 0.346, the value of standard deviation 0.137, and the t-statistic value of 2.023. It can be said that internal integration has a positive impact on the inventory system, because with the integration of data between the relevant departments able to provide better inventory level control. Related departments are able to adjust work rhythms and by paying attention to data sharing and integration within the company. This condition can control the level of safety stock, and control lead time better for manufacturing companies. Companies in MM-2100 can manage inventory levels better when there is integration between departments so that inventory costs decrease. Internal integration as measured by an integrated inventory management system, integrated logistics system capable of real-time connections between functions in the company, and real-time in obtaining inventory levels. The Fifth Hypothesis obtained internal integration in the company can provide better manufacturing performance. This

condition is seen in the t-statistic value of 2,069, which gives the conclusion that the fifth hypothesis is accepted. Internal integration has an effect of 0.378 on manufacturing performance significantly. The company's ability to control the internal system will be able to determine predictions and direction and the company's strategy going forward. The increase in the inventory system given to manufacturing performance was 0.766. The company's ability to control safety stock and inventory data sharing to other functions in the company can deliver on-time delivery and accuracy in predicting demand. Manufacturing companies always pay attention to the level of company inventory so that inventory costs can be controlled. The manufacturing industry still tries to determine the maximum-minimum inventory so that there is no excess inventory, and there is no shortage of inventory, so there is no stock out.

4. Conclusions

ERP adjustments for manufacturing companies need to be done on an ongoing basis to produce a potential performance of manufacturing companies in a sustainable manner. Based on the results of data analysis, the first conclusion can be that ERP compatibility can provide an increase in internal integration that increases so that there is cross-functional between departments, especially in data sharing companies. ERP compatibility can give control of the company's inventory level because it is easy to automate the determination of the company's lead time and the determination of safety stock. However, ERP compatibility does not directly affect the performance of manufacturing companies. Internal integration built by the company allows related departments to be able to access company inventory data making it easier to control company inventory. This condition causes internal integration to improve inventory system control. Internal integration in the company has an impact on the performance of the manufacturing company because it can provide data quickly so that the MM-2100 manufacturing company can improve on-time delivery and accuracy in predicting demand.

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