

## The role of top management commitment to improve operational performance through it adoption, supply chain integration, and green supply chain management

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### ABSTRACT

Manufacturing companies constantly strive to produce products that promote better competitiveness. In addition, the current business environment requires manufacturing companies to adopt environmentally friendly concepts, which have become a global customer concern. Therefore, companies must inevitably meet environmental protection requirements through ecologically friendly processes and products. Meanwhile, environmentally friendly adoption requires a capital-intensive investment, which doubts the management regarding the investment return. Hence, top management commitment is highly needed to maintain eco-friendly products and contribute to the company's performance. This study examines the role of top management commitment to operational performance through adopting information technology, supply chain integration, and green supply chain management. This study surveyed manufacturing companies that have implemented ISO 14000, as many as 73 companies with criteria of having more than 100 employees. Data is collected using questionnaires directly and online with Google Forms. The results of data processing analysis found that top management commitment influences information technology adoption with a priority scale to maintain competitiveness and strategies that increase competitiveness. Top management commitment through information technology can improve supply chain integration and green supply chain management. In addition, supply chain integration improves green supply chain management and operational performance. Implement environmental-friendly measures by involving external partners to impact operational performance. The results of this study contribute to enriching supply chain management theory by significantly adopting green supply chain management to improve sustainable development and performance. It also makes a practical contribution by providing insight for practitioners to generate added value for customers.

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## 1. Introduction

Globalization encourages companies to distribute goods and services globally to maximize profits and minimize waste (Nguyen & Le, 2020). Moreover, manufacturing companies are increasingly aware of the importance of supply chain management as a part of competitiveness (Santoso et al., 2022). Raw materials and semi-finished goods are obtained from various parts of the world today. At the same time, the products are produced and redistributed globally (Hopper et al., 2017; Free & Hecimovic, 2021). Companies also need to follow the standards of each country where they market the product in terms of their participation in the environment (Nguyen & Le, 2020). Globalization has encouraged the company's distribution to the global reach, which will undoubtedly improve the company's operational performance (Siagian et al., 2022). Operational performance is an improvement in the company's performance, which is expected to be the company's advantage amid a dynamic competitive environment (Abdallah & Al-Ghwayeen, 2020). Operational performance is also

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likely to direct the company in a better direction than its competitors, thus enhancing the company's sustainability (Sangwan & Choudhary, 2018). This operational performance can be achieved by building an adequate supply chain flow and providing adequate human resources (Basana et al., 2022), allocating finances to essential things, and maintaining good communication (Leksono et al., 2020). Thus, the company will provide its best products at a low cost to satisfy customers (Yu et al., 2021).

Global warming due to climate change has emerged as a primary threat to companies in reducing natural resources, resulting in a scarcity of raw materials for purchases (Gupta et al., 2022). In addition, consumers have also shifted their concerns and needs due to global concerns on environmental protection (Novitasari & Tarigan, 2022). Today's consumers prefer environmentally friendly goods made from recycled materials, or even when thrown away, they can be used again or decomposed quickly (Dou et al., 2018). 86% of respondents buy a product if the plastic used is recycled plastic (Ruokamo et al., 2022). This shows that customers are already concerned about the environment and prefer to buy environmentally friendly products and even want to repurchase them. Implementing green supply chain management (GSCM) enables companies to compete and attract customers who care about the environment and improve the company's operational performance (Adusei et al., 2023; Hartono et al., 2023). GSCM refers to efforts to overcome natural environmental problems and increase the effectiveness and efficiency of company work due to resource or energy savings (Abdallah & Al-Ghwayeen, 2020). Implementing GSCM attracts customers who care about the environment to buy products from the resulting companies (Sarkis, 2020; Kitsis & Chen, 2021). GSCM can make companies efficient in the use of raw materials, thus minimizing waste, and become part of the evidence of corporate responsibility to the environment that can increase the value of the company (Wang et al., 2020). Very dynamic market changes force companies to implement information technology (IT) that is constantly updated. IT can facilitate the company's business activities because it can improve efficiency and effectiveness (Hiebl et al., 2017) and improve the company's operational performance (Tarofder et al., 2017). Many companies have not implemented IT because of concerns about high investment risks that do not generate competitiveness (Hiebl et al., 2017). Implementing information technology requires strong support from top management because it requires a significant investment in equipment inventory, funds, and human resources (Tarigan et al., 2020a; Gangwar et al., 2014). The implementation of GSCM and IT Adoption must be distinct from the influence of top management commitment (Basana et al., 2022).

Top management commitment can provide the resources companies need to implement GSCM (Sangwan & Choudhary, 2018). The obligation and responsibility of Top Management is to respond to everything that is happening in the market, both opportunities and threats (Kitsis & Chen, 2021). Support for the implementation of GSCM operations instilled in its employees, such as providing training on GSCM, providing direction on what is the importance and how vital the implementation of GSCM is in the company, or it can be by providing rewards in its implementation (Adusei et al., 2023). Bove and Swartz (2016) state that consumer goods companies contribute 80% of greenhouse gas emissions, which can significantly impact the natural environment. Not only residual emissions of production but also transportation emissions used for mobility, both raw materials and finished goods of manufacturing companies. Even transportation is claimed to be the most significant contributor to CO<sub>2</sub>, which continues to increase yearly and has the most impact on environmental damage (Sinnandavar et al., 2018). The management of the company's supply chain integration is needed to deliver goods according to customer needs at the time and place (Tarigan et al., 2021). Supply chain integration can avoid lengthy, complex distribution flows (Sarkis et al., 2020). Thus, the waiting time for transportation modes when sending goods will be reduced to minimize fuel use and motor vehicle emissions (Sinnandavar et al., 2018). GSCM can be applied, for example, by using transportation modes for environmentally friendly distribution to reduce pollution caused by vehicles and using environmentally friendly raw materials (Habib et al., 2022). Top management is committed to producing operational performance by implementing green supply chain management and paying attention to the impact generated by the company on the environment (Adusei et al., 2023). Indonesia is famous for its manufacturing industry. Even the most enormous GDP income is contributed by companies from the manufacturing industry. Therefore, this research will take the place of research in the scope of Indonesia.

Various research found a relationship between top management commitment and IT adoption (Lin, 2013; Tarigan et al., 2020a). Others researches also shows that top management commitment improves supply chain integration (Kumar & Rahman, 2016; Truong et al., 2017; Tarigan et al., 2021; Siagian et al., 2022). Moreover, top management's commitment encourages the implementation of green supply chain management under applicable regulations (Kumar & Rahman, 2016; Suryanto et al., 2018; Carter et al., 2020; Kitsis & Chen, 2021; Gonzalez et al., 2022; Adusei et al., 2023). Meanwhile, research state that information technology adoption enables the company functions integration to improve supply chain integration (Liu et al., 2016; Zhang et al., 2016; Yu et al., 2017; Zhou et al., 2022). This implies that adequate information technology for companies supports green supply chain management in producing environmentally friendly products (Sarkis et al., 2021). Moreover, adopting information technology in companies impacts operational performance by the efficiency and effectiveness of processes (Zhou et al., 2022; Basana et al., 2024). Research discussing supply chain integration relationships influences increasing green supply chain management implementation in China (Xi et al., 2023). Supply chain integration also impacts operational performance (Bae, 2018; Sinnandavar et al., 2018; Wong et al., 2021; Tarigan et al., 2021; Siagian et al., 2023). Supply chain integration influences green supply chain management and environmental performance (Geng et al., 2017; Vanalle et al., 2017). The implementation of green supply chain management has an impact

on improving operational performance in producing green products (Yu et al., 2014; Agarwal et al., 2018; Famiyeh et al., 2018; Enoch et al., 2023; Siagian et al., 2022; Santoso et al., 2022).

Based on the previous discussion in the introduction, this study examines the role of top management commitment to improve operational performance through information technology adoption, supply chain integration, and green supply chain management. This research topic raises four primary research objectives: first, it examines the company's top management commitment to adopting information technology, supply chain integration, and green supply chain management. Second, the extent to which the company can implement information technology can influence supply chain integration, green supply chain management implementation, and operational performance. Third, assessing the supply chain integration influences the implementation of green supply chain management and operational performance. Finally, the fourth is implementing green supply chain management, which affects operational performance.

## 2. Literature Review

### 2.1. Supply Chain Management

The company focuses on meeting all customer needs, impacting customer satisfaction, not only the quality of products or services (Yildiz, 2018; Basana et al., 2024). The main factor that can make it easier for companies to respond to customer needs is to have a flexible and reliable system (Siagian et al., 2023). Therefore, companies need effective Supply Chain Management. Supply Chain Management (SCM) is an activity that provides raw materials for production needs, carries out production plans, controls the course of production, and distributes finished goods to customers (Tarigan et al., 2021). SCM ensures that companies can produce goods within the existing demand, transportation for distribution, storage of finished and raw goods, and the flow of information can run smoothly (Koech et al., 2014).

### 2.2. Top Management Commitment

The commitment must start from management at the highest level (Kitsis & Chen, 2021). Significant changes that have been planned and the presence of tremendous pressure from external parties will not make significant changes in the organization if it is not supported by commitment from top management (Agarwal et al., 2018). Top management commitment involves management planning, repairing, and controlling the organization to be competitive (Digalwar et al., 2013). Top management should plan company policies (Tarigan et al., 2020a). Top management ensures that the policy results have been implemented and communicated within the company to develop and improve company performance (Yusliza et al., 2019). Top management commitment is vital in determining company goals reflected in the decisions and actions taken (Tarigan et al., 2020b). Top management can determine the strategies and regulations applied within the company (Siagian et al., 2022) and investment decisions taken to advance the company (Agarwal et al., 2018). Top management ensures that company employees actively participate in the decisions that have been determined and that there is a need for continuous socialization (Chen & Kitsis, 2017). Top management behavior affects employee behavior in the organization (Kanwal et al., 2017).

Kitis and Chen (2021) stated that top management commitment can be demonstrated by building the company's work culture and procuring facilities to support programs set by the company. Measurement is needed so that the company can evaluate how committed top management is to the company. According to Kitis & Chen (2021), in measuring commitment, top management needs to pay attention to several things, such as considering essential parts of the company for its sustainability when deciding, considering company sustainability as necessary, providing what the company needs for sustainability, continuing to provide support for company sustainability. Employees in the company are ensured to get training to overcome issues related to corporate sustainability.

### 2.3. Information technology adoption

Adopting information technology is essential for companies to make business processes efficient and effective (Tarigan et al., 2020a). Ammirato et al. (2019) stated that information technology adoption is a tool that helps management in decision-making and supports the company's business processes to be more efficient, which can produce progress for the company. The adoption of information technology consists of software application components, hardware, and available resources, primarily operating staff (Zhou et al., 2022). IT Adoption is the mainstay of companies in every aspect, such as the strategy taken (both corporate-level, business-level, and functional-level strategy), the way the organization operates, and the management system used by the company (Nyuten et al., 2024). IT Adoption is the company's mainstay in increasing competitiveness (Santoso et al., 2022). The benefits of companies adopting information technology include companies that can generate more value, get information on market conditions that are updated on an ongoing basis, and information on the number of goods available to suppliers and customers that can facilitate the distribution of goods (Zhou et al., 2022). Not only added value, the existence of IT can also facilitate communication, both between internal within the organization and with parties outside the organization, which can make it easier for companies to overcome problems that may occur quickly and precisely (Verma & Bhattacharyya, 2017; Tortorella et al., 2020), both with suppliers and consumers (Sinnandar, 2018). In addition to obtaining and disclosing information to external parties, companies must protect critical

information and company secrets from external parties to avoid information leakage to competitors or other parties (Ogbanufe et al., 2021).

The application of IT in the company must be evaluated and ensured to have been well implemented in sharing information (Basana et al., 2024). Mand et al. (2022) stated that several factors can measure the application of IT in a company, such as the use of email, searching for information via the Internet, ordering that can be done online to suppliers, sales to customers that are integrated online, having electronic payment signs for customers, government information related to companies can be obtained online, feedback provided by customers online, Companies use e-banking services, have social media, can communicate online within the company and externally, use video conferencing, post job vacancies online, and also store documents needed by the company electronically and not hardcopy anymore.

#### *2.4. Supply Chain Integration*

Supply chain integration (SCI) is a combination of collaboration between entities in the supply chain to share information and coordinate to reach a decision that can benefit the company (Yu et al., 2017; Siagian et al., 2023). SCI is the flow of goods with raw materials and finished goods, and information is distributed through the proper process between organizations (Wong et al., 2021; Basana et al., 2024). Coordination between these entities is essential in the flow of SCI (Siagian et al., 2022) to achieve sustainability and collaborate with other organizations that have their competencies (Sinnandavar, 2018). Information in SCI is processed by coordination in a company's supply chain activities (Yu et al., 2017, 2018) and combining interpretations of information owned (Srinivasan & Swink, 2015; Swink & Schoenherr, 2015) to reduce things that can hinder the company achievement (Yu et al., 2019). This increasingly heated global competition requires companies to be able to find mutually beneficial relationships among entities in the supply chain, both internally and externally, so that companies have a competitive advantage (Yu et al., 2021). SCI is expected to have an efficient flow of goods and materials (Siagian et al., 2022) to minimize the costs that need to be incurred, both for sourcing outside the company (supplier) as well as internal costs from the company (Wong et al., 2021). Thus, companies will be able to survive in a dynamic world as profitability increases (Yang & Lin, 2020).

Wong et al. (2021) divided SCI into three parts: integration in information flow, cash flow, and company operations, which include raw materials, finished goods after production, and services. Supply chain integration comprises supplier, internal, and customer integration components (Hartono et al., 2023; Sinnandavar et al., 2018). SCI measurement is divided into green supplier integration and customer integration (Siagian et al., 2023; Yu et al., 2021). This supplier integration can be assessed through several things, namely the exchange of information carried out through information networks, the existence of an ordering system to suppliers that have been well integrated, suppliers being able to provide goods as needed stably, supplier participation in the provision of goods, and how the company's role in increasing the ability of suppliers to provide goods or services needed by the company. Green customer integration that can be considered its application is the exchange of information with customers carried out through information networks, the existence of an ordering system that can be used by customers and is well integrated, companies can provide goods needed by customers stably, the level of participation from customers in the company's production process, customer participation when the company does product design, and how customers can help the company to continue to make improvements in the procurement of goods so that they can be maximized.

#### *2.5. Green Supply Chain Management*

Green supply chain management (GSCM) is gaining attention because of global warming and the scarcity of resources that can make companies continue to compete to be superior to their competitors (Wilhelm et al., 2018). GSCM is a unique organizational strategy and is challenging to replicate (Gonzalez et al., 2022). GSCM combines operating processes that aim to minimize costs and produce more environmentally friendly products (Nguyen & Lea, 2020). Habib et al. (2022) said that green supply chain management ensures that company activities can effectively reduce environmental adverse impacts by using green design, purchasing, manufacturing, facilities, transportation, and end-of-life management (Santoso et al., 2022). GSCM is a series of solutions to environmental problems that are occurring due to the production, distribution, and use of a good / service from the company, which can be started from design, selection of primary materials, manufacturing, delivery of products to customers, and utilization of the end of product life (Abdallah & Al-Ghwayeen, 2020). So, the pressure from the external party makes some companies take action to implement green supply chain management to overcome environmental problems (Gonzalez et al., 2022).

Adusei et al. (2023) stated that GSCM has two main parts: Internal GSCM and External GSCM. Internal GSCM is an environmentally caring practice initiated by all entities in the organization that are members of the supply chain series (Basana et al., 2022). Green supply chain is the company's role to meet customer needs by involving suppliers in terms of concern for the environment (Kurt & Akyol, 2023). Green supply chain management is critical to implement, partially and at all stages, to increase operational efficiency and company profits (Khan & Yu, 2021). The importance of GSCM for business continuity requires an evaluation of the implementation of GSCM in the company on an ongoing basis (Adusei et al., 2023).

## 2.6. Operational Performance

Operational Performance is a way to increase efficiency by having low inventory, improving product quality, increasing capacity, and improving the on-time delivery system to customers (Habib et al., 2022). Performance is all company activities related to the series that occur within the company, including productivity, quality, and customer satisfaction, that can be the company's competitive advantage (Abdallah & Al-Ghwayeen, 2020; Tarigan et al., 2020a). Operational performance is the company's ability to maximize output with its resources, including improving the quality of goods and services by reducing existing costs and increasing cycle time (Wong et al., 2021). The company's operational performance is important in measuring the efficiency and effectiveness of a company compared to other competing company systems so that the company understands which direction the company should move (Sangwan & Choudhary, 2018). The company's ability is also assessed by how capable the company is in reducing the costs attached to the company's operational processes, for example, in the efficiency of using raw materials and the length of production lead time (Siagian et al., 2023; Situmorang et al., 2024; Novitasari & Tarigan, 2022). Operational performance is also vital to produce effectiveness for the company so that the products produced can achieve the best quality (Basana et al., 2022; Hartono et al., 2023). Companies can manage processes effectively and efficiently, which can influence increasing profits (Truong et al., 2017). The company's operational performance reflects the company's ability to deliver low-cost products of good quality and improve customer power (Yu et al., 2021). Truong et al. (2017) stated that operational performance is measured by reducing management costs, decreasing the lead time of producing an item, waiting time for orders, the percentage of material damage, and ensuring delivery to customers is on time and as promised.

### 2.6. The relationship between research concepts

#### 2.6.1. Relationship of Top Management Commitment and IT Adoption

Top management commitment is vital for companies applying information technology to provide adequate funds and resources (Tarigan et al., 2020a). The role of top management commitment is essential for companies in explaining company strategy and empowering employees to support the sustainable implementation of information technology (Hiebl et al., 2017). The commitment of top management to implementing information technology to become an integrated company business process between departments to facilitate coordination between employees more quickly and easily (Tarofder et al., 2017). The application of IT also requires a large enough investment to run well. Therefore, the role of top management is also crucial in determining investment decisions (Gangwar et al., 2014). Research shows that large-scale change will only succeed if it is accompanied by a stable and sufficient supply distribution of resources, which can only be done with the commitment and support of top management (Kanwal et al., 2017). IT adoption requires companies to share information with external parties and maintain company confidentiality against external parties. This is also important for top management, as their information can be leaked or their names tarnished if they cannot strengthen their firewalls (Ogbanufe et al., 2021).

**H<sub>1</sub>:** *Top management commitment affects IT Adoption.*

#### 2.6.2. Relationship of top Management Commitment and Supply Chain Integration

The influence of top management is a factor that can make companies successful in implementing supply chain integration (Tarigan et al., 2021). Top management's commitment continues to build communication and socialization so that employees are confident they can implement good supply chain integration (Uddin, 2022; Siagian et al., 2023). Top management will take steps to invest in machines and tools that can support automation systems that can increase a company's production efficiency (Siagian et al., 2022). In addition, this investment can also reduce manual processes that are too long and the possibility of human error (Bae, 2017). Commitment from top management can be a success factor in fostering cooperation, good communication, and straightforward integration with buyers and suppliers (Kumar & Rahman, 2016). Top management can make specific regulations that make suppliers have efficient supply chain regulations by the companies. In addition, pressure from customers regarding a well-integrated supply chain flow also requires commitment from top management to be realized optimally (Agarwal et al., 2018). All top management decisions can enable companies to face dynamic supply chain movements (Uddin, 2022). Truong et al. (2017) showed that top management influenced the implementation of Supply Chain Integration in 246 garment companies in Vietnam. Research from Kumar & Rahman (2016) conducted on 141 companies also found that top management commitment positively affects supply chain integration.

**H<sub>2</sub>:** *Top management commitment affects Supply Chain Integration.*

#### 2.6.3. Relationship of top management commitment and green supply chain management

Commitment is needed at all levels of the organization, starting from top management, which must support the implementation of SCM in providing the required resources (Yigitbasioglu, 2015; Tarigan et al., 2020b). Top management

must provide natural, human, and other resources to ensure IT for processes implemented in the company can run adequately (Bukhari et al., 2022). Without the commitment from top management, all plans that have been prepared for GSCM implementation will not be implemented optimally because the success of an organization's initial commitment always begins with the company's top-level management (Wisner et al., 2019). For example, the CEO of P&G (Chief Executive Officer Procter & Gamble), who targets all of its product packaging by 2030, has used recycled and reusable materials (Buss, 2019). The CEO of Microsoft also targets the same year to be able to carry out environmentally friendly processes for carbon emissions (Staff\_Guardian, 2020). The influence of top management companies can help them implement GSCM more effectively than their competitors by implementing GSCM policies to achieve company goals and create a better environment (Sangwan & Choudhary, 2018; Lee et al., 2015).

The implementation of GSCM must continue to be implemented gradually so that all components can understand company goals and instill employee concern in the environment and organization (Kitis & Chen, 2021). Continuous management commitment can produce solid and sustainable GSCM implementation (Suryanto et al., 2018; Gonzalez et al., 2022). Top management commitment positively and significantly affects implementing the company's Green Supply Chain Management (Basana et al., 2022; Adusei et al., 2023). The same is also produced that top management can improve GSCM (Kumar & Rahman, 2016; Suryanto et al., 2018; Carter et al., 2020; Kitis & Chen, 2021; Gonzalez et al., 2022).

**H<sub>3</sub>:** *Top management commitment influences green supply chain management.*

#### *2.6.4. Relationship between IT adoption and supply chain integration*

Advanced technology plays an essential role in the application of the supply chain. IT Adoption can produce renewable energy to increase the company's efficiency (Sarkis et al., 2020). The application of IT can help track products in the supply chain series (Tu, 2018). In addition, companies can design intelligent transportation systems that can provide proper delivery planning, thus creating on-time delivery by placing the product at the right time and place (Sarkis et al., 2020). IT adoption in companies can build a platform that can share information quickly with suppliers to provide stock information related to company production planning (Wamba et al., 2017). In addition, IT adoption can also help the rapid flow of information, making it easier for companies and entities outside the company to make decisions efficiently (Sinnandavar et al., 2018). The advantages of IT implementation are reducing the use of natural and human resources, reducing costs for storing goods, and responding to dynamic market demands quickly so companies can achieve a competitive advantage (Tarofder et al., 2017). Research states that IT adoption can impact the development of supply chain integration (Liu et al., 2016; Zhang et al., 2016; Yu et al., 2017). IT implemented in the company facilitates the distribution of goods and maintains communication, making it easier for both parties to carry out their respective roles optimally (Zhou et al., 2022).

**H<sub>4</sub>:** *IT adoption affects supply chain integration.*

#### *2.6.5. Relationship of IT adoption and green supply chain management*

As it grows over time, technology can effectively drive the advancement of green supply chain management (GSCM) (Jiang & Huo, 2020). Technology plays a vital role in providing a clear picture of activities for environmental sustainability and which parts need to be improved by the company (Silvestre et al., 2020). IT Adoption can evaluate various route models for distributing goods and run existing traffic simulations to find the best transportation route, saving time, cost, and energy that supports environmental sustainability (Sanjeev, 2019; Shaw, 2019). This energy saving can support GSCM practices to reduce emissions for environmental sustainability (Sinnandavar et al., 2019). IT Adoption can also reduce material waste and emissions and increase the possibility of recycling or reusing an item for efficiency (Meindl et al., 2021). Companies need the application of IT to realize customer needs for their environmental concern (Adusei et al., 2023). The application of this IT can provide various benefits, provide accurate information, and improve communication skills to increase trust (Sarkis et al., 2021).

**H<sub>5</sub>:** *IT adoption influences green supply chain management.*

#### *2.6.6. The relationship between IT adoption and operational performance*

Implementing IT is an essential decision for corporate strategy (Tarofder et al., 2017). The application of existing technology will have a good impact on the company. Applying this IT can tidy up existing systems, ensuring tremendous success for delivery by customer demand, which can improve operational performance (Sarkis et al., 2020). In addition, IT can also help identify the use of existing resources in which materials can be recycled (Meindl et al., 2021). It is also essential for customers because they are getting used to things that are network-based supply chains, such as real-time order tracking, e-invoice, and customer service that can bring competitive advantage and increase company efficiency to improve the operational performance of the company (Tarofder et al., 2017; Zhou et al., 2022). IT can facilitate organizations to get the latest information and more accessible communication between internal companies and external parties (suppliers) to jointly overcome crises and difficulties experienced (Verma & Bhattacharyya, 2017; Tortorella et al., 2020). All these facilities

can support the improvement of the company's operational performance because they can increase the efficiency and effectiveness of the company (Sarkis et al., 2020; Kaleli & Baygin, 2022). The application of IT can facilitate many things, such as fast and precise communication and the distribution of goods with real-time data to reduce high costs and increase operational performance (Tukamuhabwa et al., 2017; Schleper et al., 2021). Research from Zhou et al. (2022) can prove positive results in the relationship between IT Adoption and Operational Performance.

**H<sub>6</sub>:** *IT Adoption has a positive effect on operational performance.*

#### *2.6.7. Relationship between supply chain Integration and green supply chain management*

Supply chain integration within companies can help strengthen green supply chain practices (Hartono et al., 2023). The integration of this supply chain can regulate the flow of distribution of goods, both from suppliers to companies and companies to customers, so that carbon emissions can be reduced (Sinnandavar et al., 2018). In addition, companies can also manage goods and available resources so as not to waste resources that can pollute the environment (Gupta et al., 2022). Good management of goods is also vital, both raw materials so as not to cause residue, as well as after-life of finished goods, how to manage them, and how to recycle them (Dou et al., 2018). Companies can collaborate with supply chain entities to share information to produce environmentally friendly processes and products, ranging from the latest technology to various other innovations (Uddin, 2022; Novitasari & Tarigan, 2022). The company strives to perform well by focusing on the needs of customers who care about the environment (Adusei et al., 2023). The company's internal role and external partners can reduce pollution and sustainably contribute to the successful implementation of GSCM (Ardakani et al., 2023). Integrating supply chain and green supply chain management can be a good collaboration, influencing efficiency, leading to company profitability, and updating ways to improve the environment (Yang & Lin, 2020). Xi et al. (2023) research shows the positive influence of green management and supplier integration mediated by supply chain transformational leadership in China.

**H<sub>7</sub>:** *Supply chain integration impacts green supply chain management.*

#### *2.6.8. Relationship between supply chain integration and operational performance*

The application of supply chain integration can improve the company's ability to change the process to be automated with the help of adequate machinery and equipment in producing and distributing goods (Bae, 2017). The company's ability to use automated systems can be integrated with information technology systems, which will minimize errors and repetitive processes. The automation process in the company can reduce manual processes to be more efficient and shorter (Tarigan et al., 2021). Supply chain integration formed with suppliers can optimize the use of raw materials according to designation and reduce production waste to reduce company costs. Decreased company costs can improve operational performance (Truong et al., 2017). Transparent system integration can increase the speed of distribution of goods, reducing uncertainty in the supply chain series, which can result in reduced efficiency and harm the company's operational performance (Sinnandavar et al., 2018). Companies can implement a just-in-time system that can reduce costs for storage, reduce the possibility of late delivery of goods, and shorter customer lead times due to reduced uncertainty in the supply chain flow, resulting in improved operational performance (Wong et al., 2021). Bae's (2018) research with Korean companies in China shows that SCI produces better operational performance than before. The company's ability to manage supply chain integration well within and externally can impact the company's operational performance (Basana et al., 2024; Sinnandavar et al., 2018; Wong et al., 2021).

**H<sub>8</sub>:** *Supply Chain Integration Affects Operational Performance.*

#### *2.6.9. Green supply chain management and operational performance relationship*

Implementing GSCM will increase companies' efficiency and effectiveness through production, distribution, and recycling to attract customers who care about the environment (Adusei et al., 2023; Santoso et al., 2022). Implementing the company's GSCM can speed up the production process, reduce inventory, and speed up the goods reaching customers to improve the company's operational performance (Abdallah & Al-Ghwayeen, 2020). In addition, applying GSCM can result in savings due to a reduction in energy use (electricity, gasoline, gas) and a reduction in the remaining raw materials used in production (Agarwal et al., 2018). The operational performance produced by the company in implementing GSCM can provide more value than competitors and bring sustainability to the company (Sangwan & Choudhary, 2018). Research states that implementing GSCM in companies can produce operational performance (Yu et al., 2014; Famiyeh et al., 2018). Research in Ghana found that companies produce improved operational performance after adopting internal and external green supply chain management, even after COVID-19 (Enoch et al., 2023). Research by Agarwal et al. (2018) conducted in the United States on 121 respondents also found that the results of green supply chains positively influence operational performance.

**H<sub>9</sub>:** *Green supply chain management influences operational performance.*

Fig. 1 shows the research concept framework, which can be determined based on the introduction and explanation of the literature review.

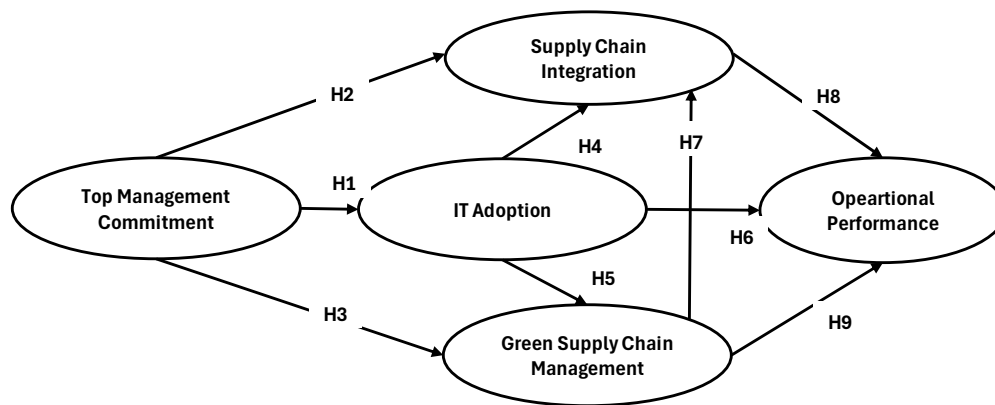


Fig. 1. Research concept framework

### 3. Research Methods

This type of research uses causal quantitative research, which aims to measure the magnitude of the influence of one variable on another variable. Quantitative research is research that uses numerical data and requires statistical analysis. This study aims to obtain the magnitude of the influence of top management commitment on operational performance through IT adoption, supply chain integration, and green supply chain management. This research has determined that top management commitment is the responsibility of company leaders to plan, evaluate, and control company achievements. The measurement items set by adopting Kitis & Chen (2021) are company leaders determining strategies that increase competitiveness (TMC1), determining priority scales in maintaining competitiveness (TMC2), providing comfort for employees (TMC3), taking the initiative to make continuous improvements (TMC4) and providing adequate training for employees (TMC5). IT adoption is the application of information technology in companies that can help them run their operations in an integrated manner to assist in decision-making (Zhou et al., 2022). The items set to measure IT adoption set from the research of Mand et al. (2022) are companies using official email from the company (ITA1), making purchases to suppliers online (ITA2), making payments using online transfers to suppliers (ITA3), making online sales to customers (ITA4), sending electronic invoices to customers (ITA5), using video conferencing in specific needs (ITA6), disseminate recruitment ads online (ITA7.1.), conduct an online recruitment selection process (ITA7.2.) and store internal data needed by companies with softfiles (ITA8). Supply chain integration is a flow of information or goods that are distributed properly and correctly in the company's internal and external in an integrated manner (Srinivasan & Swink, 2015; Swink & Schoenherr, 2015; Yu et al., 2019). The measurement items set for supply chain integration are that the company has a system that is connected to external partners in ordering products (SCIS1.1.), external partners can know the remaining stock of company goods (SCIS1.2.) directly, the company gets a stable supply of goods when using programs integrated with external partners (SCIS2.1.), external partners deliver goods on time (SCIS2.2.), external partners participate in the process the design of the materials they produce (SCIS3) and the company assists external partners in improving their systems or processes to meet the needs of the company (SCIS4).

Green supply chain management is a way for companies to carry out programs to overcome environmental problems due to company activities in the supply chain flow (Abdallah & Al-Ghwayeen, 2020). The measurement items used in GSCM variable measurement are adopted from Adusei et al. (2023), namely: the company conducts continuous program audits (GSCM1), monitors the progress of environmental systems within the company (GSCM2), the company ensures environmentally friendly product design (GSCM3), collaborates with suppliers to produce environmentally friendly products (GSCM4), monitors suppliers to ensure suppliers comply with environmentally friendly products (GSCM5), work with customers to produce environmentally friendly products (GSCM6) and work with customers to reduce activities that can damage nature (GSCM7). The last variable, operational performance, is an achievement the company produces using adequate resources at a particular time (Habib et al., 2022). The measurement items set in operational performance were adopted from the research of Truong et al. (2017). Namely, the company experienced a decrease in company costs (OP1), tried to reduce the length of product orders (OP2), reduced defective products (OP3), was able to maintain delivery accuracy (OP4), and was able to increase productivity (OP5).

Data collection is carried out by distributing questionnaires using Google Forms to respondents. The questionnaire was assigned a Likert scale in data collection with 1-5 (strongly disagree-strongly agree). This study uses a relationship model



to test the hypothesis that has been proposed using the SmartPLS software program because there are levels between related variables in its structure. This test is performed by evaluating the fit of the model. The criteria include testing the outer model as a measurement model, which connects all manifest variables or indicators with their latent variables. Second, testing the assessment of the inner or structural model is where all latent variables are connected.

#### 4. Research Data Analysis

Based on the results of the distribution of questionnaires given to manufacturing companies in Java, they have implemented information technology as part of the company's operational and administrative systems. Companies that have been determined as research samples by getting answers from a respondent from a manufacturing company implementing an environment-based quality management system, namely ISO 14000. The results of the questionnaire distribution were obtained with respondent profile data shown in Table 1.

**Table 1**  
Profile Respondent

Item profile	Description	Sum	Percentage
Gender	Man	32	43,8%
	Woman	41	56,2%
Working experience in the company	1 year < - ≤ 3 years	40	54,1%
	3 years < - ≤ 5 years	12	16,2%
	5 years < - ≤ 8 years	10	13,5%
	> 8 years	11	14,9%
Respondent Department	Staff	42	57,5%
	Supervisor	15	20,5%
	Manager	9	12,3%
	Director/CEO	7	9,6%
Company location by province	Jawa Timur	53	72,6%
	Jawa Tengah	10	13,7%
	West Java	5	6,8%
	South Kalimantan	2	2,7%
	North Sulawesi	1	1,4%
	Riau Islands	1	1,4%
	IN Yogyakarta	1	1,4%
	Company Type	Food & Beverage Industry	14
Plastic Industry		8	11,0%
Chemical Industry		7	9,6%
Metal & Machinery Industry		7	9,6%
Textile &; Apparel Industry		6	8,2%
Construction Industry		6	8,2%
Automotive Industry		5	6,8%
Paper Industry		4	5,5%
Industri Packaging		3	4,1%
Electronic Industry		2	2,7%
Home appliance industry		2	2,7%
Pharmaceutical Industry		1	1,4%
Bicycle Industry		1	1,4%
Roofing Industry		1	1,4%
Industri Furniture		1	1,4%
Industri Tissue		1	1,4%
Cigarette Sauce and Pallet Industry		1	1,4%
Wood Match Industry		1	1,4%
Cosmetic Industry		1	1,4%
Foam Industry		1	1,4%

Based on Table 1, it is generally obtained that many respondents are female, with a total of 41 respondents (56.2%), and most respondents have worked in companies for 1 to 3 years, with 40 respondents (54.1%). The position of the majority respondent was in a staff position of 42 respondents (57.5%). The location of the most respondent companies was in East Java, with 53 respondents (72.6%), with most cities being Surabaya, with 29 respondents (39.7%). Most respondent companies are in the Food & Beverage Industry, with 14 respondents (19.2%). All described data can be seen in Table 1.

Table 2 describes the respondents' questionnaire distribution results and the outer model testing.

**Table 2**  
Descriptive analysis of outer model research and testing

Research Items	Mean	Factor loading	Cronbach Alpha	Comp. Reliability	AVE
<b>Top Management Commitment (TMC)</b>	<b>3.8959</b>		0.800	0.802	0.555
The company determines the strategy to increase competitiveness (TMC1)	4.2192	0.728			
The company determines the priority scale of maintaining competitiveness (TMC2)	4.1781	0.768			
The company provides a sense of comfort for employees (TMC3)	3.6575	0.800			
The company took the initiative to make continuous improvements (TMC4)	3.8904	0.748			
The company provides adequate training for employees (TMC5).	3.5342	0.675			
<b>Information Technology Adoption (ITA)</b>	<b>4.1963</b>		0.887	0.898	0.532
The company uses an official email (ITA1)	4.0274	0.623			
The company makes purchases to suppliers online (ITA2)	4.2466	0.797			
The company makes payments using online transfers to suppliers (ITA3)	4.3288	0.798			
The company makes online sales to customers (ITA4)	4.2192	0.528			
The company sends an electronic invoice to the customer (ITA5)	4.2877	0.739			
Companies use video conferencing for specific needs (ITA6)	3.9726	0.644			
The company disseminates recruitment ads online (ITA7.1.)	4.1781	0.791			
The company conducts an online recruitment selection process (ITA7.2.)	4.0959	0.764			
The company stores the internal data needed with a soft file (ITA8).	4.4110	0.824			
<b>Supply chain integration (SCI)</b>	<b>3.6233</b>		0.799	0.817	0.504
The company has a system that connects with external partners when ordering products (SCIS1.1.)	3.9452	0.724			
External partners can find the remaining stock of company goods directly (SCIS1.2.)	3.4247	0.690			
Companies get a stable supply of goods using an integrated program (SCIS2.1.)	3.4384	0.830			
External partners deliver goods on time (SCIS2.2.)	3.7397	0.790			
External partners participate in the production material design process (SCIS3)	3.5890	0.635			
The company assists external partners in improving systems or processes (SCIS4)	3.6027	0.557			
<b>Green supply chain management (GSCM)</b>	<b>3.9746</b>		0.879	0.883	0.598
The Company conducts ongoing program audits (GSCM1)	4.1233	0.525			
The Company monitors the progress of the company's internal environmental system (GSCM2)	4.1918	0.575			
The company ensures eco-friendly product design (GSCM3).	3.9589	0.860			
The company collaborates with suppliers to produce environmentally friendly products (GSCM4)	3.9726	0.824			
The company monitors suppliers to ensure they comply with eco-friendly products (GSCM5)	3.9315	0.838			
The company collaborates with customers to produce environmentally friendly products (GSCM6)	3.8493	0.859			
The company works with customers to reduce activities that can damage nature (GSCM7)	3.7945	0.850			
<b>Operational Performance</b>	<b>4.0219</b>		0.746	0.753	0.502
The company has good sales growth (BP1)	3.8590	0.540			
The company has profit growth (BP2)	4.0822	0.741			
The company has reasonable customer satisfaction (BP3)	4.0411	0.691			
The company has increased customer loyalty (BP4)	4.2329	0.771			
Delivery of products to customers on time (BP5)	4.1644	0.773			

Based on Table 2, the average value for top management commitment is 3.8959, the average value of the lowest measurement items in the company providing adequate employee training is 3.5342, and the highest in the company determining strategies that increase competitiveness is 4.2192. This result shows that the top management commitment has good support for the programs carried out by the organization while still forming strategies in implementation and committed to providing employee training. The average value for information technology adoption was 4.1963. The lowest average value of items in companies using video conferencing for specific needs was 3.9726, and the highest in companies storing internal data needed with soft files was 4.4110, with an outstanding category. This value shows that the company has relied on information technology as an excellent operational and administrative system. The company has implemented information technology that employees can use to provide the data and reports needed jointly and integrated. The average value for supply chain integration is 3.6233, with the lowest average measurement items being at the point where external partners can find out directly the remaining stock of company goods, with a value of 3.4247. The highest average value is when the company has an integrated system with external partners ordering products, with a value of 3.9452. This means that most companies already have an integrated system with external partners to facilitate ordering materials the company needs for production. However, companies need to consider more efficiency to be able to have a system that can let external partners know the remaining stock of goods owned by the company so that it is expected that companies can quickly get the materials needed on time so that production can run smoothly.

Green supply chain management, the average value is 3.9746, with the lowest value of 3.7945 at the point of the company working with customers to reduce activities that can damage nature and the highest point of 4.1918 at the point of the company monitoring the progress of environmental systems in the companies internal. This means that most companies have tried to practice environmentally friendly activities to monitor and ensure these activities run well. Companies can also collaborate with customers to reduce production activities and use goods that can damage nature. Operational performance has an average value of 4.0219, with the lowest value being the company's points having good sales growth with 3.8590 points and the highest points of 4.2329 on companies having increased customer loyalty. This means that with

the practices carried out by customers, they can increase the number of loyal customers to the company. However, the increase in loyal customers may sometimes go in hand with increased sales growth. Table 2 shows the outer model test determined by conducting a validity test with the outer model value obtained the lowest value on top management commitment on company measurement items providing adequate training for employees by 0.675, information technology adoption on company items selling online to customers 0.528, supply chain integration on company measurement items assisting external partners in improving systems or processes as large as 0.557, Green Supply Chain Management on the company's measurement items held an ongoing program audit of 0.525 and operational performance on the company's measurement items had a good sales growth of 0.540. The validity test met the requirements, with all measurement items having loading factors exceeding 0.500. Reliability tests indicated Cronbach alpha and composite reliability values greater than 0.700, and the AVE (Average Variance Extracted) value is more significant than 0.500. The outer model meets the requirements for the analysis of the inner model. The inner processing model is shown in Figure 2 and Table 3.

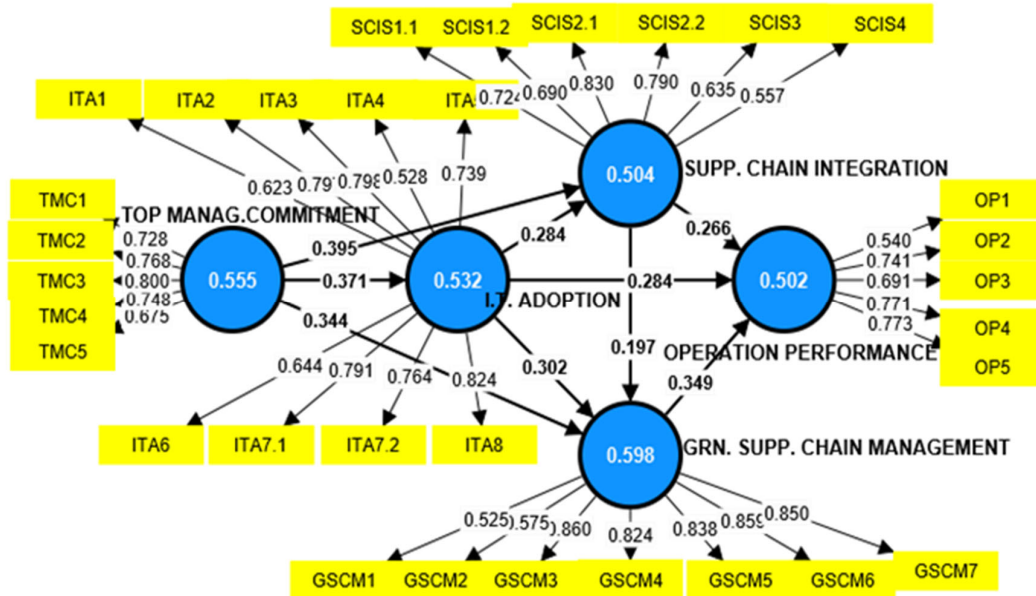


Fig. 2. Analysis results using the smartPLS Software

**Table 3**  
Results of hypotheses testing for direct influence

DIRECT PATH COEFFICIENT	Path Coeff.	T statistics	P values
Top Manag.Commitment → I.T. Adoption (H1)	0.371	3.654	0.000
Top Manag.Commitment → Supp. Chain Integration (H2)	0.395	3.435	0.001
Top Manag.Commitment → Grn. Supp. Chain Management (H3)	0.344	2.214	0.027
I.T. Adoption → Supp. Chain Integration (H4)	0.284	2.405	0.016
I.T. Adoption → Grn. Supp. Chain Management (H5)	0.302	1.963	0.050
I.T. Adoption → Operation Performance (H6)	0.284	2.235	0.025
Supp. Chain Integration → Grn. Supp. Chain Management (H7)	0.197	1.799	0.072
Supp. Chain Integration → Operation Performance (H8)	0.266	2.063	0.039
Grn. Supp. Chain Management → Operation Performance (H9)	0.349	2.374	0.018

Test the research hypothesis directly shown in Table 3. The first hypothesis established with top management commitment affects information technology adoption by 0.371 with t-statistics of 3.654 (>1.96), so the hypothesis is accepted. Top management's support in determining strategies that increase competitiveness and priority scale in maintaining competitiveness influences IT adoption by creating purchases of raw materials and supporting suppliers online. Companies make payments using online transfers to suppliers. The study's results support previous research, which states that top management commitment affects information technology adoption (Hiebl et al., 2017; Tarofder et al., 2017; Gangwar et al., 2014; Tarigan et al., 2020a). The second hypothesis, namely top management commitment, affects supply chain integration by 0.395 with t-statistics of 3.435 (>1.96), so the second hypothesis is accepted. Top management support in providing adequate training for employees and taking initiatives to make continuous improvements has an influence on supply chain integration by increasing systems that connect with external partners in ordering products and external partners participate in the design process of manufactured materials. The results confirm the results of previous studies that state that top management commitment affects supply chain integration ((Tarigan et al., 2021; Uddin, 2022; Siagian et al., 2023; Siagian et al., 2022; Kumar & Rahman, 2016; Agarwal et al., 2018; Truong et al., 2017). The third hypothesis, top management commitment, influence green supply chain management of 0.344 with t-statistics of 2.214 (>1.96), so the third hypothesis is accepted. Management's commitment to providing adequate training for capable employees and taking the

initiative to make continuous improvements improves the implementation of the green supply chain. Commitment from top management can carry out program audits on an ongoing basis and monitor the progress of environmental systems in the company's internals. This research supports the results of research which states that top management commitment affects increasing the implementation of green supply chain management (Yigitbasioglu, 2015; Tarigan et al., 2020b; Bukhari et al., 2022; Wisner et al., 2019; Sangwan & Choudhary, 2018; Kitis & Chen, 2021; Suryanto et al., 2018; Basana et al., 2022; Adusei et al., 2023; Kumar & Rahman, 2016; Suryanto et al., 2018; Carter et al., 2020; Gonzalez et al., 2022).

The company's ability to adopt information technology affects supply chain integration with a t-statistic value of 2.405 (>1.96), and it is stated that the fourth hypothesis is accepted. Information technology adoption positively and significantly affects supply chain integration by 0.284. Companies have widely used information technology applications in carrying out practical and operational activities by purchasing suppliers and selling online to customers, which can impact supply chain integration. Companies can provide an overview of the implementation of supply chain integration by having a system connected to external partners when ordering products. External partners can find the remaining stock of company goods online through the information technology system. This research follows the results of research that state information technology adoption influences increasing supply chain integration (Tu, 2018; Sarkis et al., 2020; Wamba et al., 2017; Sinnandavar et al., 2018; Tarofder et al., 2017; Liu et al., 2016; Zhang et al., 2016; Yu et al., 2017; Zhou et al., 2022). Information technology adoption owned by companies affects green supply chain management as the fifth hypothesis. The results of data processing found that the t-statistic value was 1.963 (>1.96), and it was stated that the fourth hypothesis was accepted. Information technology adoption influences increasing green supply chain management by 0.302. Information technology adoption in companies can be described by the company's ability to use official email in conducting administrative systems, sending electronic invoices to customers, storing internal data needed with soft files as a form of paperless operational activities, and reducing energy use, which can increase the green supply chain. The company's green supply chain can monitor suppliers to ensure suppliers comply with environmentally friendly products and monitor the progress of environmental systems within the company. The results of the study support the results of previous studies that stated that information technology adoption affects improving green supply chain management (Jiang & Huo, 2020; Silvestre et al., 2020; Sanjeev, 2019; Shaw, 2019; Sinnandavar et al., 2019; Meindl et al., 2021; Adusei et al., 2023; Sarkis et al., 2021). The sixth hypothesis, information technology adoption, affects operation performance with a t-statistic value of 2.235 (>1.96), and it is stated that the hypothesis is accepted. Adopting information technology owned by the company can improve operational performance by increasing customer satisfaction and delivering products on time. The results confirm previous research that states information technology adoption influences improving operation performance (Tarofder et al., 2017; Sarkis et al., 2020; Meindl et al., 2021; Zhou et al., 2022; Verma & Bhattacharyya, 2017; Tortorella et al., 2020; Tukamuhabwa et al., 2017; Schleper et al., 2021).

The seventh hypothesis determined by supply chain integration has an influence on the green supply chain with a t-statistic value of 1.799 (>1.65 significance level of 10%), and it is stated that the hypothesis is accepted. Supply chain integration running in companies with systems directly connected to external partners in product ordering activities and getting a stable supply of goods when using an integrated program increases green supply management. This condition impacts the company's ability to ensure environmentally friendly product design and work with suppliers to produce ecologically friendly products. The results of the study support previous researchers who stated that supply chain integration has a significant influence on the green supply chain (Hartono et al., 2023; Sinnandavar et al., 2018; Dou et al., 2018; Uddin, 2022; Novitasari & Tarigan, 2022; Adusei et al., 2023; Ardakani et al., 2023; Yang & Lin, 2020; Xi et al., 2023). Supply chain integration formed in the company can have an impact on operational performance with a t-statistic value of 2.063 (>1.96), and it is stated that the hypothesis is accepted. The company's ability to develop supply chain integration by obtaining a stable supply of goods when using an integrated program, external partners participating in improving the system, and the participation of external partners in the production design process has an impact on improving operational performance. Supply chain integration resulted in profit growth and increased sales growth. The results of the study confirm researchers who state supply chain integration influences operational performance (Bae, 2017; Tarigan et al., 2021; Truong et al., 2017; Sinnandavar et al., 2018; Wong et al., 2021; Basana et al., 2024).

Finally, the ninth hypothesis stipulates that green supply chain management influences operational performance, obtained with a t-statistic value of 2,374 (>1.96), and it is stated that the hypothesis is acceptable. The company implements the green supply chain by ensuring environmentally friendly product design, working with suppliers to produce environmentally friendly products, and monitoring the progress of environmental systems in the company's internal environment, which impacts operational performance. In improving operational performance by implementing a green supply chain, the company can increase customer loyalty, have reasonable customer satisfaction, and deliver products to customers on time. The results support the results of previous studies, which revealed that green supply chain management influences improving operational performance (Adusei et al., 2023; Santoso et al., 2022; Abdallah & Al-Ghwayeen, 2020; Agarwal et al., 2018; Sangwan & Choudhary, 2018; Yu et al., 2014; Famiyeh et al., 2018; Enoch et al., 2023). The resulting research contributes to developing a green implementation system theory to maintain sustainable developments in companies and sustainable performance. Practical contributions to research provide insight for managers and management to maintain adequate commitments. In addition, it provides practical implementation in maintaining green manufacturing in the company to reduce the use of energy and recycle products in maintaining sustainable performance.

## 5. Conclusion

The government provides regulations to make companies strive sustainably to produce products that are friendly to the environment. The company strives to use raw materials efficiently and save energy to provide added value for the company. An environmentally friendly company requires solid and consistent top management commitment. This research shows that top management commitment by providing adequate employee training and determining priority scales to maintain competitiveness can accelerate the adoption of information technology and improve supply chain integration and green supply chain. The manufacturing company strives to optimize the adoption of information technology by making purchases to suppliers online, making payments using online transfers to suppliers, and storing internal data needed with soft files affecting supply chain integration, green supply chain, and operational performance. Manufacturing companies that have been integrated internally and external partners as supply chain integration can produce green supply chain and operational performance with external partners can find out directly the remaining stock of company goods and participate in the design process of the materials they produce. The company's ability to conduct environmentally friendly program audits on an ongoing basis and ensure environmentally friendly product design as a form of green supply chain significantly impacts operational performance by increasing good sales growth, profit growth, customer satisfaction, and customer loyalty. Manufacturing companies always carry out economic processes but produce environmentally friendly products as a form of competitiveness.

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