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The Adoption of Green Practices in the Manufacturing Industry

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Abstract: The integration of green practices within the manufacturing sector holds significant importance since the manufacturing industry has contributed to the country's economic development. Any adverse environmental impacts stemming from this sector not only affect the ecosystem but also pose risks to human well-being. Green practices, designed to mitigate such impacts, strive to minimize environmental harm, conserve resources, and enhance production efficiency, all while prioritizing worker and public safety and health. Despite their potential benefits, the adoption of green practices remains relatively low among organizations. In addition, previous research has addressed aspects of green practices in other industries. This study uniquely focuses on identifying the key elements and success factors associated with the adoption of these practices in the manufacturing industry. Hence, this study aims to explore the various green practices prevalent in the manufacturing industry, clarifying their success factors and outcomes. Employing a qualitative content analysis approach, the research identifies key elements discussed in prior studies about green practices. Additionally, it investigates the factors influencing the adoption of these practices and their resultant effects. The analysis reveals three prominent categories of green practices: green manufacturing, green supply chain management, and green logistics. This conceptual study provides insight into the adoption of green practices in Malaysia, emphasizing the drivers behind successful adoption and examining their associated benefits.

Keywords: *Green Practices, Green Manufacturing, Green Supply Chain Management, Green Logistics, Manufacturing Industry*

1. Introduction

The industry's adoption of green practices has caught the attention of industry players. The elements of green activities in the industry have been extensively discussed, which has increased the interest of organizations in adopting green activities in their operations. The benefits of green practices to organizational performance, especially in terms of environmental, social, and economic aspects, are encouraging more organizations to explore the beauty of green practices. Studies have demonstrated the benefits that common green practices like green construction, green building, and green accounting bring to their respective industries. However, the discussion on green activity in the manufacturing industry has not been well explored, even though the manufacturing industry is synonymous with the growth of the economy of the country. Therefore, this paper explores the adoption of green practices in the manufacturing industry.

Green practices in the manufacturing industry have a significant impact on manufacturing performance. The study of Ramayah et al. (2013) on small and medium enterprises (SMEs) in developing countries has shown that the implementation of green practices in the input and production stages of the manufacturing life cycle has a significant impact on manufacturing performance. The application of various green practices in manufacturing, such as green manufacturing and green logistics, ensures optimal efficiency by improving various features such as durability, maintenance, reuse, refurbishment, and recycling (Umar et al., 2021). Conding et al. (2012) emphasized that incorporating green practices into sustainability efforts allows organizations to move beyond compliance to cost savings, competitive advantage, and improved profitability while optimizing environmental performance.

The manufacturing sector in Malaysia plays a crucial role in the country's overall development and economic growth. This industry also plays a crucial role in promoting sustainable economic growth and acts as a fundamental component of the economy (Jaeger & Upadhyay, 2020). The manufacturing industry accounted for 23.4 percent of the country's gross domestic product (GDP) in 2022. In July 2023, the Department of Statistics Malaysia (DOSM) released a report stating that the value of sales in the Manufacturing sector had

climbed by 5.1% from 2022, reaching RM741.2 billion by the end of May 2023. The substantial growth rate of the industry demonstrates its major contribution to the overall development of the country.

In 2025, the economic contribution of the manufacturing sector in Malaysia is expected to increase by 54% to RM 392 billion (Jamil et al., 2021). This forecast underscores the pivotal role of the manufacturing industry as one of the primary drivers of economic growth worldwide. Supported primarily by advanced technologies and efficient processes, the manufacturing sector significantly influences the development of the global economy and is poised to continue doing so in the years ahead (Ghadimi et al., 2020). Given that the manufacturing process entails converting inputs into outputs through various transformation processes (Heizer & Render, 2016), the selection of appropriate technologies and methods is crucial for enhancing productivity and averting potential issues.

The manufacturing industry's advancement and contributions have been pivotal to the country's development, driving significant economic growth. The expansion of this sector necessitates the integration of green practices, not only to sustain growth but also to effectively manage environmental impacts. Embracing green practices in manufacturing is essential for maintaining the balance between economic progress and the well-being of both the ecosystem and the population, ultimately supporting the country's long-term sustainable development.

The existing literature reveals a significant gap in research focused on green practices within the manufacturing industry, highlighting the necessity for more in-depth exploration of this critical area. As the manufacturing sector continues to be a driving force in economic growth, the integration of green practices is becoming increasingly essential. This paper aims to address the gap by thoroughly investigating the key green practices that are currently gaining traction in the industry.

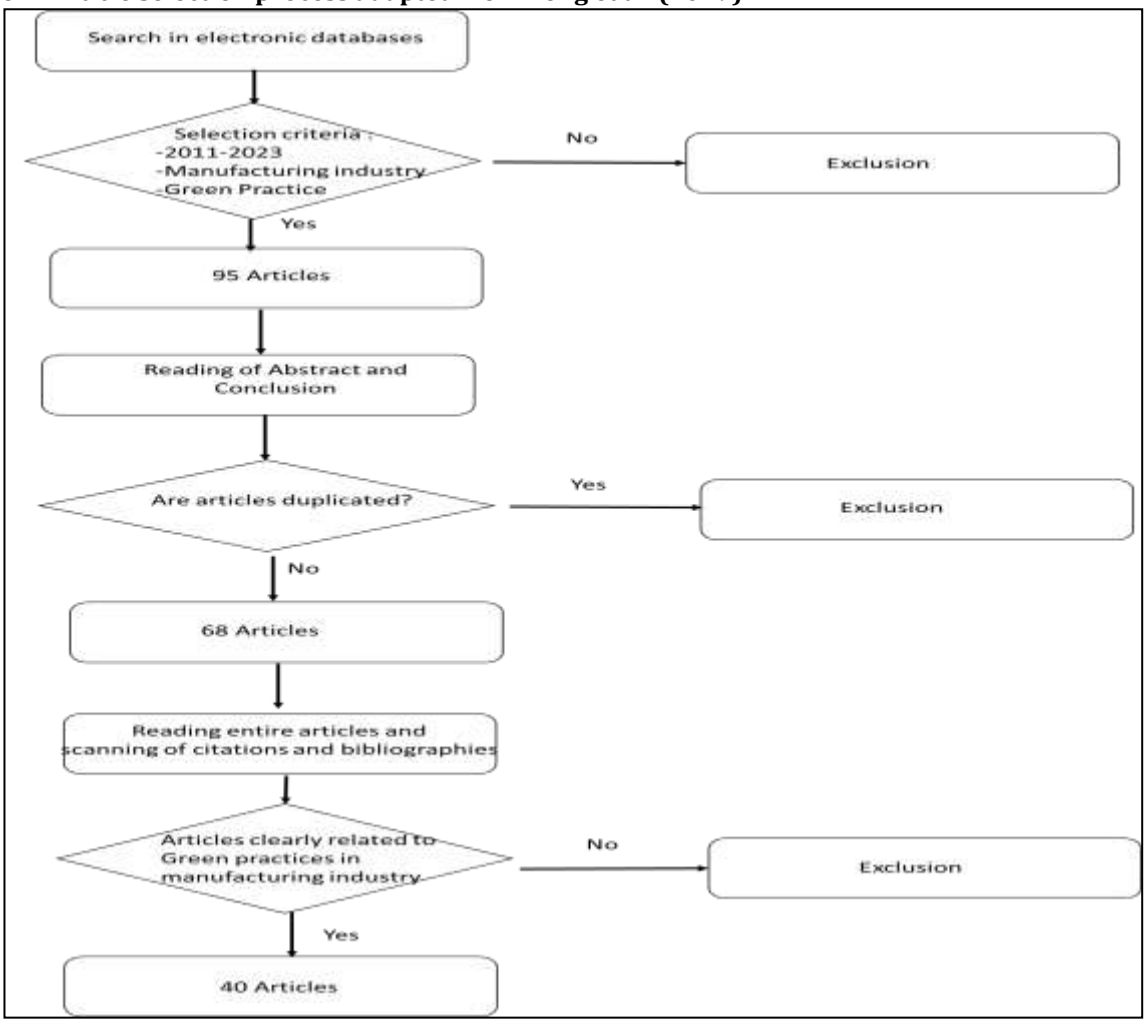
In addition to identifying these practices, the study explores the various factors that encourage their adoption. By analyzing these antecedents, the research seeks to provide a comprehensive understanding of what motivates manufacturing companies to implement green practices. **Through this investigation, the paper aims to deepen the understanding of the determinants that drive the adoption of green practices within the manufacturing industry, contributing to the broader discourse on green practices in the manufacturing industry.

This article is organized into several sections, as follows: Section 2 elaborates on the methodology utilized in this study, detailing the approach taken to gather and analyze data. Section 3 presents the core findings, focusing on the most prominent green practices observed within the manufacturing industry. Following this, the factors that drive the adoption of these green practices in the manufacturing sector are discussed. Subsequently, the tangible impacts of incorporating these practices into manufacturing operations are explained. Finally, the conclusion and suggestions for future research directions aim to contribute to the ongoing discourse on sustainability in the manufacturing sector.

2. Methodology

This paper utilized a categorization-based content analysis approach to examine a literature review, aiming to explore diverse perspectives on green practices. To ensure the discussion of the findings is reliable, the article selection approach adopted the techniques used by Yong et al. (2019), as shown in Figure 1. This study has established a range of publication dates for the journal articles between 2011 and 2023 to confirm the collected and reviewed information is current and relevant for exploration. This selection of articles from these years allows the study to focus on recent, relevant, and manageable literature that reflects current trends and developments in green practices. In addition, this study utilized multiple online databases, including prominent platforms like Emerald Insight, ScienceDirect, SpringerLink, Taylor & Francis, Wiley Online Library, and SAGE Publications. This database online was used based on the scope and coverage of the journal, which is known for its extensive coverage in a wide range of fields such as social science, humanities, and management. This research also employed Google Scholar to comprehensively identify current and relevant literature about green practices.

Figure 1: Article selection process adapted from Yong et al. (2019)



The first step of article selection started with searching for the article using specific keywords such as "green practices," "green practices in the manufacturing industry," "sustainable manufacturing," and "green manufacturing." All articles published in prominent academic journals between 2011 and 2023 were considered. The initial outcome had a total of 95 articles. The next process involved skimming the abstracts to assess the relevance of journal articles to green practices. To maintain a constant focus and minimize bias, articles that appeared unrelated to this study have been removed, including any duplicate publications, to avoid redundancy in the analysis. Based on the listed criteria, a total of 40 articles for review were selected, which led to the next phase of the analysis process to achieve the research objectives.

3. Findings

The adoption of green practices was one of the few sustainable manufacturing techniques that were presented in earlier studies (Wang et al., 2015). These practices addressed one or two aspects of sustainability. According to Wang et al. (2022), green practices are a method that is friendly to the environment and helps lessen the adverse effects that humans have on the ecosystem. Through the framework of the Green Technology Master Plan Malaysia 2017–2030, one of the execution techniques that enables manufacturers to reorganize value chain activities gradually is the implementation of green processes inside corporate operations. The green process may involve transitioning to more environmentally friendly production, cutting down on waste, recycling, reusing resources, and offering incentives to suppliers, partners, consumers, and staff to ensure that they follow a shared path.

Implementing green practices within the organization is voluntary and requires the commitment and cooperation of the organization's top management. Stakeholder pressure is another factor that aids an organization in implementing green practices. In particular, green or sustainable business practices that focus on three aspects of performance—namely, the environment, society, and the economy—have the potential to reflect an organization's performance and productivity, which includes safety. Green practices are designed to minimize the negative consequences that are caused to the environment, reduce the amount of resources that are consumed, and maximize the efficiency of production while simultaneously protecting the health and safety of both employees and the general public. Evidence suggests that businesses with environmentally responsible practices also tend to have better safety and overall performance. The study by Duric and Topler (2021) showed that environmentally friendly business practices help realize various value-adding benefits, including protecting workers' rights and the general public's well-being.

Green Practices in the Manufacturing Industry

Several green practices have been highlighted by past researchers. The dominant findings related to green practices in the manufacturing industry were identified in the areas of green manufacturing, green logistics, and green supply chains. Table 1 shows the green practices used in the manufacturing industry.

Table 1: Green Practices Elements in The Manufacturing Industry

No	Elements	Author(s)
1.	Green supply chain management practices, green Lean Six Sigma, and green balanced scorecard	Conding et al., (2012)
2.	Green Manufacturing	Ramayah et al., (2013)
3.	Green manufacturing, green warehousing, green packaging, and green distribution	Wang et al., (2013)
4.	Green Manufacturing	Sangwan and Choudhary, (2018)
5.	Green supply chain which includes green transport, green purchasing, green IT and reversed logistic	Dorantes et al. (2019)
6.	Green Manufacturing	Afum et al., (2020)
7.	Green supply chains include green design, green manufacturing, green logistics, reconditioning and core disposal	Sahar et al. (2020)
8.	Green manufacturing and green logistics	Umar et al., (2021)
9.	Green Manufacturing	Wang et al., (2022)

Three key green practices have been extensively studied, which include green manufacturing, green supply chain, and green logistics. What makes it even more interesting is that several green practices can stand independently, such as green logistics and green manufacturing (Umar et al., 2013; Afum et al., 2020; Ramayah et al., 2013). In addition, other researchers are investigating the inclusion of green logistics and green manufacturing in the field of green supply chain management practices (Sahar et al., 2020). In another perspective, a study by Dorantes et al. (2019) discovered various components of green supply chains from multiple perspectives. These components include green transportation, green purchasing, green information technology (IT), and reverse logistics. The upcoming exposition will cover the concept of green practices, their execution, and the benefits that result from their implementation.

Green Manufacturing

The term green manufacturing (GM) refers to a manufacturing approach that focuses on implementing efficient production processes characterized by reduced material consumption, streamlined processes, and the use of safe manufacturing practices. Following the Green Practices Guideline for Manufacturing Sector 2022, GM demonstrates an innovative manufacturing paradigm that incorporates various environmentally friendly techniques and strategies (including technological advances and innovations). These methods aim to increase operational efficiency by implementing practices that minimize negative environmental impacts, promote

productivity while reducing waste and pollution, and take a comprehensive approach to reduce the generation of harmful waste during the manufacturing process.

Other than that, GM attempts to conserve resources and energy, eliminate the utilization of hazardous materials, reduce waste, and strive to minimize environmental consequences across the entire life cycle of products (Sunmola et al., 2024). This statement is corroborated by Haleem et al. (2022), who conducted a study on green manufacturing, also known as green production. Furthermore, the adoption of green practices not only supports sustainable manufacturing methods but also improves worker, community, and product safety (Amornkitvikai et al., 2024). Therefore, green manufacturing concerns target not only environmental issues but also other areas that need improvement. The GM approach differs from traditional methods in its primary goals of reducing the use of natural resources and introducing energy- and material-efficient manufacturing processes as mentioned by Barzegar et al. (2018), the GM approach aims to minimize the negative impacts of waste and pollution, thereby reducing negative externalities.

Green manufacturing methods are one of the practices that are emerging as a solution to the constraints of industrialization (Ahmad et al., 2019). The concept of green manufacturing includes improving production processes as opposed to controlling technology, substituting finite resources with renewable resources, adopting recycling practices among employees, and strategic decision-making by companies regarding internal production or external procurement of the product (Maruthi & Rashmi, 2015). Organizations are increasingly adopting practices such as reuse, remanufacturing, and recycling of used items as part of their commitment to the environment and ecological responsibility. This is particularly evident among manufacturers of electrical appliances, as highlighted by Paul et al. (2014).

To broaden the visibility and accessibility of green manufacturing practices, Haleem et al. (2023) emphasized an extensive variety of strategies that are intended to cultivate a sustainable environment. These methods, as depicted in Figure 2, are designed to encourage environmentally favorable manufacturing operations and ensure that they are consistent with the industry's overall sustainability goals. The implementation of these strategies by organizations can make a substantial contribution to the global initiative to mitigate the environmental impact of industrial activities.

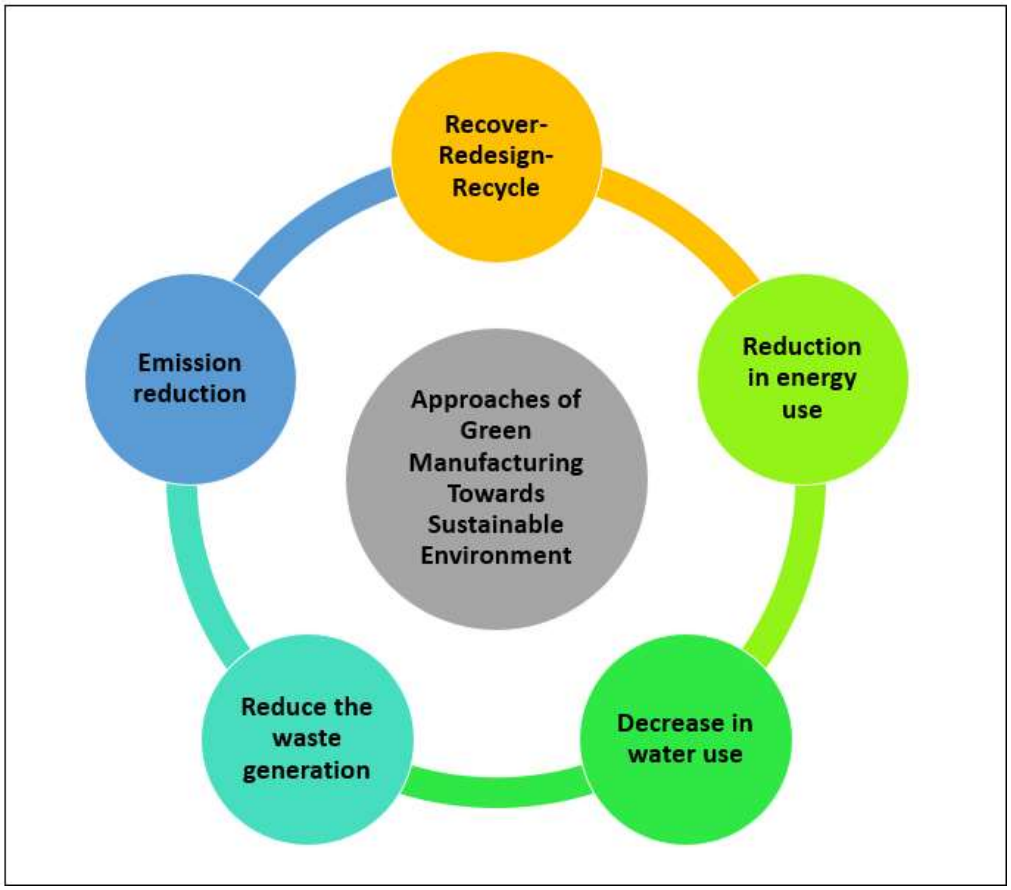
Smart and energy-efficient measures are among the most critical components of these green manufacturing techniques. These measures must be implemented not only to reduce the environmental impact of manufacturing processes but also to optimize resource utilization. For instance, the implementation of cutting-edge technologies that decrease energy consumption can result in substantial cost reductions while concurrently reducing greenhouse gas emissions, thereby aiding in the mitigation of climate change.

In addition to energy efficiency, these methods underscore the significance of minimizing water consumption in manufacturing processes. The conservation of water is indispensable for sustainable development, as it is a critical resource in numerous industrial processes. Water-saving technologies and practices can be implemented by manufacturers to reduce their reliance on this essential resource, minimize effluent generation, and safeguard local ecosystems.

Furthermore, the necessity to reduce waste generation during the production process is also addressed by green manufacturing techniques. Not only does waste reduction alleviate the burden on landfills and the environment, but it also improves the efficacy of manufacturing operations. To achieve more sustainable operations, manufacturers can substantially reduce the amount of waste produced by implementing practices such as recycling, repurposing materials, and optimizing production processes.

These green manufacturing techniques are also essential for reducing emissions. In addition to contributing to environmental degradation and global warming, the manufacturing sector is a substantial source of greenhouse gas emissions and air pollution. By instituting emission control technologies, improving process efficiency, and utilizing renewable energy sources, manufacturers can mitigate their environmental impact and aid in the development of a more sustainable and healthier future.

Figure 2: Approaches of Green Manufacturing Towards Sustainable Environment



The use of green manufacturing in businesses yields numerous benefits. One of the notable benefits of green manufacturing is the reduced consumption of materials and energy, which results in cost savings for the organization. At the same time, the implementation of green manufacturing practices allows the organization to effectively reuse and recycle the waste generated during the production process, using it as a source of energy that can subsequently be used in the production cycle.

Green Supply Chain Management

Green Supply Chain Management (GSCM) is described as educating partners about their green commitments throughout the supply chain, including suppliers, manufacturers, customers, and reverse logistics (Ye et al., 2023). Consequently, the implementation of GSCM is an expression of an organization's desire to work with various stakeholders to improve the environmental performance and sustainability of its supply chains (Toktas, 2021). According to Khan et al. (2019), implementing green supply chain practices can effectively improve organizational performance and provide a competitive advantage in the global market. The main objective of implementing a green supply chain is to effectively manage and contain waste materials within the manufacturing process, thereby minimizing waste generation, conserving energy resources, and preventing the release of pollutants into the environment (Bhool & Narwal, 2013).

Chatzoudes and Chatzoglou (2022) mentioned that the integration of environmentally friendly practices into the supply chain is influenced by a combination of internal factors, such as comparative advantage and entrepreneurial orientation, as well as external drivers, such as stakeholder pressure and customer demands. These findings suggest that both organizations and stakeholders, such as societies, can influence existing manufacturing practices, potentially facilitating changes toward more sustainable approaches. In addition, the findings by Hebaz et al. (2024) show that organizations are more likely to improve their efforts in GSCM if they

are under institutional pressure and also the successful implementation of GSCM depends on management commitment and support, especially in terms of regulatory compliance, which is recognized by many stakeholders (Sahar et al., 2020).

GSCM practices include a range of measures. In a study conducted by Ninlawan et al. (2010), four green activities were identified in the context of the green supply chain. These activities include green procurement, green manufacturing, and green distribution, which include specific components such as green packaging, green logistics, and reverse logistics. In the study by Çankaya and Sezen (2019), eight GSCM dimensions were identified. These dimensions include green purchasing, manufacturing, distribution, packaging, marketing, education, internal environmental management, and investment recovery. In the past, the study of GSCM was conducted as a single functional dimension. However, over the decade, activities for GSCM practices have expanded to include product design, material procurement and selection, manufacturing processes, product delivery, and product end-of-life management phases (Çankaya & Sezen, 2019).

Green Logistics

The concept of green logistics (GL) refers to the systematic assessment, examination, and eventual reduction of the environmental impacts associated with logistics operations (Blanco & Sheffi, 2017). GL received considerable attention within a specific timeframe, although it was integrated into the GSCM framework (Baah et al., 2020). GL involves incorporating sustainable practices into both forward and reverse logistics operations to achieve a well-rounded performance improvement, with a particular focus on social, environmental, and economic aspects. It is critical for managers to prioritize the implementation of GL to maintain their competitive advantage in the market, improve public safety, meet regulatory requirements, ensure customer satisfaction, and increase profitability (Agyabeng-Mensah & Tang, 2021). Not only that, a study by Maji et al. (2023) highlighted that GL techniques can enhance a business's reputation as an environmentally responsible brand and as a result, this leads to a rise in customers' loyalty, brand trust, and business profit.

The main goal of green logistics is to address the environmental impacts associated with the logistics process. This goal can be achieved through several strategies, such as optimizing routes, increasing transportation capacity, minimizing fuel consumption, and reducing emissions (Sahar et al., 2020). A recent study by Baah et al. (2020) examined a specific GL practice for small and medium logistics companies in Ghana. The study identified several key elements that have been implemented in GL activities, including the adoption of sustainable transportation methods, the use of reusable and recyclable materials, the incorporation of green materials for inner and outer packaging, the promotion of improved sharing of environmental information within the logistics network, and the establishment of monitoring and evaluation mechanisms for environmental policies and practices. In a study conducted in Ghana, Agyabeng-Mensah et al. (2020) found that the manufacturing, logistics, and entertainment sectors had comparable GL practices. In addition, these industries employed additional practices, including reverse logistics, the implementation of green reward systems and compensation, participation in green training for employees and stakeholders, and the use of green information processing and distribution.

The antecedents of green practices in the manufacturing industry

The implementation of green practices in the manufacturing industry can be associated with several factors. Since the manufacturing industry is known as an industry that contributes greatly to the numerous pollutions that lead to environmental degradation, organizations strive to identify the best methods to mitigate this issue. A study by Sunmola et al. (2024) identified a growing demand for manufacturers to integrate green practices into the various stages of product development and manufacturing to eliminate non-value-added activity in the manufacturing process, which leads to more efficiency and higher productivity. Together with the commitment and efforts of the top management, the adoption of green practices became effortless for organizations. The study by Lin and Sheu (2012) showed that organizational influence was particularly beneficial to the adoption of GSCM techniques, with institutional pressure influencing green supply chain practices that further enhance manufacturing performance. At the same time, competent authorities also play an important role in ensuring that environmental regulations are met. Although this study focused on three different green practices, it can be concluded that the antecedents for the practices were similar. Two main factors were identified, namely the environment and the employees who are responsible for implementing green practices in the organization.

Environmental forces

As mentioned earlier, the environmental problems caused by the manufacturing industry are the main reason for adopting green practices in the organization. This environmental problem causes shareholders to be concerned about the organization's image and performance, while stakeholders are concerned about their welfare. The manufacturing industry is facing increasing pressure from stakeholders due to the negative environmental impacts caused by the sector's activities over a long period (Kannan et al., 2022). Findings by Barzegar et al. (2018) have shown that the adoption of green practices in manufacturing systems within the organization was necessary due to the harmful environmental impacts associated with certain production methods. From different perspectives, the automotive industry in China is adopting a wide range of sustainable manufacturing methods, such as green manufacturing, due to pressure from the government, regulators, international customers, and stakeholders (Wang et al., 2015). Moreover, the use of green practices by companies can effectively mitigate their potential environmental pollution through the utilization of safe materials, recycling of disposable parts, and appropriate management of worn-down equipment (Wang et al., 2018).

The study by Singh and Singh (2024) in the Indian manufacturing industry identified several manufacturing companies in India that believe adopting environmentally friendly practices will enhance their business opportunities. By implementing sustainable practices and developing environmentally friendly products, these companies aim to adhere to demanding global environmental regulations and achieve a competitive advantage which is helping these Indian firms to broaden their operations into nations with rigid environmental laws. In response to stakeholders' environmental expectations and the imperative to ensure human safety, numerous organizations have integrated environmentally sustainable practices into their logistical operations, leading to the emergence of what is referred to as GL (Agyabeng-Mensah et al., 2020). Wang (2018) asserts that the logistics industry is actively adopting environmentally friendly measures to effectively address and mitigate environmental issues.

Employees' Concerns

Adopting green practices within the organization demands a comprehensive approach beyond addressing environmental issues. To optimize the advantages of these practices, it is essential to incorporate them into broader organizational initiatives, particularly those connected to employee involvement and productivity. By actively engaging workers in the production process, organizations may establish a work environment that is more inclusive and responsive. This not only improves productivity but also cultivates a sense of ownership and dedication among employees.

Engaging employees in green practices directly and positively affects the entire operation of the firm. When employees actively participate in environmentally sustainable practices, they are more prone to support these initiatives, resulting in improved efficiency and effectiveness in production processes. For example, when employees receive training on how to maximize resource utilization, minimize waste, and adhere to sustainable methods, they help to reduce operational inefficiencies and improve overall productivity. This engagement also fosters creativity at the operational level, where employees who have the most access to the manufacturing processes may provide practical insights and suggestions to enhance sustainability initiatives.

Moreover, the acknowledgment by management that the business can only accomplish its objectives by actively engaging its employees is a crucial element in the successful implementation of green practices. By recognizing the significance of employee involvement in sustainability initiatives, management establishes the foundation for a workforce that is more committed and enthusiastic. This acknowledgment serves to enhance the bond between management and staff, while also ensuring that the organization's environmental aims are in line with its operational goals. When employees see that they are appreciated and actively included in the organization, they are more inclined to demonstrate dedication to their achievements, resulting in enhanced performance and a more robust organizational culture.

The active involvement of management in encouraging green practices conveys a strong message that the organization appreciates its employees and is committed to establishing a safe, healthy, and sustainable work environment. The implementation of green practices in manufacturing ensures the safety and health of employees, as these practices effectively mitigate potential hazards in the production process. The study

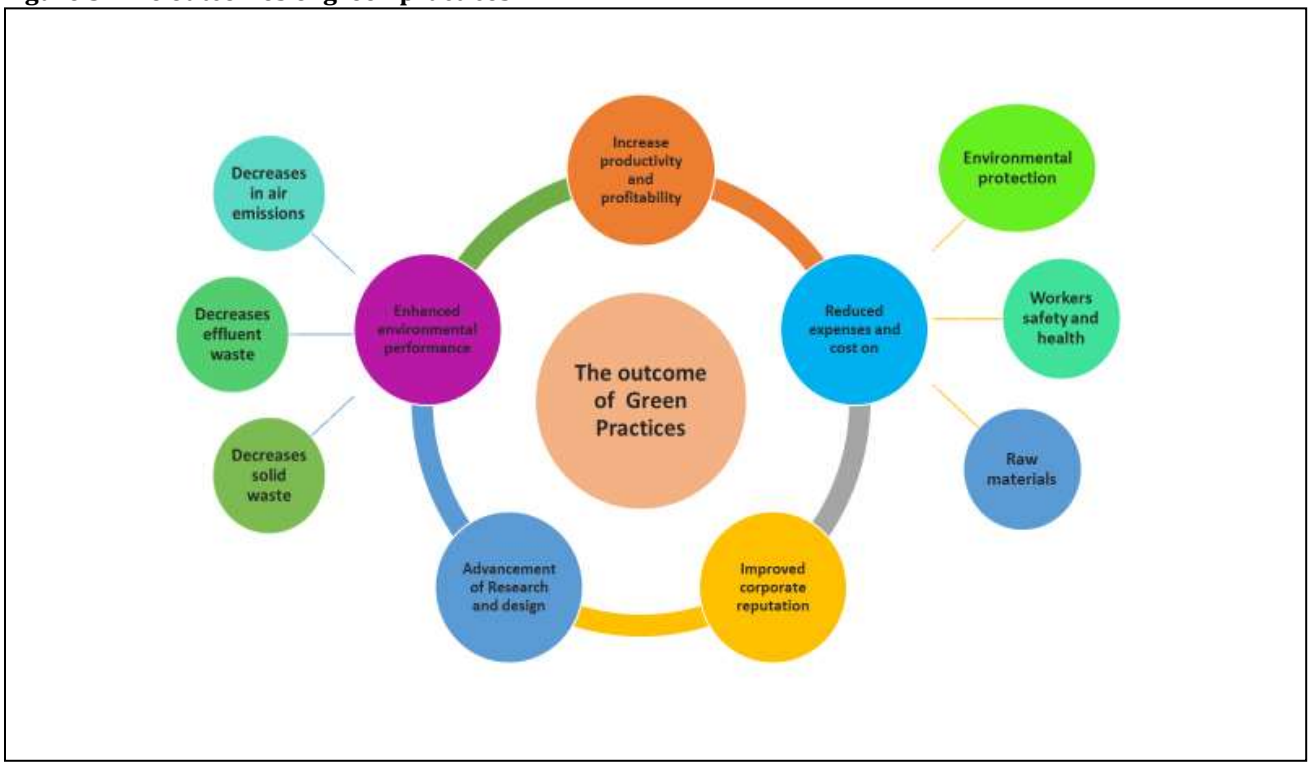
conducted by Barzegar et al. (2018) found that workers actively support the implementation of green practices in manufacturing systems within the organization. This is mainly due to the potential hazards that could arise for the health and safety of employees. This statement is also in line with the study by Jamil et al. (2021), which found that manufacturers tend to adopt green manufacturing practices due to their employees' reactions to the environment. Bhool and Narwal (2013) found that employee motivation, safety, and health play a critical role in the adoption of GSCM in the Indian two-wheeler manufacturing industry. This finding suggests that prioritizing employee safety can significantly improve the successful implementation of green practices in organizations, thereby promoting the progress of the industry.

Overall, the organization should view the adoption of green practices as a comprehensive approach that includes concern for environmental performance, active employee involvement, and top management's commitment to employee safety, well-being, and productivity improvement. The organization's sustainability and performance rely on management's unwavering dedication to these policies, which prioritize employee well-being and environmental impact.

The outcomes of green practices

Implementing green practices offers a wide range of benefits for both the organization and its surrounding environment. Previous research on green practices in the manufacturing industry has identified several positive outcomes, particularly in terms of sustainability, which encompasses environmental, economic, and social dimensions. Sezen and Cankaya (2013) highlighted that green practices significantly enhance both environmental and social performance. Building on this foundation, the present study delves into the specific advantages of adopting green practices within the manufacturing sector. The three green practices explored in this study share common benefits, including increased productivity and profitability, cost reduction, improved corporate reputation, advancements in research and development, and enhanced environmental performance. These benefits, as illustrated in Figure 3, underscore the substantial value that green practices bring to manufacturing operations, driving both organizational success and sustainable development.

Figure 3: The outcomes of green practices



The outcomes of green practices can increase the productivity and profitability of an organization. The application of green practices allows the organization to reduce unnecessary processes in manufacturing that do not add value to the production process. In a study by Atlas (1998), it is mentioned that the implementation of GM technology is associated with many benefits, such as increased production efficiency. These benefits include better organizational productivity in terms of financial gains and efficiency, as well as the ability to identify patterns in organizational growth (Sahar et al., 2020). Not only that, by implementing a green approach, firms have the potential to gain a competitive edge and enhance their profitability (Waqas et al., 2023). Therefore, profitability can be increased through organizational cost savings (Hasan et al., 2019).

Second, the expenses and costs associated with the manufacturing process are reduced when green practices are implemented. This occurs because of reduced material consumption in the production process and reduced environmental and safety expenditures (Atlas, 1998), as well as reuse or recycling. Similar benefits were also found by Al-Hakimi et al. (2022). The adoption of green manufacturing methods has the potential to yield several benefits, including reduced environmental and worker safety expenditures and lower raw material costs. Costs associated with worker safety, such as accident costs and insurance claims, can be reduced by adopting green practices. In addition, green practices can reduce product development costs and shorten the life cycle of a product (Paul et al., 2014). In the field of logistics, Hasan et al. (2019) mentioned that waste generation in logistics was reduced through green practices, and organizations were able to minimize operating costs through this reduction. The study on green supply chains by Ghadimi et al. (2020) also highlighted that adopting green practices resulted in cost savings in manufacturing and facilitated the establishment of a robust green supply chain within the organization's operations.

The implementation of green practices significantly enhances an organization's reputation and image, as demonstrated by Hakimi et al. (2022), and fosters positive public perceptions, as noted by Maruthi & Rashmi (2015). This improvement in reputation stems from the organization's visible commitment to environmental protection and public well-being, which resonates with increasingly eco-conscious consumers and stakeholders. However, the widespread adoption of green practices remains limited, primarily because the tangible benefits often take time to materialize. Despite this, organizations that do embrace green practices not only demonstrate environmental responsibility but also open the door to greater creativity in managing and mitigating environmental risks, as highlighted by Baah et al. (2021). Their research shows that the implementation of green production practices has a profound and favorable impact on both the firm's reputation and its environmental performance.

Moreover, integrating green practices into business operations serves as a catalyst for innovation in production and product development. When organizations strategically plan and execute green practices, they are more likely to invest in research and design initiatives that drive sustainable advancements. Maruthi & Rashmi (2015) emphasize that a well-thought-out strategy for production and product development not only enhances environmental performance but also spurs progress in research and design, leading to the creation of more sustainable products and processes. As a result, organizations that effectively implement green practices position themselves as industry leaders in sustainability, gaining a competitive advantage and fostering long-term growth in a market.

Last but not least, the benefit of green practices is improved environmental performance (Maji et al., and Sahar et al., 2020). The adoption of green techniques is expected to lead to improved environmental performance, as evidenced by reductions in air emissions, effluents, solid wastes, and the use of harmful materials (Green et al., 2012). A study in Indonesian SME manufacturing companies by Dzikriansyah et al. (2023) highlighted companies that adopting green supply chain management would be able to improve environmental performance through government regulations as an external factor. Not only that, Manufacturers in Bangladesh engage in partnerships with suppliers and customers to develop environmentally friendly products, thereby improving environmental performance and reducing pollution. In addition, the manufacturers also engage in partnerships with downstream stakeholders to enhance their environmental performance in distributing their products (Al-Karim et al., 2024).

In summary, the adoption of green practices significantly enhances production efficiency, profitability, corporate reputation, and environmental performance. By streamlining production processes and reducing

operational costs, these practices provide companies with a competitive edge in the marketplace. Moreover, green practices foster a culture of environmental innovation and creativity, further elevating an organization's public image and reputation. Reducing emissions, waste, and the use of toxic materials not only improves environmental performance but also aligns companies with global sustainability goals and regulatory standards. By integrating green practices into their operations, companies demonstrate a strong commitment to environmental stewardship, positioning themselves for sustained success in an increasingly eco-conscious world.

5. Conclusion

After thoroughly examining existing research on green practices within the manufacturing industry, it is evident that three key practices stand out as the most widely implemented: green manufacturing, green supply chain management, and green logistics. Many organizations have integrated these practices into their strategies, directly enhancing productivity and profitability. Green manufacturing, for instance, focuses on minimizing waste, optimizing energy use, and incorporating sustainable materials, all of which lead to a more efficient production process. Beyond the manufacturing activities, green supply chain management maintains sustainability throughout the entire supply chain, from sourcing raw materials to delivering finished products. Green logistics further complements these practices by streamlining transportation and distribution processes, reducing fuel consumption, and lowering carbon emissions. Collectively, these initiatives not only contribute to cost savings and increased efficiency but also play a crucial role in improving environmental performance.

The increasing adoption of these environmentally friendly practices indicates that organizations are becoming more aware of the significance of environmental sustainability and this situation attracts the interest of consumers, investors, and other interested parties. Furthermore, these practices prioritize employee safety and health by creating a cleaner and safer working environment. This dual focus on environmental and employee well-being helps to build a positive corporate image and strengthens the organization's reputation in the marketplace. Companies that successfully integrate green practices often enjoy increased customer loyalty, enhanced brand value, and a competitive edge in their industry.

Incorporating green practices is not just a matter of environmental responsibility; it is also a strategic move that supports the broader pillars of sustainability—environmental, social, and economic. By aligning their operations with these pillars, organizations can achieve long-term success and resilience in an increasingly sustainability-conscious world. This study underscores the significant potential of green practices to enhance organizational performance, driving growth while simultaneously addressing critical sustainability challenges. However, the limitations of this research should be acknowledged, especially its reliance on content analysis, which could restrict the generalizability of these findings in various contexts. Future research should aim to address these limitations by exploring the levels of acceptance and challenges that organizations encounter when adopting green practices in the manufacturing sector. Additionally, there is a need for more nuanced investigations into the various sub-sectors within Malaysia's manufacturing industry, each of which may present unique challenges and opportunities related to green practices. Understanding these sector-specific dynamics enables future studies to provide more targeted recommendations and uncover additional benefits that green practices may offer to different areas of the manufacturing industry.

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