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Assessing the Benefit of Adopting ERP Technology and Practicing Green Supply Chain Management toward Operational Performance: An Evidence from Indonesia

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Abstract: The recent concern on the environmental protection and COVID-19 issue is increasingly affecting the manufacturing industry. This research assessing the benefit of adopting ERP technology and practicing green supply chain management toward operational performance in manufacturing industry. The study is essential to provide insight for the manufacturing industry regarding the consequences and benefits of practicing the green supply chain and adopting ERP technology amid the current constraints of the environmental protection issue and the COVID-19 pandemic. The study has surveyed 122 companies domiciled in Indonesia. Data collection used a questionnaire designed with a seven-point Likert scale. Questionnaire created in Google form, printed and distributed using social media and postal mail. Data analysis used SmartPLS software version 3.0. The result revealed that ERP adoption enables green purchasing, production, distribution, and operational performance. Furthermore, operating performance is directly affected by green purchasing and green production. However, operating performance was not supported by green distribution. In addition, ERP adoption indirectly improves operational performance through green purchasing and green production. But ERP adoption did not affect operational performance through green distribution. This result provides essential insight for the manager in the manufacturing industry that adopting ERP in the era of the COVID-19 pandemic and practicing environmental protection such as green purchasing, green production enhances operational performance. In summary, the result of this study encourages the practitioner to adopt environmental protection in running their business since it benefits the company. While there are very few studies examining the relationship between ERP adoption, green supply chain practices, and operational performance, this study is essential in terms of exploring the mediating role of green supply chain practices on the effect of ERP adoption on operational performance. Thus, these research findings could enrich the current research in the supply chain management context.

Keywords: green purchasing; green production; green distribution; enterprise resource planning; operational performance

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1. Introduction

Environmental protection has come to the world's attention in recent years, and scientists have been emphasizing the need to limit planetary warming. As a result, world leaders from 40 countries have participated in the world climate summit. The Summit has highlighted how these climate ambitions would create jobs with good incomes, accelerate technological innovation, and help countries in need to adopt the effects of climate change [1]. Based on the suggestion conveyed by [2], many organizations began to show concern for maintaining the environment due to the emergence of global awareness about the importance of preserving the environment. This eco-friendly mindset to nurture the source of the earth has reached peak momentum so that the organizations feel pressured

to start thinking critically in building environmentally friendly business practices. Green supply chain practices (GSCP) are believed to have a potential contribution throughout the entire supply chain process, from suppliers, manufacturers, customers, and until the disposal of the product [3]. According to [4], companies need to compete through the implementation of information technology to contribute to the efficiency of the company by helping retailers to manage material management. In this way, system management in the company can be fully integrated and effective to compete optimally in terms of speed, production with high capacity, high quality, low cost and have a minimum inventory. The green supply chain practices can reduce the cost of purchasing raw materials, energy consumption, waste management, and environmental damage and improve the company's operational performance. Therefore, the nature of sustainable development in economic terms can enhance its operational performance [5]. Environmental protection in Indonesia is contained in law No. 32 of 2009 in Management and Protection of the Environment. This law regulates the implementation of environmental regulations and the provisions warnings for those who violate the rules [6].

On the other hand, previous research in Indonesia has assessed the supply chain performance of companies which are using cloud information technology. This research has surveyed companies listed in the Indonesian Logistics Association (ALI) and the Indonesia Stock Exchange [7]. It has been found that cloud technology can facilitate the supply chain process to reduce paper usage, pollution, and excess fuel use. It can also improve its operational performance [7]. Enterpise resources planning (ERP) is one of the information technology which has a significant influence in enhancing the company's performance [8]. Today, the manufacturing companies have constant pressure to improve their operations by delivering high-quality products at the lowest possible price and delivery as quickly as possible. One of the solutions to this problem is performing supply chains activities using information technology [9]. Then the company seeks to implement business practices while reducing the risk of environmental damage through the company's products, services, and operations [10].

Manufacturing behavior also changes due to consumer behavior. The product development and production processes related to green products become popular issues for manufacturers. For example, the incandescent lamp from Phillips Alto II has the lowest mercury level, up to 1.7 milligrams per lamp [10,11]. Green purchasing plays a significant role in manufacturing companies' environmental-friendly business strategies. With the growing awareness of the environment, the demand for ecological-friendly products increases. A survey of 1005 retailer consumers in Rumania indicated that they are environmentally concerned consumers, displaying an increased awareness of their essential role in impacting sustainable production and consumption by adopting green purchase behavior. The study also points out that retailers reinforce their brand perception on sustainability issues [12]. Green purchasing can increase the value of a product alone, but it also helps manufacturing companies improve their good environmental image. In addition, green purchasing allows manufacturing companies to collaborate with suppliers to design supply chain processes upstream and downstream, creating efficiency in the company's operations [13]. ERP implementation process, that runs stable, perform data alignment, and continuously improves the systems can improve the company's operational performance [14]. Green supply chain management (GSCM) interest is essential due to the company's growth and increased recognition from manufacturers and consumers; however, there is a wide gap in the existing literature and corporate regulations regarding GSCM. The fact remains that there is no comprehensive theoretical model to support the accelerated demands of the GSCM [15].

Besides, the current COVID-19 pandemic has also caused severe disruption in the supply chain. The disruption in demand and supply has resulted in a downturn in manufacturing performance, as indicated by the purchasing manufacturing index (PMI). However, for specific sectors such as pharmaceuticals products, the demand has significantly increased, particularly for COVID-19 treatment, such as sanitizers, masks, and medicines.

While the need for other goods such as sporting goods and automotive has decreased drastically. Overall, manufacturing companies have experienced a decline in performance during this pandemic. The decreased performance of manufacturing companies is indicated by the Purchasing Manufacturing Index (PMI), which declined from 45.3 in April 2020 to 27.5 in August 2021, the worst record since 2011 [16]. According to the Industrial Ministry, manufacturing industry performance has declined up to 50 percent, caused by the COVID-19 pandemic. PMI is calculated based on a percentage of five influencing factors: cost, new product, time to market, flexibility, and delivery [17]. PMI also reflects the extent to which manufacturing sector performance achievements, such as manufacturing operational performance. Therefore, the manufacturing companies need to take immediate initiatives to balance the economic growth while avoiding the spread of COVID-19. The essential question is what strategy the companies should adopt or have adopted to keep in operation while dealing with the COVID-19 pandemic. The principal response is that the company should keep doing business while obeying the pandemic health protocol and cope with any uncertainty in supply and demand. One solution that could solve the problem of obeying the health protocol is using information technology such as enterprise resources planning (ERP).

The discussion above shows that the company's operational performance can be improved by adopting ERP technology, practicing green purchasing, green production, and green distribution. However, previous studies only looked at or noticed the direct relationship between the two variables. To the extent of the author's knowledge, no study had looked at these five variables together. This research creates a model addressing these five constructs simultaneously to examine the benefit of ERP adoption on operational performance through the mediation of green purchasing, green production, and green distribution. The main objectives of this study are to examine: (1) whether ERP adoption by the manufacturing company affects the green supply chain practices, including green purchasing, green production, and green distribution, (2) whether the green practices, namely, green purchasing, green production, and green distribution affect the operational performance, (3) whether ERP adoption indirectly affects operational performance through the mediating role of green practices. The novelty of this study is the creation of a research model which has never existed before and examines the mediating role of green supply chain integration consisting of green purchasing, green production, and green distribution. Therefore, the findings of this study could contribute in terms of managerial implication and theoretical enrichment. For managerial implication issues, the results are expected to provide an insight to the manufacturing industry practitioner that adopting ERP and practicing ecological protection will benefit the company's operational performance. Furthermore, in terms of theoretical contribution, this study could enrich the current research in two forms: (1) the extended acceptance of previous studies to be applied in the manufacturing industry in Indonesia, (2) the new findings on the mediating role of the green supply chain in enhancing the operational performance. It could enrich the current research in supply chain management.

The following order describes how the rest of the paper is organized. First, the theories relating to the definition of research constructs and the development of hypotheses are discussed in Section 2. The research methodology is then described in Section 3, followed by the results of data analysis and discussion in Section 4, a discussion of the analysis results in Section 5, and lastly, the study's conclusions in Section 6.

2. Literature Review

2.1. Construct Definition

2.1.1. Green Supply Chain Practices (GSCP)

GSCP is defined as the supply chain management (SCM) oriented on practicing supply chain activities corresponding to the interests of the environment protection through the design, acquisition, production, and distribution of the company's goods and services. GSCP is also concerned with the reuse, recycling, and disposal of the company's goods to

avoid any damaging impact on the environment. It simply lays out green practices, but more consistently, holistic improvement and environmental practices performance in all management and factory areas [18]. GSCP includes planning, execution, and controlling practices, approaches, and tools that help companies be socially responsible and sustainable through environmental protection [19]. In addition, supply chain integration has been proved to improve the manufacturing company's business performance through supply chain resilience, flexibility, and responsiveness [20]. The supply chain integration includes the supplier, production, and distribution integration interconnection to achieve the same goal of serving customer demand.

2.1.2. Green Purchasing

Green purchasing also refers to purchasing practices that focus on reducing waste sources and realizing recycling and reclamation regarding product purchases without hindering environmental needs by destroying certain materials. On the other hand, choosing environmentally friendly suppliers, green purchasing also focuses on evaluating environmental performance in suppliers and providing advice on how to improve their performance. Green purchasing can then play a role in ensuring that suppliers can also develop environmentally friendly orientation capabilities [21]. Furthermore, green purchasing is included in sourcing-reduction and recycling activities in the supply chain; green purchasing can minimize waste and support product recycling. Further findings state that green purchasing activities reduce pollution control costs and improve organizations' environmental performance [2]. In addition, [22] stated that environmental friendliness, green purchasing, or procurement could also be interpreted as integrating environmental-related issues into purchasing standard requirements to reduce waste and help achieve GSCP. In this study, the authors adopted green purchasing indicators from previous research conducted by [23]. Here are the green purchasing indicators: (1) buy environmentally friendly products from suppliers, (2) prioritize suppliers who implement environmentally friendly management systems, (3) require that suppliers be certified by ISO 14001, (4) prioritize the purchase of recyclable products, (5) avoid buying environmentally unfriendly materials such as lead or toxic materials, (6) applying environmental friendliness criteria is one of the requirements in evaluating suppliers.

2.1.3. Green Production

The concept of green extends to almost every process, from acquiring raw materials, production, storing, packaging, shipping, and product distribution [24]. The primary purpose of green production is sustainability. Every manufacturing sector should nurture natural resources for future generations. The manufacturing industry should know where its responsibilities will end and how toxic emissions have affected the environment [25]. According to [26], friendliness and social quality. The development of green products has long been an essential topic in sustainable supply chain management, as demonstrated by various works of literature. Companies use tools such as design for environment (DFE), design for dissembling (DFD), and life cycle analysis (LCA) to reduce the impact of the product on the environment. From the review of green production-related literature, this study adopted the indicator of green production suggested by [27] as follows: (1) attempt to eliminate waste in the production process, (2) trying to reduce environmental pollution, (3) trying to implement the recycling process, (4) implementing environmentally friendly production processes, (5) reduce material costs on target, (6) the production process runs efficiently or quickly, (7) improve the timely delivery of goods, (8) not using toxic materials, (9) using technology to make the production process environmentally friendly.

2.1.4. Green Distribution

The green distribution addresses the transportation services that do not harm human health or environmental ecology, regardless of short-term or long-term effects. The four principal roles of green distribution are: (1) reduce the burden of emissions and waste;

(2) the use of renewable resources must be below the speed of production, and the usefulness of non-renewable resources below the speed at which they can be re-created; (3) reduce the impact of land use and noise; and (4) the company should pay a certain amount of social costs to its corporate activities that have an impact on the environment [28]. Companies such as Pepsi, Nestlé, and L'Oreal collaborate with Tesco, one of the largest retail partners, to form the Supply Chain Leadership Coalition, which promotes ways to reduce the carbon footprint from suppliers to distribution activities to customers [29]. The author adopted previous research indicators on green distribution from [30] from the green distribution literature presentation. There are six green distribution indicators as follows: (1) reduce the use of packaging materials/packaging goods, (2) use environmentally friendly packaging materials, (3) use packaging materials that can be recycled and reusable, (4) use environmentally friendly transportation, (4) apply delivery with maximum volume according to the transportation capacity used, (5) delivering goods via the fastest route.

2.1.5. Enterprise Resource Planning (ERP)

Enterprise resources planning (ERP) systems integrate information flow within companies ranging from financial accounting, human resources, supply chain management, and customer information [31]. ERP system is a technology system used to develop the company's competitive nature because it will enhance its excellent operations. ERP systems rely on information technology that can combine business functions more efficiently. The company always tries to adapt to ERP based on the needs and uniqueness of the company's operations and the relationships and consumers that are quite influential on the company. However, changes to the ERP configuration system will bring huge costs, and implementation will pose risks [8]. In this study, ERP adoption was studied using several indicators of previous research by [32], is as follows: (1) ERP provides accurate information about operations, (2) ERP provides quality and useful information, (3) Easy ERP usage procedure, (4) the intensity of ERP usage is very high, (5) ERP users feel very satisfied, (6) ERP features are easy to understand, (7) ERP can help user works faster.

2.1.6. Operational Performance (OP)

Operational performance is the company's operational achievement, measured primarily in cost, quality, flexibility, and delivery. The operational performance also indicated the company's competitive position among companies in the supply chain. Each company in the supply chain needs to improve overall operational efficiency in enhancing performance. Supply chain management (SCM) has an independent effect and positively impacts business performance. However, operational performance also depends on operational and financial factors. Combining SCM and business performance is also expected to positively impact financial performance, such as increased sales and profits [33]. Operational performance is performance related to the company's internal operations, such as productivity, product quality, and customer satisfaction. Operational performance is also an indication of the capabilities and resources of manufacturing companies that should focus on increasing priority improvements that impact strategic capabilities [11]. This study used five measurement items for operational performance adopted from [34] as follows: (1) improved the quality of the product, (2) reduced lead time or faster delivery process, (3) improved its position to compete in the market, (4) improved product development, (5) increased sales in international markets

2.2. Hypotheses Development

2.2.1. Enterprise Resource Planning (ERP) Adoption and Green Purchasing

The basis enabler for coordination and cooperation in information sharing can be facilitated comprehensively using information communication and technology (ICT) or, for example, the adoption of ERP [35]. Ref. [36] expressed their opinion that the environmentally friendly purchasing function is facilitated by information technology as an instrument for streamlining and promoting the process of purchasing. The environmentally

friendly goods from supplier to the company improve the company performance. For more than 30 years, systems such as material requirements planning, called enterprise resource planning (ERP), have helped companies manage their changing business activities throughout the ages by integrating information into the supply chain network. Green purchasing is applied as a valuable tool to mitigate environmental damage through excessive consumption and realizing clean production technology. The technology will then provide the information needed by the companies to align all activities within the supply chain network [37]. Based on the above argument, the first hypothesis is proposed as follows:

Hypothesis 1 (H1). *ERP adoption affects green purchasing*.

2.2.2. Enterprise Resource Planning (ERP) Adoption and Green Production

A study by [31] explained the role of ERP support for production planning so that the company can achieve an environmentally friendly production process. Ref. [8] suggest that information technology integration can open up integration between sup-pliers and companies in ecologically friendly production planning and capacity, delivering environmentally friendly goods from suppliers. Furthermore, information technology integration can use ERP as a means for companies to develop effective systems to improve user satisfaction in executing enterprise strategies to be more environmentally friendly. Ref. [19] suggest that six steps need to be implemented against green production as follows: (1) overview, (2) eco-profile, (3) inter-departmental network, (4) quantification, (5) conceptualization, (6) green production. Information technology through ERP plays a significant role to accommodate the movement of these six process steps, especially step number 3, namely networking between departments. Based on the above discussion, the second hypothesis is proposed.

Hypothesis 2 (H2). *ERP adoption affects green production*.

2.2.3. Enterprise Resource Planning (ERP) Adoption and Green Distribution

Solutions from green information and communication technologies have solutions to achieve automation, simplification, and network optimization of supply chain de-sign such as location, distribution, reverse logistics, inspection/sorting of used products, etc. GrICT has solutions to improve communication and achieve coordination, cooperation, and integration between supply chain partners, both from suppliers/trading partners and distribution or delivery of goods to customers [19]. By adopting ERP, customers can execute orders and record sales orders. "The delivery scheduling and calculation of the working time need to be recorded before placing the order or request of material. Then, ERP system will issue a production schedule and request for material packaging and shipment from supplier or warehouse. So that through ERP, documents will be issued to the warehouse, and reservations can be packed and shipped". Companies can control how goods are distributed to customers through ERP and effective delivery [31]. Researchers have previously stressed the positive impact of using information systems and technology on reverse logistics to achieve service quality and economic performance [38]. Hence, the third hypothesis is formulated.

Hypothesis 3 (H3). *ERP adoption affects the green distribution*.

2.2.4. Green Purchasing and Operational Performance

Green purchasing is also considered a strategic function in manufacturing com-panies. Green purchasing practices are also responsible for acquiring environmentally friendly materials of appropriate quality at the right price. Then green purchasing evaluates vendors and management to reduce the cost of materials to improve the quality of environmental friendliness as a manufacturing process at the beginning [39]. Ref. [37] stated that most internal suppliers from manufacturing and retail apply significant pressure to outside suppliers to practice environmentally friendly supply chain activities effectively. Various

case studies from companies in Europe and Australia have shown that green procurement practices are used as a tool to achieve a competitive advantage to improve operational and financial performance. A study on the 351 supply chain management professionals from different manufacturing companies in Saudi Arabia found that green supply chain management practices, including green purchasing, green manufacturing, and green logistic, directly and positively affect operational performance in the manufacturing industry [40].

Green purchasing also minimizes raw materials, develops suppliers, and reduces sources to create efficiency in green supply chain practice activities that will improve the company's operational performance [41]. Furthermore, a study by [20] surveyed 81 manufacturing companies in East Java, Indonesia, and found that green purchasing improves operational performance. Based on this discussion, the following hypothesis is proposed.

Hypothesis 4 (H4). *Green purchasing affects operational performance.*

2.2.5. Green Production and Operational Performance

The green production and innovation processes reduce the impact on the environment and increase the company's competitive advantage and green image [42]. The company's competitive advantages include the quality of the production process that produces environmentally friendly goods. Another study also argues that green manufacturing and green production consist of design processes, product design, and high efficiency [41]. The company's production capacity increases and improves the company's operational performance. Green manufacturing can have the ability to reduce costs, introduce new technologies and improve the work environment. Furthermore, the company can improve its performance through environmentally friendly production from its factories and the entire production chain process [43]. Hence, the fifth hypothesis is determined as follows:

Hypothesis 5 (H5). *Green production affects operational performance.*

2.2.6. Green Distribution and Operational Performance

Green distribution is an important activity that impacts the performance of the environmentally friendly supply chain. Green distribution includes all activities that reduce/eliminate environmental damage, and waste in waste in shipping, such as gasoline consumed by product transportation to customers, can be reduced. A study on the manufacturing industry in Turkey found that green distribution positively affects operational performance [30]. The following green distribution factors will impact the company's operational performance: ecological materials for primary packaging, recyclable or reusable packaging/containers in logistics, selection of cleaner transportation methods, effective shipment consolidation, and full vehicle loading. Moreover, a study by [44] found that environmental friendliness performance can be improved with effective transportation planning and distribution network strategy. This method will then impact the efficiency of faster delivery to customers. Furthermore, [11] stated that the company's operational performance reflects the distribution and manufacturing efficiency, thus impacting operational performance.

Hypothesis 6 (H6). *Green distribution affects operational performance.*

2.2.7. Green Purchasing and Green Production

Green purchasing focuses on working with suppliers to develop environmentally friendly products and ensuring purchased products meet the company's environmental friendliness criteria. The criteria include reducing or eliminating hazardous items, reducing waste of natural resources, and helping to realize recycling and recovery of material purchases (or reusable materials) [27]. Similarly, a study result suggests that green purchasing can also be defined as an environmental purchasing initiative that aims to ensure the purchase of products and materials that comply with the company's environmental

friendliness criteria [45]. The criteria include reducing excessive use of natural resources, recycling, reusing, and life-cycle costs of a product [23]. Based on the above discussion, the seventh hypothesis is postulated.

Hypothesis 7 (H7). *Green purchasing affects green production*.

2.2.8. Green Production and Green Distribution

In an environmentally friendly context, distribution networks play an essential role in marketing and supply chain relationships. As the rotation of product flows, the carbon footprint is also a parameter to describe the "greenness" of a production process that is environmentally friendly or not [46]. Environmentally practices of goods and services distribution are influenced by the response rather than marketing to environmental impacts ranging from design, environmentally friendly production, packaging, labeling, and use of these goods. Many eco-friendly production strategies are recycling, using spare parts of such products, reducing packaging, making the product more durable, repairable, compostable, good for health, and safe for shipping distribution [38]. Companies need hard work to record reciprocity from customers to develop more environmentally friendly products or eco-products. Moreover, companies need to adopt environmental practices in manufacturing processes and use environmentally friendly packaging. This effort requires the company's coordination of green production and distribution processes to strive for the application of customer response and advice [11].

Hypothesis 8 (H8). *Green production affects green distribution*.

2.2.9. Enterprise Resource Planning (ERP) Adoption and Operational Performance

ERP plays a role in working on a person's tasks, and the organization can reduce the duration of the activities. Moreover, ERP can also calculate large amounts of data and produce useful information in decision-making. Therefore, ERP can also be related to business process improvement (BPI), and enables the company to improve operational performance [47]. Implementing information communication and technology (ICT) such as ERP can improve organizational performance in terms of reduced cost, improved quality, faster delivery, more product variety, and time to introduce new products to the market from other competitors [35]. A survey of 57 manufacturing companies in East Java, Indonesia, showed that information technology application affects organizational performance significantly [48]. Furthermore, previous research has also stated that companies that efficiently use the sources of information presented by ERP can improve the company's operational performance in areas such as process standardization and timely delivery of goods [14]. The study surveyed 111 manufacturing companies (medium and large) in Indonesia and found that IT capability plays an essential role in enhancing firm performance [49]. Besides, a survey of 61 respondents representing 61 manufacturing companies domiciled in the region of East Java, Indonesia, also found that ERP adoption by the manufacturing company improves the firm performance [50]. Besides enhancing the operational performance, ERP also con-tributes to the improved competitive advantage, which reflects the operating performance of the manufacturing industry [51]. Therefore, the ninth hypothesis is deter-mined

Hypothesis 9 (H9). *ERP adoption affects operational performance*.

2.2.10. Enterprise Resource Planning (ERP) Adoption and Operational Performance through the Mediation of Green Purchasing

The ERP can indirectly affect the company's operational performance through green purchasing [39]. E-procurement practices with internet practices and technologies such as ERP can provide success for green purchasing. Green purchasing strategies consist of hazardous material substitution and can then improve the quality of raw materials to impact the quality performance of goods expected by the company [19,41,52].

Ref. [43] suggest that ERP responds to the competitive pressures of companies to maximize the internal resources of their organizations, such as green purchasing, green purchasing will become more efficient. Then the company can compete to im-prove its operating performance. So it can be concluded from the previous paragraph that the adoption of information technology such as ERP can indirectly affect the company's operational performance through green purchasing. Based on the above argument, the tenth hypothesis is postulated as follows:

Hypothesis 10 (H10). *ERP adoption affects operational performance through green purchasing.*

2.2.11. Enterprise Resource Planning (ERP) Adoption and Operational Performance through the Mediation of Green Production

Green production process applications can benefit from competitive environ-mental friendliness, which can finally satisfy its customers and bring the company to grow more rapidly in implementing its company operations [19]. Moreover, adopting technology programs such as ERP for green production can minimize energy and re-sources. Green production can reduce the cost of energy consumption to improve products through their quality [42]. Ref. [53] argues that adopting technological processes against green supply chain management and green production can lead companies "to reduce waste, usage of water, and energy consumption during the production process.". The company can gain a competitive advantage through green products be-cause it can sell by-products at relatively lower prices, or companies can modify them to be products with good quality. In the same way, the company can increase flexibility and reduce the company's production costs. From the previous paragraph, adopting information technology such as ERP can indirectly affect the company's operational performance through green production.

Hypothesis 11 (H11). *ERP adoption affects operational performance through green production.*

2.2.12. Enterprise Resource Planning (ERP) Adoption and Operational Performance through the Mediation of Green Distribution

Information technology such as ERP integrates environmental friendliness issues in green distribution such as packaging, transportation, and logistics activities. Green distribution can reduce packaging costs, fuel consumption, noise, pollution, and congestion by revamping better relationships with customers [54]. By adopting ERP, companies can control how goods are distributed with environmentally friendly processes. An environmentally-friendly distribution process will also have the impact of reducing lead times [33,55]. Furthermore, the role of technology adoption and telecommunications (telematic applications) can help the distribution process be environmentally friendly to reduce the distance of truck routes in the process of shipping goods as well as have better routes. So that green distribution can reduce transportation costs and then speed up shipping [19]. Hence, the adoption of information technology such as ERP can indirectly affect the company's operational performance through green distribution.

Hypothesis 12 (H12). *ERP adoption affects operational performance through green distribution.*

Based on those hypotheses developed above, the research framework is depicted in Figure 1.

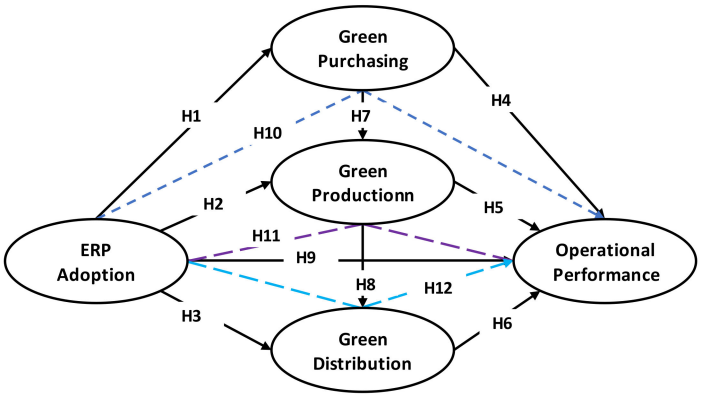

Figure 1. Research framework and the relationship between constructs. Note. (1) black color line indicates the direct relationship, (2) colored dot line indicates the indirect relationship.

3. Methods

3.1. Study Design, Population, and Sample

This study used a cross-sectional design and collected empirical data through an online and paper-based survey in East Java, Indonesia. The population of this study is manufacturing companies engaged in manufacturing industries such as food, beverage, textile, and pharmacy domiciled in East Java, Indonesia. The list of companies was obtained 578 companies from the East Java Bureau of statistics 2020 considered eligible as they meet the criteria categorized as limited companies status registered in the Trade and Legal Department [56]. The minimum number of samples required for this study is 85, obtained using the Slovin formula with a tolerance error of 10%. However, this study tries to obtain as many samples as possible to increase the accuracy of the research. Sampling technics used a stratified sampling method to provide all the population members an equal chance to be selected as a sample. The stratified sampling divides the population into exclusively relevant, appropriate, and meaningful groups to research or study science [57]. Data collection used a questionnaire designed with a 7-point Likert scale with 1: strongly disagree up to 7: strongly agree. The questionnaires were distributed through mail and online. The online distribution used a Google Form Link sent through email and social media to the companies. The study respondents are determined as in charge at the managerial level, such as Supervisor, Manager, General Manager, and Director. This requirement implies that they are knowledgeable in its strategy and decision-making. In addition, the letter from the institution was attached to let the respondents understand the purpose of this research. Of the 578 questionnaires distributed, 133 were returned and correctly fulfilled. However, only 122 (21% response rate) questionnaires were considered valid, and the other 11 questionnaires were excluded due to not meeting the criteria as engaged in the predetermined manufacturing sector.

3.2. Measurement Item

The questionnaire's items lists are separated into two parts: the screening process and the main statement item adapted from the previous literature. The questionnaire is designed with a seven-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neutral, 5 = somewhat agree, 6 = agree, 7 = strongly agree. The respondents were requested to respond to every statement based on their agreement or disagreement with their objective opinion. Each construct is measured using measurement items or indicators defined in the literature review. ERP adoption instruments adopted research by [32] with green purchasing instruments use [23]. Green production instruments use [27], green distribution instruments use [30], and operational performance instruments use [34]. Green purchasing with six items, green distribution with five items, green production with nine items, ERP with seven items, and operational performance with five items.

3.3. Data Analysis

Collected data is analyzed using the partial least square (PLS) technique. This technique assesses the data in two steps. The first step is to evaluate the measurement model or construct indicator validity and reliability. The validity assessment consists of convergent validity and discriminant validity. Convergent validity is satisfied when the factor loading value of the indicator exceeds 0.5. While the discriminant validity is evaluated using the Forner-Larcker criterion. Furthermore, the reliability of construct indicators is evaluated using composite reliability and averaged variance extracted (AVE). The block of indicators of each construct is considered reliable when the composite reliability value exceeds 0.70 and the AVE value exceeds 0.5. Once the measurement model satisfies the predetermined criteria, further analysis, namely, inner model analysis, can proceed. The second step of the analysis is the inner model evaluation, which assesses the relationship between constructs in terms of path coefficient, T statistics value, and *p*-value. Finally, the model is assessed for the goodness of fit by looking at the R square and Q square values.

4. Results

4.1. Respondent Demographic Profiles

The first stage of analysis is descriptive analysis to observe the profile of the respondents in terms of gender, job position, and working experiences. Table 1 illustrates the composition of respondents' profiles. The respondents consist of males and females. The majority of them are male, indicating that it is in line with the current social culture in the manufacturing industry that most employees are male.

Table 1. Respondent Demographic Profiles.

Category	Frequency	Percentage
Gender		
Males	87	71
Females	35	29
Total	122	100
Job position		
Supervisor	73	60
Manager	47	38
General Manager	1	1
Director/CEO	1	1
Total	122	100
Working experiences (in years)		
1–2	12	10
3–5	62	51
6–10	40	33
>10	8	6
Total	122	100

Based on the job position, the respondents have a position involved in the company's strategic decision-making ranging from supervisor to director. This composition indicated that they are eligible as respondents and capable of responding to the statements in the questionnaire. In addition, respondents have sufficient working experience within one up to 10 years more. This result indicated that most of the respondents are familiar with the company's operation and decision-making.

Based on the department of the respondents, Table 2 showed that most respondents are in charge of the department related to this research requirement, such as purchasing, procurement, warehousing, logistic/distribution, PPIC, production, Quality control, and Engineering. These departments are directly involved in supply chain activities. This composition implies that the respondents understand the function of the supply chain in the company.

Table 2. Department Profile.

Departement	Frequency	Percentage (%)
Purchasing	7	7%
Procurement	11	9%
Warehousing	8	8%
Logistics/Distribution	12	10%
PPIC	12	10%
Production	25	20%
Marketing	6	5%
Quality Control	16	13%
Engineering	10	9%
Others department	11	9%

As has been noticed, this study requires that respondents are from the manufacturing company using the ERP software. Table 3 demonstrates the type or brand of ERP the company is using, which implies that those respondents have used ERP in their daily operations. Furthermore, the manufacturing companies used various types of software available in the market. This finding implies that all respondents recognize the ERP technology and could provide information regarding ERP adoption. However, this study did not detail the extent to which they adopted the ERP since it contains several modules in its software package.

Table 3. ERP software used by the Company.

ERP Software	Frequency	Percentage (%)
SAP	39	32%
Oracle	9	7%
BAAN	13	11%
MFG Pro	17	14%
JD Edwards	11	9%
People Soft	6	5%
Others brand	27	22%

4.2. Measurement Validity and Reliability

Further analysis is to assess the validity and reliability of the measurement model using smartPLS software version 3.0. The validity test assesses the factor loading for convergent validity and the Forner-Larcker criterion for discriminant validity. An indicator is considered valid in convergent validity once it has a factor loading value exceeding 0.50. Table 4 demonstrated the value of factor loading for each indicator and reliability for each construct. The indicators are considered reliable if the composite reliability exceeds 0.70 and the average variance extracted (AVE) exceeds 0.50 [58]. Based on these criteria and the result indicated in Table 4, it is concluded that all indicators are valid convergent, and also reliable. Table 4 also indicated the mean score of each item of measurement. As has been stated before, the scale used a 7-point Likert scale. The mean score value on those indicators demonstrated that those indicators have the mean score in the range of 5.36 up to 6.50, which means it is on a high level. This result indicated that those respondents have practiced the construct addressed in this study.

In addition, the value of the outer variance inflation factor (VIF) addresses the collinearity between indicators, with the VIF value requirement being less than 5.0 [59]. The result indicated that VIF is in the range of 1.540–4.201, which implies that those indicators satisfy the VIF requirement values.

Besides convergent validity, the measurement item needs to examine the discriminant validity to ensure that all indicators correlate higher with its construct than other constructs. The Forner-Larcker criterion is used to address the discriminant validity, as shown in Table 5. The square root value of AVE of each construct (written in bold) is greater than its

correlation with other constructs (other values on the same column); hence the discriminant validity of the construct indicators is satisfied [58].

Table 4. Validity and reliability of the variables.

Construct	Item Number	Mean	Factor Loading	Outer VIF	Composite Reliability	AVE
ERP adoption	ER1	5.93	0.80	2.308	0.92	0.65
	ER2	5.97	0.75	2.036		
	ER3	5.62	0.85	2.956		
	ER4	5.67	0.78	2.019		
	ER5	5.73	0.86	3.071		
	ER6	5.5	0.83	3.251		
	ER7	5.84	0.78	2.062		
Green purchasing	GP1	5.92	0.76	2.371	0.89	0.57
	GP2	5.8	0.76	2.631		
	GP3	5.49	0.73	1.754		
	GP4	5.52	0.79	1.932		
	GP5	6.03	0.67	2.174		
	GP6	5.51	0.79	2.818		
Green production	GPR1	5.43	0.81	4.169	0.92	0.58
	GPR2	6.07	0.77	2.247		
	GPR3	5.77	0.77	2.165		
	GPR4	5.97	0.87	3.723		
	GPR5	5.82	0.83	4.201		
	GPR6	6.1	0.62	1.784		
	GPR7	6.11	0.8	2.502		
	GPR8	5.96	0.61	1.521		
	GPR9	6.04	0.7	2.130		
Green distribution	GD1	5.25	0.62	1.518	0.86	0.51
	GD2	5.77	0.83	2.336		
	GD3	5.7	0.79	2.040		
	GD4	5.36	0.76	1.771		
	GD5	6.12	0.63	1.476		
	GD6	6.21	0.61	1.273		
Operational performance	OP1	6.32	0.79	1.731	0.87	0.58
	OP2	5.84	0.58	1.237		
	OP3	6.16	0.84	2.098		
	OP4	6.31	0.76	1.609		
	OP5	6.13	0.81	2.001		

Table 5. Discriminant validity.

Variable	ERP Adoption	Green Distribution	Green Production	Green Purchasing	Operational Performance
ERP Adoption	**0.807**				
Green Distribution	0.617	**0.712**			
Green Production	0.618	0.688	**0.760**		
Green Purchasing	0.569	0.696	0.735	**0.753**	
Operational Performance	0.671	0.551	0.652	0.622	**0.761**

The further analysis addresses the inner model assessment of coefficient of determination (R^2) and predictive relevance denoted as Q^2. Table 6 shows the results of R square measurements with values in the moderate range (0.30–0.60) [58]. The value of R square is the value obtained using research data from the survey results, while adjusted R square is the value of R square corrected based on the number of samples adjusted. The value of R square is the extent to which the variance of the influencing variable explains the variance of the variable in question. For example, operational performance has a value of R

square 0.562 which means the variance of operational performance can be explained by ERP adoption, green purchasing, green production, and green distribution variables up to 56.20%. The rest of the variance, which was not explained in the study, was explained by other variables.

Table 6. R^2 and Q^2 assessment result.

Variable	R Square	Q Square
ERP Adoption	-	-
Green Purchasing	0.324	0.170
Green Production	0.600	0.340
Green Distribution	0.533	0.250
Operational Performance	0.562	0.310

Table 6 also shows the value of Q^2, which is greater than zero. According to [58], the value of Q^2 greater than zero indicates that the model has a good predictive relevance. Therefore, the research model involving the five constructs, namely, green purchasing, green production, green distribution, and operational performance, have good predictive relevance. Finally, Goodness-of-fit (GoF) in PLS-SEM has no standard statistic like in CB-SEM. The calculation of goodness of fit (GoF) uses the square root of multiplication between the mean of the determination coefficient (R^2) and AVE [60], as shown in Equation (1). The result indicated the value of 0.548, which is good fit (>0.36) [61].

$$\text{GoF} = \sqrt{\text{R}^2 \times \text{AVE}} = \sqrt{0.505 \times 0.578} = 0.540, \quad (1)$$

4.3. Hypothesis Testing

The previous discussion indicated that the first step of the analysis, measurement model assessment, has satisfied the requirement set in the partial least square (PLS) technique. Further analysis can proceed to hypothesis testing to examine whether the empirical data support the direct and indirect hypotheses. Table 7 shows the test result of the hypotheses examination that has been formulated in the previous section. The hypotheses consist of nine direct hypotheses and three indirect hypotheses. Eight hypotheses (H1–H5, H7–H9) were supported, and one hypothesis was not supported (H6). A hypothesis is supported if the T statistics value exceeds 1.96 or the *p*-value less than 0.05. The sign of the path coefficient value (negative or positive) indicated the direction of the influence. The positive value indicates the positive direction of influence.

Table 7. Direct hypothesis Testing Result.

Relationship	Path Coefficient	T Statistics	*p* Values	Remark
ERP Adoption -> Green Purchasing (H1)	0.569	9.33	0.000	supported
ERP Adoption -> Green Production (H2)	0.296	3.44	0.001	supported
ERP Adoption -> Green Distribution (H3)	0.310	3.17	0.002	supported
Green Purchasing -> Operational Performance (H4)	0.225	2.05	0.042	supported
Green Production -> Operational Performance (H5)	0.261	2.34	0.021	supported
Green distribution -> Operational Performance (H6)	−0.034	0.31	0.760	not supported
Green Purchasing -> Green Production (H7)	0.567	7.29	0.000	supported
Green Production -> Green Distribution (H8)	0.497	5.92	0.000	supported
ERP Adoption -> Operational Performance (H9)	0.403	4.46	0.000	supported

Table 7 shows that all direct hypotheses, the direct causal relationship between two constructs, are positive and significant for the significant level of 0.05 (or 5%). As shown, ERP adoption affects green purchasing with a path coefficient value of 0.569, a T statistic value of 9.33, and a *p*-value of 0.000. This finding implies that ERP adoption positively affects green purchasing, and the influence is significant for the significant level of 0.05 or a T-value of 1.96. Furthermore, ERP adoption positively affects green production (H2) with a patch coefficient of 0.296, a T statistic value of 3.44, and a *p*-value of 0.001. Moreover,

ERP adoption affects green distribution (H3) with a coefficient of 0.310, T value of 3.17, and *p*-value of 0.002. Green purchasing also influences operational performance (H4) with a coefficient value of 0.225, T value of 2.05, and *p*-value 0.042. Similarly, green production influences operational performance (H5) with a coefficient value of 0.261, T value of 2.34, and *p*-value of 0.021. However, green distribution does not affect the operational performance (H6) since the t statistic value is 0.31, less than 1.96, or *p*-value is 0.760 greater than 0.05. Instead, green purchasing positively affects green production (H7) with a coefficient value of 0.567, T value of 7.29, and *p*-value of 0.000. Green production also influences green distribution (H8) with a coefficient value of 0.497, T value of 5.92, and *p*-value of 0.000. The last direct hypothesis is the influence of ERP adoption on operational performance (H9), which is supported with a coefficient value of 0.403, T value of 4.46, and *p*-value of 0.000.

Furthermore, the indirect hypotheses assessment result is indicated in Table 8. Three indirect hypotheses were proposed, and the result shows two hypotheses (H10, H11) were supported while one was not supported (H12).

Table 8. Indirect Hypothesis testing Result.

Indirect Relationship	Path Coefficient	T Statistics	*p* Values
ERP Adoption -> Green Purchasing -> Operational Performance (H10)	0.128	2.012	0.045
ERP Adoption -> Green Production -> Operational Performance(H11)	0.077	2.096	0.036
ERP Adoption -> Green Distribution -> Operational Performance (H12)	−0.011	0.289	0.773

The ERP adoption indirectly influences operational performance through the mediating role of green purchasing (H10) with a coefficient of 0.123, T value of 2.012, and *p*-value of 0.045. Besides, the ERP adoption also indirectly affects operational performance through the mediating role of green production with a coefficient of 0.077, T value of 2.096, and *p*-value of 0.036. However, ERP adoption did not indirectly affect operational performance through the mediating role of green distribution.

Figure 2 shows a summary of the research model with the results of analysis using smartPLS software. The yellow box is an indicator of the variable. The value lies on the line between the variable, and the indicator is the factor loading. Furthermore, the value inside the circle indicates the average variance extracted (AVE), and the value of the line between variables is the path coefficient.

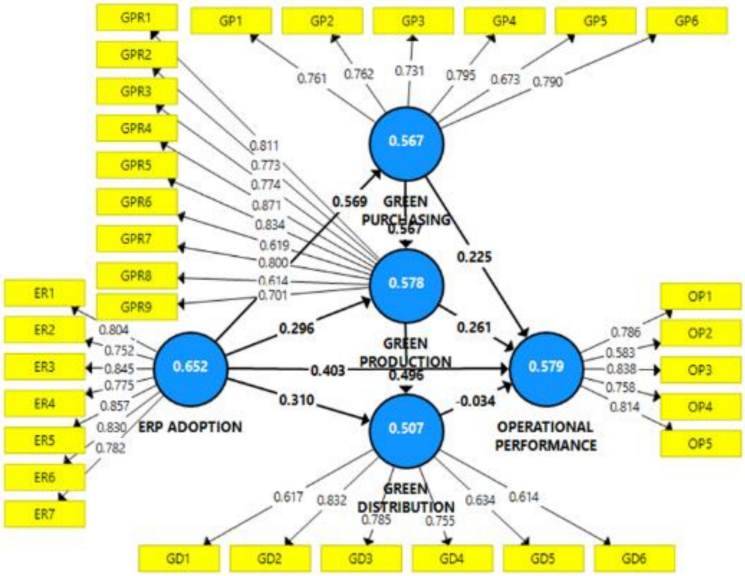

Figure 2. Research model and analysis result.

5. Discussion

The results of the first hypothesis test (H1) stated that ERP adoption has a positive effect on green purchasing. This finding means that if the company *adopts ERP*, such as providing accurate information with the relevant supplier about the company's needs, such as material needs that meet the standard with environmental protection criteria, it will allow the supplier to be able to provide the intended requirements. These results support previous research that adopting information technology such as *ERP* can improve supplier capabilities by increasing business relationships between companies and *suppliers* to create increasingly environmentally friendly purchases [35–37]. The second hypothesis (H2) that ERP adoption affects green purchasing was also supported in this study. Implementing ERP in the company allows effective coordination and enables the company to adopt green production. Green production eliminates waste, pollution, recycling, material provisioning, and technology in preparing environmentally friendly production processes. The research is also following previous research [8,21,33], which states that ERP *adoption* affects *green production*. This result means that if the company intensively uses ERP technology in providing and sharing quality information, they could benefit from more environmetally friendly production process.

Furthermore, the result showed that the third hypothesis (H3), ERP adoption has a significant effect on green distribution because it has a positive statistical value result with a significance value of 5%. These results support previous research [21,33,40], stating that adopting information technology such as ERP that provides information about the company's operations is the main key in green distribution success. It enables minimizing the use of packaging, load optimization, reduction of material consumption, and use of integrated transportation systems to reduce the impact of environmental damage from transportation.

In addition, the results of the fourth hypothesis (H4) test showed that green purchasing affects operational performance. The manufacturing companies are interested in collaborating on environmentally friendly purchases with suppliers to create positive profits, supported by case studies from manufacturing companies in Europe and Australia showing that ecologically friendly purchasing practices are used to improve company operations. These results also follow previous research [22,39,41,43], which states that green purchasing affects operational performance. As expected, test results revealed that green production is positive improves operational performance (H5). These results support previous research that environmentally friendly production innovation processes reduce the impact of environmental damage and improve the quality of production processes capable of producing environmentally friendly goods [41–43].

However, the hypothesis (H6) test showed that green distribution had no direct effect on operational performance. Therefore, these results do not support the proposed hypothesis. However, previous research has also demonstrated that the logistics or distribution industry is very closely related to environmental friendliness performance rather than operational performance that tends to be related to increasing profits or quality of goods. This finding is evident from implementing green distribution to the operating performance that is not satisfactory enough in developed city areas such as Beijing and Shanghai. These results are also under previous research. In the context of Indonesia, the underlying reason for green distribution may not affect operational performance is the condition of infrastructure in Indonesia that has not been able to improve operational performance. In addition to infrastructure problems, bureaucratic processes regulated by regulations and legislation have not been effective and efficient. Such as, shipping by land and sea requires a long waiting time compared to neighboring countries. This result is evident from the logistic cost in Indonesia, which still reaches 23% of the total cost. While in neighboring countries reached 12 to 15%.

Instead, the seventh hypothesis (H7) is supported that green purchasing influences green production. Companies practice environmentally friendly production by reducing or eliminating hazardous materials or materials, reducing excessive use of sources, and

encouraging recycling and purchasing reusable materials [25,29,47]. A company using environmentally friendly products enables it to practice environmentally friendly production. Moreover, the hypothesis (H8) test result showed a significant impact of green production on green distribution. This study supports the previous research stating that green production support green distribution [11,40,48]. However, green production should not stand alone in practicing the green concept. Green production requires green distribution, such as coordination and collaboration between the company and its distributor to transport the green product using fuel-efficient transport, recyclable and reused packaging, eliminating waste, and optimizing the route. The company tries to implement the recycling process in its production process. At the same time, the company will also transport or store the product using packaging materials that can be recycled and reused.

The hypothesis (H9) test revealed ERP adoption improves operational performance in the manufacturing industry. Successful adoption of ERP can enhance organizational performance such as cost, quality, delivery, product variation, and company time to introduce new products to the market from other competitors. Adopting ERP into the company operation can help the company make a decision quickly. In addition, the company will potentially reduce lead time so that the delivery process can be more responsive. This finding extends the acceptance of previous research stating that ERP adoption improves operational performance [14,37,49–52]. The hypothesis (H10) test showed a significant influence of ERP adoption on operational performance mediated by green purchasing. Companies adopting ERP enables integration between departments to be more intense and fruitful such as decision-making in purchasing the green product from the supplier. Companies that carry out ecologically friendly purchasing processes can improve manufacturing operational performance, such as environmentally friendly product development. These results are also in line with previous research [21,41,43,45,54] stated that ERP adoption affects operational performance through green purchasing. Suppliers who have implemented an environmental friendliness management system supported by accurate information enable the company to improve its product development.

Furthermore, the hypothesis (H11) showed a significant impact of ERP adoption on operational performance mediated by green production. The ERP will enhance environmentally friendly production processes such as water utilization and energy. As a result, first, it can produce green products and sell relatively cheaper. The company can also develop the following products to further increase its competitiveness in the market. These results align with previous research, which states that ERP adoption affects green production operational performance. However, hypothesis (H12) shows that green distribution does not significantly mediate the influence between ERP adoption and operational performance (H12). The finding is the consequence of hypothesis (H6) stating that green distribution did not improve operational performance. The possibility of the underlying reason ERP adoption does not affect operational performance through green distribution, the implementation of green distribution has not been able to contribute to a delivery with the fastest route. This result is likely to happen because the infrastructure system in Indonesia is still slow and has not been able to improve operational performance.

6. Managerial Implication and Theoretical Contribution

The managerial implication of this study is highlighted as follows. Firstly, the findings have indicated that ERP adoption is essential for the company in enhancing its operational performance. ERP is an information technology that enables the organizations involved in a supply chain to communicate seamlessly in coordinating all activities related to fulfilling customer orders. Furthermore, during the COVID-19 pandemic, adopting information technology such as ERP allowed the organization to operate without exposing the people to the risk of being infected. ERP technology facilitates the provision of accurate and quality information for daily operations. This information is shared among the supply chain partners on the downstream and upstream sides. Based on the shared information, the supply chain partners could collaborate in real-time and efficiently, such as collaborative planning,

forecasting, and replenishment. This kind of collaboration is highly essential for eliminating the bullwhip effect and, at the same time coping with demand fluctuation. Therefore, the companies currently using ERP are enjoying the benefit during the pandemic. Finally, this study suggests that companies who are not using ERP consider it since they could benefit from adopting ERP, particularly during the current pandemic. Indeed, adopting the ERP technology requires an expensive investment, and it takes time to achieve the break event point. However, ERP will enable manufacturing companies to achieve a competitive advantage in the long run. Secondly, as noticed previously, environmental protection is becoming an essential issue in global trade. In contrast, fulfilling ecological protection regulations and adopting green practices requires a considerable capital investment, such as investment in green technology. As part of the green supply chain practices, green purchasing concerns buying environmentally friendly products from suppliers and prioritizing suppliers who implement environmentally friendly management systems and are certified by ISO 14001. Green purchasing is also concerned with avoiding buying ecologically unfriendly products such as lead and toxic material. Applying these green purchasing criteria in many cases is not easy work. It may require a drastic change in company policy, or it may need a company to develop its supplier, which is costly for the company. Besides, green production concerns eliminating waste in the production process, reducing environmental pollution, implementing the recycling process, adopting environmentally friendly production processes, not using toxic materials, and using technology to make the production process environmentally friendly. Green production adoption requires new innovative technology such as new machines, equipment, production processes, and new skills, enabling the organization to meet the green production criteria. Like ERP technology, green purchasing and green production stipulate the organization to invest in capital-intensive resources. Indeed, this capital-intensive investment requirement makes the company management doubt whether the investment will benefit the company. However, this research indicated that practicing the green concept such as green purchasing and green production could benefit the company's operational performance. Hence, the company management of the manufacturing industry is encouraged to adopt green purchasing and green production based on their capability in providing the budget requirement. In addition, the global attention on environmental issues has advocated the manufacturer to practice ecological protection as a predetermined condition in the worldwide market. It requires a considerable investment; however, it enables the company to access a broader market globally. In return, the company will benefit from potential opportunities. The company will benefit from wider opportunities, gain a competitive advantage, and improve operational performance in the long term.

Furthermore, this study also contributes to the current supply chain management theories. Firstly, the findings of this study have proved the extended acceptance of the previous research in the population of the manufacturing industry in Indonesia. Furthermore, such previous studies show that adopting ERP technology benefits the companies, particularly in the ongoing pandemic, to improve operational performance. Besides, the study also enriched the current research that practicing a green approach in the manufacturing industry contributes to enhancing the operational performance even though the doubt is due to high capital investment requirements. The second contribution to the theoretical issue is the findings showing that green practicing mediates the indirect impact of ERP technology adoption in improving operational performance.

7. Conclusions

This research has assessed the benefit of adopting ERP and practicing green supply chain management toward operational performance in the manufacturing industry in Indonesia. The result has revealed that adopting ERP technology and practicing green supply chain management could enhance operational performance, particularly amid the current COVID-19 pandemic and increasing society's concerns about environmental protection. Based on the research model and proposed hypotheses, a more detailed conclusion is also

presented. The study has developed thirteen hypotheses to be examined, consisting of nine hypotheses of direct relationships and three of indirect relationships between constructs. The adoption of ERP technology enhanced the adoption of green purchasing (H1), green production (H2), green distribution (H3), and operational performance (H9). Furthermore, operational performance is directly affected by green purchasing (H4) and green production (H5). However, operational performance was not supported by green distribution (H6). Moreover, green purchasing support green production (H7), and Green distribution supports green production (H8). In addition, ERP adoption indirectly improves operational performance through green performance (H10) and green production (H11). But ERP adoption did not affect operational performance through green distribution (H12).

This result provides essential insight for the manager in the manufacturing industry that adopting ERP and practicing environmental protection such as green purchasing, green production enhances operational performance. Furthermore, this research extends the acceptance of previous research related to ERP adoption, green purchasing, green production in improving operational performance. The novelty of this study is the revelation of mediating role of green purchasing and green production in the influence of ERP adoption on operational performance. Hence, this study contributes to enriching the current research in supply chain management. Finally, this research has a limitation in methodology and population coverage, which focuses on the manufacturing companies in East Java, Indonesia. This study used an online questionnaire as a survey instrument, which could be exposed to a biased response due to the arbitrary attitudes of respondents. The usage of online questionnaires should be verified, to some extent, for some responses by phone call or direct interview to make sure the online responses are valid. However, this idea is not affordable given the pandemic situation. The second limitation issue is the population coverage that focused on specific industry sectors, namely food and beverage, textile, and pharmacy. For future research, the author suggested covering a broader population and industrial sectors such as the service industry and including additional constructs such as top management commitment and customer relationship management.

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