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Green supply chain integration and environmental performance in Vietnam agricultural industry

Thi Thu Thuy Nguyen[a], Dinh Toan Nguyen[b*], Thi Thu Hien Phan[c], Tuan Anh Luong[d], Thi Huong Linh Nghiem[e] and Thi Diep Uyen Doan[f]

[a]*School of Economics and Management, Hanoi University of Science and Technology, Vietnam*
[b]*Faculty of Marketing - National Economics University, Vietnam*
[c]*Faculty of Accounting & Auditing, Foreign Trade University, Vietnam*
[d]*East Asia University of Technology, Vietnam*
[e]*Foreign Trade University, Vietnam*
[f]*University of Economics - Technology for Industries, Vietnam*

A B S T R A C T

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Environmental problems are always a burning problem all over the world. In recent years, the understanding of the impact of green supply chain integration (GCSI) on the performance of enterprises in all aspects has developed rapidly, and they are particularly interested in the environmental performance of enterprises. me. Therefore, this study wishes to clarify the impacts of GCSI on the environmental performance (EP) of Vietnam's agricultural sector, specifically rice, coffee and rubber producers in Vietnam through five mediate variables include investment cycle, green process innovation, green product innovation, green purchasing and green cooperation with customers. Using the PLS - SEM method, the study analyzed and evaluated based on survey data collected from 863 enterprises including rice, coffee and rubber producers in Vietnam. Research shows that GSCI can help companies increase their environmental performance to match the trend of the times and international integration through the five mediate variables mentioned above. In addition, multi-group analysis shows that there are differences in the impact of mediating factors on the environmental performance of enterprises. Finally, the moderate analysis shows that both firm size and the proportion of exported products play a role in moderating the impact of GSCI on EP.

1. Introduction

In the current context, trade between countries is becoming easier and easier, so international trade has also become indispensable. At that time, developing economies countries are directly affected both positively and negatively by world economy factors. Along with the world integration, businesses, in addition to paying attention to financial issues, must also consider environmental issues in order to gain a competitive advantage (CA) in a market that is extremely exciting as it is now (Vasileiou & Morris, 2006). To have CA in the market and achieve environmental performance, the integration of green supply chain (GSCI) (Afum et al., 2020; Chee et al., 2020) inside and outside the enterprise is an extremely urgent thing. However, solving the problem of the relationship between GSCI and environmental performance (EP) of an enterprise is always a difficult thing and always needs research to find a reasonable answer. Today, organizations and businesses are constantly striving to achieve fast growth, continuous improvement, preparation for the future and global integration. Businesses increasingly must rethink their supply chains to face environmental challenges such as global environmental regulations, green consumerism and climate change. Changing to match the global trend is an urgent matter that consumes a lot of time and money of businesses. Therefore, from the very beginning, it is extremely important to learn and apply GSCI

* Corresponding author Tel.: 0983 100 668
E-mail address nguyendinhtoan@neu.edu.vn (D.T. Nguyen)

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so that enterprises can achieve the best environmental performance in the future. Existing studies have shown that good adoption of GSCI is becoming indispensable for achieving environmental sustainability in organizational networks (Vachon & Klassen, 2006).

Conducting green innovation to reduce negative impacts on the natural environment is considered an important source of CA (Dangelico, 2017). Existing literature suggests that both institutional and market pressures have forced companies to attempt green innovation (Chen, 2018). Green Supply Chain Management (GSCM), as an environment-focused strategy, has been the subject of much research interest (Zhu & Sarkis, 2004). It can only be used appropriately if everyone in the organization collaborates as each link in the chain. While many companies still believe that passive environmental strategies are sufficient, it is essential for them to move beyond this belief and take a proactive environmental stance across the supply chain to create a healthy environment. Jung (2018) concluded that a business with a sustainability perspective achieves a brighter future by pursuing sustainability goals as it improves relationships with stakeholders leading to reduced conflict costs and higher employee productivity. Therefore, managers should consider sustainable practices as the competitive strength of the company to deliver future profits because long-term sustainable income depends on economic, environmental and social systems (Ait Sidhoum & Serra, 2018).

At the present time, there are many studies on the relationship between GSCI and environmental performance of enterprises. Adding a “green” idea to the manufacturing supply chain involves adopting a different worldview where both environmental and supply chain activities are taken care of at the same time to make the world greener. Christmann (2000) reported that organizations are increasingly considering the natural environment as the main source of CA. Scholars also argued that companies can create added value through efficient use of their resources (Darnall & Edwards 2006). Based on a meta-analysis of studies focusing on the relationship between environmental responsiveness and corporate financial performance, Orlitzky (2003) also concluded that environmental responsiveness tends to be related to better financial performance. In general, previous studies have not clearly shown whether GSCI directly or indirectly affects the EP of enterprises or both, and the indirect influence is what the mediating factors are. Therefore, this study will help to clarify the relationship between GSCI and EP of enterprises.

This research is based on innovation theory, lean management theory; information processing theory to clarify the purpose and role of applying green supply chain (Dai et al., 2015) integration in supply chain management activities of enterprises; Based on the theory of resources and the theory of sustainable development to clarify the impact of the application of green supply chain integration in an enterprise on the formation of competitive advantages that help businesses develop sustainable development as well as improve business performance, especially environmental performance.

Vietnam is a socialist-oriented country with an emerging economy in Asia. With unremitting efforts along with the correct policies of the State, Vietnam is gradually affirming its role and economic strength on the world economic map. Vietnam is also known as a country with a good record of trade surplus. Many Vietnamese products have continuously penetrated into major markets in the world with large export turnover and been positively received. Especially not to mention agricultural products. In recent years, agriculture has increasingly asserted its position as the backbone of the economy, having a strategic position in the cause of industrialization and modernization of the country. Large agricultural export enterprises have been well implementing strict regulations on the quality, design, ... of agricultural products to be able to integrate with the world economy. And in order to meet the environmental requirements during the integration process, these large organizations are always interested in GSCI issues in enterprises. However, besides that, the majority of small and medium enterprises in Vietnam today are not doing well or even applying "green" criteria to their supply chains.

Realizing that Vietnamese agricultural products are products that many major countries are interested in, especially three products of rice, coffee and rubber. Meanwhile, the application of GSCI in agricultural production enterprises is still limited. Theoretically, there are very few studies on GSCI issues within enterprises; The influence of GSCI on environmental performance of enterprises through specific mediate variables has not been analyzed. In addition, previous studies have not detailed the agricultural production in Vietnam.

Starting from the theoretical and practical bases mentioned above, the research team focused on studying the influence of GSCI in rice, coffee and rubber production enterprises. The reason we focus on researching these three products is because they are the main products of the agricultural production industry. In addition, rice, coffee, and rubber are also major contributors to the GDP of Vietnam's economy in general and the agricultural product industry in particular. It can be said that these three items greatly affect the economic development of Vietnam, so when GSCI is applied, they will bring about significant changes.

2. Literature review and hypotheses

2.1. Green Supply Chain Integration (GSCI)

Green supply chain integration (GSCI) can be defined as the extent to which a manufacturer builds strategic relationships with its supply chain partners to integrate environmental concerns into internal and inter-organizational processes (Lo et al., 2018). It is an issue that is attracting the attention of many scholars around the world. These studies demonstrate the importance of applying the SCI philosophy to GSCM (Wong et al., 2015). However, much time is needed for scholars to

reach a consensus on how GSCI should be based on SCI and how this integrated approach to GSCM affects performance. The main problem of the existing research on GSCI is the incomplete concept of GSCI. Although scholars often base GSCI definitions and dimensions on SCI (Song et al., 2017), they classify GSCI as green supplier integration (GSI), green customer integration (GCI) and green internal integration (GII), the way they conceptualize GSI, GCI and GII is quite different. Some studies treat each dimension of GSCI as a unidimensional structure (Lo et al., 2018), others operate GSI, GCI and GII as a quadratic structure (Wong et al., 2018). Some studies limit supplier participation in green activities upstream and limit customer participation in green activities downstream (Yu et al., 2014), some studies highlight the importance of involving supply chain partners in all green processes (Wong et al., 2018). In fact, SCI uses three components to highlight strategic collaboration among supply chain partners at multiple levels: information sharing, process coordination, and strategic alignment (Wong et al., 2011). Based on the research team's understanding, there are no existing studies on GSCI that combine all three ingredients. Wong et al. (2018) are the first attempts to capture the essence of SCI. However, they overlook the most important ingredient: strategic alignment.

The resource-based view proposes that competitiveness can only be achieved through the cooperation of inter-organizational activities. To compete in the global world, relying solely on internal sources is not enough as the level of risk faced by firms has increased (Pfeffer & Salancik, 2003). Many environmental problems are not caused by a manufacturer's internal operations but are related to its upstream and downstream supply chains (Lai et al., 2013). To reduce environmental pollution and establish an environmental image, manufacturers must actively cooperate with their suppliers and customers to implement GSCI.

2.2. Direct impact of green supply chain integration on environmental performance

Environmental performance is one of the aspects of an enterprise's operational performance. Environmental performance refers to reducing pollution and saving energy (Geng et al., 2017). An increasing number of studies document a positive relationship between internal environmental management and environmental performance (Geng et al., 2017). Several studies have reported that the environmental cooperation of suppliers and customers affects the environmental performance of enterprises (Fang & Zhang, 2018). Some companies have changed their management behavior towards green supply chains by introducing environmental assessment and certification standards as ISO 14001 and SA 8000, as well as giving support their suppliers for the environment (Wu et al., 2012; Han & Huo, 2020) and promotion of environmental cooperation (Caniato et al., 2012). Past research has also addressed a potential relationship between a company's friendly environment and its internal capabilities; this implies that basic competencies must be available before organizations can develop any superior green management capabilities that can significantly impact their environmental performance (Christmann, 2000). However, if a company lacks any basic competencies, it will inevitably fail, as its environmental performance will only cost money.

In fact, businesses may face many environmental risks associated with their supply chains (Handfield et al., 2005). Environmental issues are also considered a major threat to a company's bottom line because managing the environment requires huge investments in technology. Hillman and Keim (2001) argued that investing in socially and environmentally responsible initiatives will not create any additional value for the company. At the same time, there are still researchers who view pollution control initiatives as a waste of resources and resources. And many other researchers also argued that companies were often forced to adopt environmental practices, even though such activities can have an uncertain or even negative impact on their performance (Winn, 2012). These conflicting results may be the result of an increased focus on end-of-cycle pollution control, rather than adopting proactive sustainability initiatives focused on pollution prevention. And as analyzed above, passive environmental strategies are not enough, organizations must have proactive views on the environment throughout the supply chain to achieve high performance in all aspects of development.

Despite the fact that both positive and negative signals are reflected, the application of green supply chain integration is still an inevitable trend in the management as well as improving operational performance and environmental performance. When applied GSCI will initially motivate employees in the enterprise to raise their awareness of the environment, thereby creating a green operating philosophy in the enterprise. This philosophy of the business will spread to customers and suppliers. This process will help businesses form and maintain a green philosophy throughout the supply chain, thereby creating competitive advantages and having a positive impact on the environmental performance of the business (Shah & Bahadur, 2021). From there, the study hypothesizes:

Hypothesis H_1: *Green supply chain integration has a positive impact on environmental performance.*

2.3. Indirect impact of green supply chain integration on environmental performance through mediate variables: investment cycle, green process innovation, green product innovation, green purchasing and customers green cooperation

Not only direct impact, GSCI also indirectly affects the environmental performance of enterprises through mediate variables.

The mediate variables mentioned are the competitive advantages owned by the enterprise. A firm's competitive advantage can be defined as anything a business can do really well relative to its competitors (Phan et al. 2020). That is, when a business can do or own something that competitors cannot do, cannot have even if they want to, it is considered a competitive advantage of the business. The study hypothesizes that: GSCI not only helps businesses achieve green-oriented goals in their

operating philosophy, thereby promoting environmental protection, but also creates benefits for businesses as investment cycle, green process innovation, green product innovation, green purchasing, customer green cooperation.

Managers are increasingly interested in recovering capital and profiting from the effective disposal of scrap, redundant and obsolete materials, waste and assets generated in the company (Vijayvargy, 2017). In recent years, the problem of disposal has become more complex and important as companies are faced with increasingly stringent environmental laws and increasing disposal costs. The focus on the entire supply chain means that managers must find return cycles to recover their original materials investment through remanufacturing, repair, reconfiguration, and remanufacturing. Recycling. The investment cycle requires attention to environmental issues and regulations and the ability to identify opportunities for revenue recovery or cost reduction. Such investment recirculation related activities have the potential to improve the revenue of manufacturers (Zhu et al., 2008). Resource utilization and waste reduction are strongly influenced by the active and influential role of integration held among all stakeholders (Salem, 2018). A similar conclusion was reached by Green et al. (2012) on whether investment recirculation is positively associated with economic performance. Therefore, our study will extend the previous work of Chiou et al. (2011) to clarify the link between green activities within the organization and the company's performance through investment recirculation - a factor that helps improve the corporate profitability. Thereby, we hypothesize:

Hypothesis H_2: *Green supply chain integration has a positive impact on the investment cycle.*

Hypothesis H_7: *Investment cycle has a positive impact on environmental performance.*

Green product innovation uses cleaner product materials and technology to (re)design products and packaging (Huang & Li, 2017). Green process innovation uses green sourcing, manufacturing and logistics technologies (Agyabeng-Mensah et al., 2020) without changing product design (Christmann, 2000). Early evidence suggests that both process innovation and green products can promote CA (Chen et al., 2006), but a recent study shows the underperformance of green process innovation (Chang, 2011). Therefore, the EP of green products and process innovation may be different. Both green product and process innovation have been shown to have a positive association with business performance and the environment (Liu et al., 2018), but green product design does not improve environmental performance in China (Zhu et al., 2007). Green process innovation (i.e. green manufacturing) has been shown to benefit both financial and non-financial operations, but does not achieve a cost advantage if a company simply adopts these methods (Liu et al., 2018). There are several reasons why the performance benefits of green products and process innovation might differ. First, green innovation may not reduce costs because it involves costs of environmental compliance (Christmann 2000) and technology (Zhu & Sarkis 2004). Second, green product and process innovation can generate different cost and price benefits. Green process innovation reduces costs by promoting efficient use of resources, while green product innovation generates profits through selling green products at favorable prices (Christmann 2000). Third, any innovation involves uncertainty about the outcome; very few companies have the right ability to increase the success rate. Wu (2013) argues that GSCI is an important capability for green product and process innovation, and points out that three aspects of GSCI (GII, GSI, GCI) positively impact both products and processes innovation. Thereby, we hypothesize:

Hypothesis H_3: *Green supply chain integration has a positive impact on green process innovation.*

Hypothesis H_4: *Green supply chain integration has a positive impact on green product innovation*.

Hypothesis H_8: *Green process innovation has a positive impact on environmental performance.*

Hypothesis H_9: *Green product innovation has a positive impact on environmental performance.*

Preuss (2002) observed that purchasing is placed at the starting point of material flow within an organization. Therefore, purchasing can be used as a screener for incoming materials to promote green products and a company's sustainability activities. Green purchasing mainly involves controlling the environmental performance of suppliers (Eltayeb et al., 2011). Quayle (2002) argued that proactive commitment between suppliers on a long-term basis creates a win-win philosophy for continuous improvement. Solving the common problem of improving the environmental image makes manufacturers and suppliers more familiar with each other, which helps manufacturers coordinate purchasing processes. Therefore, green integration with suppliers can motivate manufacturers to cooperate with suppliers to improve green purchasing practices (Zhu and Sarkis, 2007). Suppliers will be selected using environmental criteria, such as ISO 14001 certification, and manufacturers will become more active in carrying out environmental assessments of their internal operations suppliers and evaluating tier two supplier environmental management practices (Blome et al., 2014). For example, maintaining close contact with customers helps manufacturers better understand and meet customer requirements for green management, and so manufacturers can better design green purchasing processes (Flynn et al., 2010). Through the planning process that is synchronized with the customer in production and delivery, green purchasing is more likely to be realized as it must fully take into account the customer requirements. In addition, in order to better meet customer requirements, manufacturers will also actively seek the support of suppliers, thus promoting cooperation between manufacturers and suppliers to establish consistent environmental goals (Yang et al., 2010). By integrating sustainability goals into procurement practices, green procurement plays an important role in the success of manufacturers' environmental strategies (Blome et al., 2014). With increasing environmental awareness, the demand for environmentally friendly products is increasing (Chiou et al., 2011).

Thus, green purchasing can not only enhance the value of products but also help manufacturers establish a good image of the environment (Zhu & Sarkis, 2007). Green integration with customers can help manufacturers use less hazardous materials and optimize production processes, facilitating green purchasing practices (Vachon & Klassen, 2007). Customer integration is beneficial for the collaborative implementation of cleaner production, green packaging, and product recycling in the upstream supply chain (Zhu & Sarkis, 2007). For example, maintaining close contact with customers helps manufacturers better understand and meet customer requirements for green management, and so manufacturers can better design green purchasing processes (Flynn et al., 2010). Thereby, we hypothesize:

Hypothesis H_5: *Green supply chain integration has a positive impact on green purchasing.*

Hypothesis H_{10}: *Green purchasing has a positive impact on environmental performance.*

Green purchasing and green cooperation with customers have been considered the two main GSCM practices (Hwang et al., 2010). Green integration with suppliers can effectively ensure that suppliers deliver environmentally friendly products of high quality and consistency, which can significantly improve customer satisfaction, allowing them to cooperate more actively with manufacturers in achieving environmental goals (Zhu et al., 2005). Manufacturers are also willing to increase investment in pollution prevention in the downstream supply chain, thereby enhancing green cooperation with customers (Vachon & Klassen, 2007). As a result, supplier quality integration encourages manufacturers to develop a detailed and written environmental policy and planning in supply chain management (e.g. the recycled content of bags, packaging, and solvent emissions), facilitating green customer collaboration (Blome et al., 2014). Thus, green integration with suppliers forms the basis for achieving collaborative solutions to reduce the environmental impact of material flows with customers (Yang et al., 2010). Manufacturers are willing to share their own knowledge and co-develop green management strategies with customers (Flynn et al., 2010). Involving customers in quality improvement projects also promotes shared problem solving, such as product recycling and reduced energy consumption during transportation and distribution, facilitating green cooperation with customers (Vachon & Klassen, 2006). Furthermore, green integration with customers encourages manufacturers to increase investment in pollution control technology and adopt an “external control” environmental management program, improving customer green cooperation (Wu, 2013). Green partnership with customers allows manufacturers to undertake environmental improvement projects to reduce pollution in the downstream supply chain (Vachon & Klassen, 2006). Green cooperation with customers also allows manufacturers to comply with different environmental regulations in different markets, improving operational efficiency and competitiveness (Yang et al., 2013). By partnering with customers to align environmental goals, manufacturers can incorporate a green philosophy in the design of their distribution and transportation processes, reducing carbon emissions, wastewater, solid waste, and the consumption of hazardous materials in the downstream supply chain (Green et al., 2012). Partnering with customers on eco-design, cleaner manufacturing, and green packaging allows manufacturers to optimize production and operations to reduce pollution and energy consumption and improve environmental performance (Yu et al., 2019). Thereby, we hypothesize:

Hypothesis H_6: *Green supply chain integration has a positive impact on customer green cooperation.*

When a business conducts green supply chain integration. That enterprise will conduct all 3 aspects: green internal integration, green supplier integration, and green customer integration. This means corporates will build strategic relationships with their supply chain partners (including corporates) and work together to integrate environmental concerns into firms' internal processes. This is expected to help businesses form, consolidate and have a positive impact on competitive advantages, which businesses outperform other businesses, including investment cycle, green process innovation, green product innovation, green purchasing, and customer green cooperation. These competitive advantages will help businesses improve overall performance. When considering their effect on environmental performance (one of the three main factors of operational performance), the study hypothesizes:

Hypothesis H_{11}: *Customer Green cooperation has a positive impact on environmental performance.*

Competitive advantage is one of the enterprise's resources, which is the distinguishing value that the enterprise excels in compared to competitors. The competitive advantages mentioned in the research: investment cycle, green process innovation, green product innovation, green purchasing, and customer green cooperation are effective tools to help businesses maintain stability and development. According to the theory of sustainable development, the stability and development of enterprises is based on three important areas: economy, environment and society. Therefore, it is hypothesized that these competitive advantages will have a positive impact on the environmental performance of the firm. So, we hyothesize:

Hypothesis H_{12}: *Green supply chain integration has a positive impact on environmental performance through mediating role of investment circularity, green process innovation, green product innovation, green purchasing, and customer green cooperation.*

GSCI, in addition to predicting a positive direct influence on the environmental performance of an enterprise, also affects the environmental performance of an enterprise through the formation and development of the investment cycle, process innovation, green process, green product innovation, green purchasing, and customer green cooperation.

2.4. Indirect effects of green supply chain integration on the environmental performance of enterprises through moderating variables: size and export product ratio

In addition to the mediate variables, there are many other moderating variables that affect the relationship between GSCI and EP of enterprises. Previous studies have identified different factors affecting the integration of GSC in organizations. These factors include the size of the organization, the type of business sector, the level of investment, the level of equipment/machinery, the size of the supply network and the customer base (Vijayvargy, 2017). Environmental issues concern all aspects of the operation of a business and force all businesses to manage the environment in new ways. Not all companies are "green" or equally proactive in responding to environmental issues. The challenges and difficulties faced by organizations of different sizes are also different (Vijayvargy, 2017). Organizational size is an important factor often used in the literature on environmental management and operational strategy (Grant et al., 2002). Using firm size along with other control variables including age of plant equipment, industry, and advanced manufacturing and operations management. González-Benito and González-Benito (2005) empirically analyzed the relationship between the initiative in environmental activities of enterprises and environmental performance to conclude that environmental practices are related to the transformation of logistics processes, and influence the corporate governance structure of the enterprise. Firm size is determined to have a positive relationship with the environmental performance of the enterprise. Large organizations have sufficient financial and human resources to allocate to green supply chain management practices and can afford to procure and implement environmental systems such as pollution prevention systems (Vijayvargy et al., 2017). In contrast to large organizations, typically smaller organizations invest less in environmentally friendly technologies and respond more strongly to green issues (Grant et al., 2002). In addition, there is also research that shows that businesses of different sizes implementing green supply chain management practices can improve product quality, reduce lead times and increase sales opportunities to sell their products internationally (Zhu et al., 2008). All previous studies on firm size promote the investigation of the basic relationship between GSCI and organizational performance through the moderating variable of organization size.

Besides the size, the export product ratio of the enterprise also moderates the relationship between GSCI and EP of the enterprise. Zhang (2018) came to the conclusion that whether an enterprise exports or not have a moderate effect on the influence of GSCI on the business performance of enterprises. Christmann and Taylor (2001) argue that exports and sales to foreign customers are the two main drivers for improving the environmental performance of enterprises in China. Enterprises when exporting will face technical barriers in clean technology. Therefore, if relevant international environmental standards are not met, the benefits of joining bilateral and multilateral trade organizations will be reduced. Incorporating environmental concerns into all processes of production, through the reduction of energy consumption and hazardous materials, improved environmental image, improved waste disposal, and emission reduction, will help to increase the environmental performance of enterprises, thereby improving international business performance (Christmann & Taylor, 2001). Better environmental performance leads to a better brand image, enhanced reputation, and meets international ecological criteria, enabling exporters to expand exports in existing markets, and penetrate new markets. However, Ural (2009) argues that exporting is part of a company's marketing program. Exporting causes costs such as the cost of EMS adoption, the cost of air pollution, and the cost of operating a business (Darnall & Edwards, 2006). Considering the long-term business process, it can be seen that these costs are short-term costs, which can be offset by the benefits obtained such as saving energy, reducing waste of resources, and image improved companies also deliver higher profits in the future. These benefits will improve the environmental performance of the enterprise in the market and meet the environmental criteria (Shi et al., 2012). In general, there are studies using the moderator variable which is the export product ratio of enterprises, and some studies using the moderating variable as firm size, but the research results have not been the same.

In this study, we refer to both size and export moderate variables when considering the indirect relationship between GSCI and EP of firms, and hypothesize:

Hypothesis H_{13}: *Green supply chain integration has a positive impact on firm performance through the moderating variables of firm size and exports.*

2.5. Research gap

Jawaad and Zafar (2020) found that the mediate factor between GSCI and EP of enterprises is investment cycle and competitiveness, but did not mention other mediate variables. Research by Wong et al. (2020) has pointed out three aspects of GCSI: GII, GSI, and GCI; At the same time, mediating variables such as green process innovation and green product innovation has also been identified. However, green cycle, green procurement, customer green cooperation, and moderate variables have not been mentioned. The research paper considers GSCI as a special resource to create CA for enterprises. CA will be the foundation to create the business's operating system, thereby helping the enterprise to improve its environmental performance. Vietnam is a developing country in the emerging Asian economy. Many organizations in Asia's emerging economies are forced to build GSCM and work hard to achieve their vision of becoming an eco-friendly economy through

their regulations. However, the studies on GSCI in Vietnam are still very limited and have not fully exploited the influence of GSCI on the environmental performance of enterprises. At the same time, studies around the world, despite exploiting the aspects that GSCI affects the organization's environmental performance, the agricultural industry, especially the production of agricultural products, has not been exploited much.

Therefore, it is extremely urgent to fill the above research gaps so that Vietnam can apply GSCI more effectively in its supply chain. At the same time, the study will exploit aspects that have not been done by previous studies, helping Vietnamese enterprises, especially those producing rice, coffee, and rubber, to have the right perception, an overview of GSCI and its impact on the environmental performance of enterprises through mediate and moderate variables. In addition, in the context of rice, coffee, and rubber companies in Vietnam, many factors such as the size and export product ratio of enterprises will directly affect the level of impact of GSCI on EP. Therefore, we propose a moderate role of exports and firm size in the relationship between GSCI and environmental performance.

3. Method

3.1 Research sample

This study focuses on the influence of green supply chain integration on the environmental performance of rice, coffee, and rubber producers in Vietnam through mediate variables including investment cycle, change of new green process, green product innovation, green purchase, and customer green cooperation. Vietnam's agricultural products are products that many major countries are interested in, especially the three products of rice, coffee, and rubber. In recent years, these products in Vietnam have continuously penetrated into major markets in the world and are well received. However, the regulations on quality, and design, etc. are becoming more and more stringent and countries all over the world are always interested in environmental protection and sustainable development. Meanwhile, the application of GSCI in enterprises is limited and there are very few studies on GSCI on environmental performance through specific mediate variables. There were 90 leaders at middle and senior levels at 90 small- to large-scale agricultural production enterprises in all 3 regions of the North, Central, and South regions. Each interview lasted from 90 to 120 minutes. The results of analyzing the collected data show that agribusinesses in Vietnam already have an awareness of the concept of a green supply chain. There have been large enterprises investing in and appreciating the importance of green supply chains in the agricultural industry today.

"*Our company has moved to a greener and more environmentally friendly production model for more than 5 - year, the leaders always want to invest in more advanced technology and techniques to be able to completely go green production stages and conduct the use of green supply chain integration instead of the traditional supply chain. Or as in the production stage, the hydroponic system will be used alternately to grow some vegetables and tubers in combination with prioritizing the use of organic fertilizers, and biological fertilizers, and limiting the use of chemical fertilizers as much as possible. We also integrate using containers, ships, and planes to transport products*" – Director of an agricultural business in the South.

The Head of purchasing department of a Northern enterprise replied: "*Our company has applied green supply chain integration through the green purchasing process. The purchasing department is always trying to find materials that have little impact on the environment and human health. When evaluating options for the same purpose, we also consider additional criteria: saving energy, being recyclable, and not causing too much harm to the environment. Our company is trying to use as few disposable products as possible*."

However, besides that, small and medium enterprises, or households are not completely aware of this concept, the interviewees often mentioned specific phrases such as "green logistics", "organic agriculture", "green agriculture", "green purchasing"

From being aware of the concept of the green supply chain, there have been businesses applying it and seeing benefits from integrating green supply chains within enterprises, with suppliers, and with customers.

The leaders said, "*First when we start applying green methods of production and transportation, our costs will increase, for example, the cost of organic fertilizers more than chemical fertilizers but then more cost savings, reduced transportation costs, production by reducing the energy and natural resources that businesses consume to produce products and its services while reusing raw materials will also reduce the necessary costs*".

"*In the current situation, the outbreak of the Covid-19 epidemic is very complicated, greatly affecting the production and consumption of products, creating many challenges for businesses, many businesses have had to go bankrupt because there is no supply or there are businesses that have to pay a lot of money for the transportation of goods due to the shortage of containers, the freight rates increase. As for my business, we have used many integrated methods of transporting goods before, so during the outbreak, we still secured the contract, maintained our reputation with customers, and saved more costs. It can be said that our business has continued during this epidemic season thanks to the cost savings from green supply chain integration*" – A director of a medium-sized agricultural production enterprise in the North.

In particular, agricultural enterprises from large scale to small scale are aware of the environmental benefits that green supply chain integration brings. Large enterprises find that the performance of their environment has improved more and towards the sustainable development of the business. For example, a common signal of both large enterprises is that they have used green logistics, businesses have used a combination of road and water transport, for some businesses also use aircraft to transport goods and products. Businesses find that this is an optimal transportation option, especially in times of epidemics, where containers are rare and difficult to move. Small businesses and households have taken a number of steps, such as limiting the use of chemical fertilizers, using self-composting fertilizers, and rotating crops to protect the land. A farmer in the Central region: “Using such self-composting fertilizer helps me protect the soil, as well as the surrounding water environment, from the death of the shrimp and fish we raise. And in our house, we also rotate crops to get more crops, increase our income, and protect the soil and avoid erosion." Applying simple methods to green the production and cultivation process helps people have a better living environment, less harmful to the environment around them. Therefore, their health is also improved, and the working environment is also less toxic.

To test the research hypotheses, we distributed survey questionnaires to Vietnamese agricultural enterprises. Data analysis is performed on 863 Vietnamese agricultural enterprises.

3.2 Research model

Based on the established relationships from the research hypotheses, the study proceeds to build an empirical research model. The experimental research model is shown in Fig. 1.

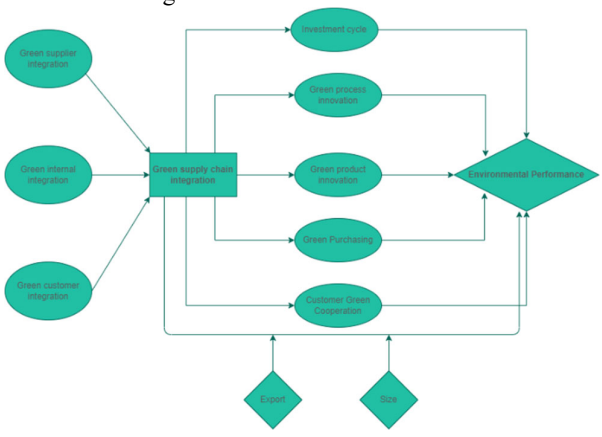

Fig. 1. Research model *Source: Authors*

Summary from the research review and theory on the correlation between Green Supply Chain Integration and Environmental Performance of rice, coffee and rubber producers in Vietnam and qualitative research results done above. The research team discussed and agreed on the final research model. Scales for research variables are presented in the appendix.

3.3. Analytical techniques

Cronbach's Alpha coefficient is used in testing the reliability of the scale to find unreasonable variables and eliminate them. Based on the Cronbach's Alpha test coefficient of the scale components and the Cronbach's Alpha coefficient of each measurement variable, we can test the reliability of the variables in the scale. We will remove the variables with the total correlation coefficient of the variable < 0.3. For Cronbach's Alpha coefficient, the research team takes the standard as greater than 0.7. EFA is a method to analyze the dependence of different variables. This means that no independent variable can be explained based on the inverse relationship between the related variables. EFA is used to derive a smaller set of more significant factors from a set of reference variables. Based on the linear relationship between the factors and the observed variables, we have a basis for this extraction. The EFA method is commonly used in research to briefly evaluate the relationships. However, EFA relies only on collected information sources, and then finds the constitutive factors that can then indicate whether previous models or studies are appropriate or not. As for structural measurement, EFA will not be a good method. Therefore, EFA is only used to analyze mediate variables, and OC is a structural measure, so it is not suitable for EFA analysis. The alternative to evaluate the scale is to use the extracted variance: when the extracted variance is > 50% and Eigenvalue > 1 or the factor loading coefficient (Factor loading) ≥ 0.5, the measurement problem is solved (Hair et al. associates, 2014).

Combined reliability, convergent value and discriminant value are the three values to be able to evaluate the measurement model: Combined reliability assessment measures the reliability of a set of measured observed variables a concept (factor) and the confidence coefficient Cronbach Alpha that measures the intrinsic consistency across the set of observed variables of the responses. The composite confidence value is greater than 0.7 and Cronbach Alpha confidence is 0.6 or higher, then it

will be satisfactory. Evaluation of the convergence value of the scale is achieved when the normalized weights (Outer loadings) of the scale are all high (> 0.5) and statistically significant ($p < 0.05$) and the total variance extracted reflects the quantity of the scale. The general variation of the observed variables explained by the latent variable is significant when the value is above 0.5 hidden (Henseler et al., 2009). Evaluation of discriminant validity: is the degree to which a concept of a particular latent variable is distinguished from the concept of other latent variables (Henseler et al., 2009). Multicollinearity detection: Through the Variance Inflation Factor (VIF), we can conclude that there is a sign of multicollinearity when VIF > 10.

After having the structural model, we need to test the new variable, quantify the impact of GSCI on EP and test the hypotheses, we use the following tool: Measure the defined population coefficient (R-square value), an index that measures the model fit of the data or the explanatory power of the model. Depending on the extent, values around 0.67 and above would be strong, respectively, around 0.33 moderate, and 0.19 weak. The Path Coefficient to describe the effects of different variables is similar to the normalized beta obtained through the PLS model and is significant to have the same effect as the sign of the coefficient. T-value: using the student distribution to evaluate the significance level. Bootstrap estimation test: feasible in PLS method through sample processing to get confidence intervals for all estimates as well as build a premise for statistical inference. By treating it with randomness, the Bootstrap template will generate cases with replacements from the original templates. At the same time test the mediating role and the moderate role of the research variables.

4. Results

Before conducting EFA, we used Cronbach's Alpha coefficient (Hair et al., 2009) to evaluate the reliability of scales of both models. The condition to accept the reliability of the scales is Cronbach's Alpha > 0.7 (Hair et al., 2009). The results show that all scales have Cronbach's Alpha > 0.7. However, the scales GSCI_SUP1, GSCI_INT5, GSCI_CUS1, GPC7, and EP6 do not satisfy the correlation index of 0.4, so they need to be removed from the model to ensure the reliability of the variables.

Thus, after removing the inappropriate scales, the remaining scales of the research variables all satisfy the conditions and ensure the reliability of Cronbach's Alpha > 0.7 and the validity according to the guidance of Hair et al. (2011; 2014; 2017) and Henseler et al (2009; 2015). The EFA results show that: KMO = 0.890 > 0.5, sig Bartlett's Test = 0.000 < 0.05, so the EFA exploratory factor analysis is appropriate.

Table 1
Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CGC	0.913	0.914	0.931	0.658
EP	0.892	0.908	0.917	0.650
GPC	0.876	0.893	0.905	0.613
GPCI	0.804	0.814	0.872	0.630
GPDI	0.849	0.852	0.898	0.689
GSCI	0.937	0.945	0.945	0.592
IR	0.842	0.853	0.905	0.760

Source: Authors

The results in Table 1 show that all the research variables have the composite Cronbach's Alpha coefficient greater than 0.7, the smallest value is 0.804, proving that the scales in the research variables have good reliability. Hair et al., 2014). At the same time, the extracted variance value (AVE) is also mostly greater than 0.5, the smallest value is 0.592. This result is suitable for conducting further tests.

Evaluate the convergence value of the scale

The results show that the values except the 2nd order factor GSCI_INT4 have high values, larger than most of the variables outside the scale. Due to the structural characteristics of the 2nd order factor variables, the discriminant validity is temporarily accepted to perform the next tests.

Discriminant validity

Table 2
Heterotrait-monotrait Ratio

	CGC	EP	GPC	GPCI	GPDI	GSCI	IR
CGC							
EP	0.500						
GPC	0.165	0.307					
GPCI	0.340	0.441	0.150				
GPDI	0.274	0.385	0.180	0.237			
GSCI	0.385	0.637	0.286	0.293	0.477		
IR	0.277	0.560	0.133	0.273	0.181	0.372	

Source: Authors

The results show that the coefficients of HTMT are all less than 0.85, so the factors are distinct from each other (Henseler et al., 2015).

Multicollinear Detection

The Variance Inflation Factor (VIF) should be less than 5 to avoid multicollinearity (Hair et al., 2019). However, when VIF is < 10, it is still acceptable (Mason and Perreault 1991). Variance magnification factor (VIF): Research results show that all VIF coefficients are less than 5 with the largest value being 4,431. Therefore, there is no multicollinearity between the factors, suitable for the next evaluation.

Evaluate model fit

The fit of the model: If the SRMR coefficient of the model is < 0.08, then the model is considered suitable (Hu & Bentler, 1999). However, if the SRMR coefficient is < 0.1, the model can still be accepted (Hu and Bentler, 1999). The SRMR index is the goodness of fit index of the PLS-SEM model that can be used to avoid parameter bias in the model (Henseler et al., 2014).

Table 3
Model fit

	Saturated Model	Estimated Model
SRMR	0.046	0.057
d_ULS	0.889	0.952
d_G	0.666	0.687
Chi-Square	2378.923	2412.811
NFI	0.855	0.853

Table 4
R - square

	R Square	R Square Adjusted
CGC	0.13	0.129
EP	0.535	0.531
GPC	0.076	0.074
GPCI	0.069	0.068
GPDI	0.191	0.19
IR	0.112	0.11

Source: Authors

Research results show that the model has a SRMR coefficient < 0.08, so the model is completely suitable (according to Hu & Bentler, 1999).

Evaluate coefficients R-square, F-square

The coefficient of determination R-square helps to measure the explanatory strength of the model for a variable, with R-square values of 0.67, 0.33 and 0.19 representing strong, moderate, and weak explanations, respectively. Hair et al., 2014). The results show that the variables studied in the analytic model account for more than 53% (53.5%) of the variability of the Environmental Performance variable – this means that Green Supply Chain Integration is important for environmental performance. of the enterprise. Here, because the structure of the 2nd order factors variables is done by the method of taking weights from the scales, the R-square is approximately 1, which shows that there is nothing unusual here. The f-square coefficient shows the level of explanation of one variable for another, if the f-square coefficient is greater than 0.15 it will show that the two variables are closely related and the f-square coefficient < 0.02 will shows that the two variables are not related (Hair et al., 2014). Based on the f-square coefficient, Green Supply Chain Integration has a great influence on the Environmental Performance of enterprises. The remaining research variables are Green Consumption Cooperation (f-square = 0.072), Green Production Innovation (f-square = 0.040) and Return on Investment (f-square = 0.136) with medium influence. to the environmental performance of the business. Meanwhile, with f-square < 0.02, Green Consumption and Green Product Innovation have an extremely small impact on the Environmental Performance of enterprises.

Check the impact from GSCI to EP when there is no mediate variable:

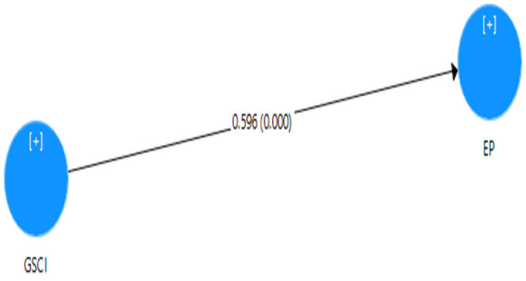

Fig. 2. Model test results without mediate variables

Source: Authors

When there is no mediate variable, the impact from Green Supply Chain Integration on the environmental performance of enterprises is positive and very strong. One unit of modified GSCI will result in 0.596 units of variable EP.

To test the research hypotheses, the study used Bootstrapping technique on Smart PLS and obtained the following results:

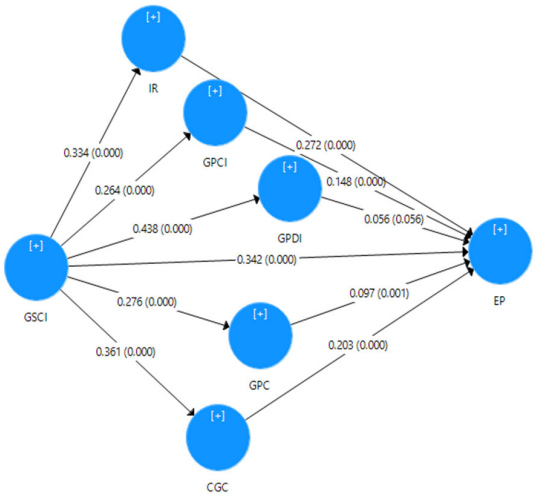

Fig. 3. Model test results when there are mediate variables *Source: Authors*

Based on the results of hypothesis testing on the figure, it shows that 6 hypotheses (H1-H6) have been tested. All 6 hypotheses are supported at 1% significance level due to the P-value < 0.01. Considering the hypothesis H1, the effect of GSCI on EP is positive, with a coefficient of 0.342. This result indicates that Green Supply Chain Integration has a direct effect on Environmental Performance with a relatively high degree without the need for an intermediary variable. Hypotheses from H2 to H6 indicate the reflection of the GSCI independent variable on the mediate variables IR, GPCI, GPDI, GPC and CGC. Considering the impact coefficients, the results show that GSCI affects GPDI the most (equivalent to 0.438). Promoting Green Product Innovation is an integral part of Green Supply Chain Integration and moving towards the goal of sustainable development. These innovations require businesses to choose materials that are less polluting, energy efficient and classifiable for future production processes. In addition, the effects of GSCI on IR and CGC are similar (coefficients 0.334 and 0.361, respectively) with CGC slightly better. This shows that the process of promoting investment circulation is more important than green cooperation with customers in the process of Green Supply Chain Integration. The coefficient of impact of GSCI on GPCI and GPC is relatively small (about 0.264 and 0.276) showing that Green Supply Chain Integration has not had much impact on Green Process Innovation and Green Purchasing. In agricultural enterprises in Vietnam this is completely understandable. Currently, Vietnam's agriculture is still based on a small-scale basis, so it is difficult to apply closed and large-scale production forms in the characteristics of green agriculture. In addition, environmental factors and climate change are major barriers in integrating green supply chains in enterprises today. Besides, the purchase of green products has not been paid attention and received by consumers. From hypothesis H7 to hypothesis H11, hypothesis H9 is significant at 5% significance level due to P-value = 0.043 < 0.05. In addition to this relationship, in this result, the remaining hypothetical relationships are significant at 1% and the impact coefficients all have positive signs, showing that the impact direction between the factors is a positive relationship. positive (positive effect). The impact level from GPC to EP is the largest among the hypotheses (H7-H11), the impact coefficient is 0.097. This shows that the direct impact from GPC to FP is the most, accurately reflecting the relationship between Green Purchasing and Environmental Performance. The impact coefficients of IR and CGC on EP are similar (respectively 0.272 and 0.203) in which the impact coefficient of IR is slightly higher. This shows that promoting investment cycles has more impact than Green Cooperation with customers in improving Environmental Performance. This is completely reasonable because currently efforts to cooperate with customers are not really effective and the concept of Green Marketing is still quite new and has not been widely applied in businesses in Vietnam. Besides, although there have been signs of green cooperation in recent years, the reception of customers in Vietnam still has many issues worth discussing. Therefore, promoting the investment cycle to restore and reuse used or redundant equipment and materials has a stronger impact on the environmental performance and operational efficiency of enterprises. The impact coefficient of GPCI on EP is the smallest (about 0.148), showing that the impact of Green Process Innovation has a relatively small impact on the environmental performance of enterprises. In Vietnam, only a small number of rice, coffee and rubber producers are able to upgrade modern production lines and promote awareness of environmental responsibility (Lee et al., 2018). The use of pesticides is still rampant and uncontrolled in many localities, leading to the process of Green Process Innovation not really brought into play. However, in the future, in order to meet the needs of countries importing rice, coffee and rubber in large quantities, Vietnamese enterprises need to consider and invest in the production process. environmentally friendly and responsible.

Table 5
Summary of hypothesis testing results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CGC → EP	0.203	0.204	0.029	6.931	0.000
GPC → EP	0.097	0.096	0.03	3.278	0.001
GPCI → EP	0.148	0.147	0.031	4.823	0.000
GPDI → EP	0.056	0.056	0.027	2.03	0.043
GSCI → CGC	0.361	0.365	0.032	11.163	0.000
GSCI → EP	0.342	0.343	0.038	9.094	0.000
GSCI → GPC	0.276	0.279	0.037	7.446	0.000
GSCI → GPCI	0.264	0.268	0.038	6.846	0.000
GSCI → GPDI	0.438	0.441	0.026	16.799	0.000
GSCI → IR	0.334	0.339	0.035	9.666	0.000
IR → EP	0.272	0.273	0.029	9.304	0.000

Source: Authors

Evaluation of the mediate role

To test the intermediary role of IR, GPCI, GPDI, GPC and CGC in the relationship between GSCI and EP, the study follows 4 steps as described in chapter 3 – research method with test results. Detailed relationships are made on Smart PLS software as follows:

Table 6
Verification of the mediate role

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
GSCI → CGC → EP	0.073	0.074	0.012	6.123	0.000
GSCI → GPC → EP	0.027	0.027	0.009	2.94	0.003
GSCI → GPCI → EP	0.039	0.039	0.01	3.899	0.000
GSCI → GPDI → EP	0.024	0.025	0.012	1.986	0.048
GSCI → IR → EP	0.091	0.092	0.014	6.694	0.000

Source: Authors

The five separate indirect effects all have P-value < 0.05, so the factors IR, CGC, GPCI, GPDI, and GPC have a mediating role in the impact relationship between GSCI and EP. In which, IR plays the strongest intermediary role with the regression coefficient of the indirect effect of 0.091. This is consistent with the proposed hypothesis and the fact that the recovery of excess inventories, raw materials, scrap, and equipment helps to minimize the amount of waste released into the environment, thereby improving environmental performance. The recovery mechanism aims to recover and regenerate leftover or used resources to save costs and improve production efficiency for enterprises. Next is the mediating role of CGC and GPC in the relationship between GSCI and EP with regression coefficients of 0.073 and 0.027. This result shows that these two factors have a positive effect in the relationship between Green Supply Chain Integration and Environmental Performance with Green Cooperation with the environment having a much stronger effect than Green Purchasing. This result is completely consistent with and consistent with previous studies by Rao and Holt (2005), and Zhu et al. (2005, 2013). Based on these studies and the fact that Green Purchasing can effectively green inputs, thereby reducing the later negative impacts of materials and components throughout the product life. As a result, businesses can apply the production process of green products. These initiatives require active cooperation from customers, towards the goal of environmentally friendly design, cleaner production, green packaging, energy-saving, and a favorable product recovery process. Today, with increasingly strict government regulations and pressure from stakeholders, green cooperation with customers will definitely help businesses improve their operations to develop green output products, leading to a better and more efficient environment. Finally, the mediate effect coefficient of GPCI on the relationship between GSCI and EP is 0.039, showing that this is a positive and relatively large effect. Green Process Innovation is an integral part of Green Supply Chain Integration. For rice, coffee, and rubber producers in particular and manufacturing enterprises in Vietnam in general, innovating green production processes with modern technologies can replace processing cycles. management of traditional materials, minimizing emissions of toxic dust, wastewater, and other wastes. In addition, green processes eliminate the use of pesticides and plant growth stimulants, thereby partly improving the soil, developing good properties, and facilitating the growth of plant beneficial bacteria proliferate. Therefore, Green Process Innovation directly positively affects the relationship between Green Supply Chain Integration and Environmental Performance.

Multi-group analysis

The multi-group analysis is based on the analysis of the total impact from GSCI to EP for 3 groups: (1) rice, (2) coffee and (3) rubber. The results of multi-group analysis on Smart PLS are summarized below.

Table 7
Multi-group analysis by product produced (total effect)

	Total Effects Original Group (1)	Total Effects Original Group (2)	Total Effects Original Group (3)	Total Effects-diff group (1) vs (2)	Total Effects-diff group (1) vs (3)	p-Value (1) vs (2)	p-Value (1) vs (3)
CGC → EP	0.129	0.074	0.39	0.055	-0.261	**0.358**	**0.001**
GPC → EP	0.082	0.029	0.198	0.053	-0.116	**0.346**	**0.143**
GPCI → EP	0.208	0.1	0.14	0.108	0.067	**0.116**	**0.396**
GPDI → EP	0.072	0.097	-0.065	-0.024	0.138	**0.694**	**0.079**
GSCI → CGC	0.294	0.428	0.341	-0.134	-0.048	**0.089**	**0.581**
GSCI → EP	0.592	0.852	0.34	-0.26	0.252	**0.000**	**0.000**
GSCI → GPC	0.334	0.249	0.293	0.085	0.041	**0.287**	**0.661**
GSCI → GPCI	0.303	0.283	0.222	0.021	0.081	**0.799**	**0.378**
GSCI → GPDI	0.451	0.421	0.497	0.03	-0.046	**0.643**	**0.498**
GSCI → IR	0.288	0.45	0.251	-0.162	0.037	**0.055**	**0.697**
IR → EP	0.284	0.149	0.319	0.135	-0.035	**0.032**	**0.629**

Source: Authors

The results show that there is a difference between the impact of GSCI on EP between rice producers and coffee producers, as well as between rice producers and rubber producers at 1% because the P-values are all less than 0.01. Analysis of the impact coefficients for each group shows that coffee producers are the group of businesses that receive the largest impact due to the impact coefficient of 0.852. This shows that when coffee producers raise GSCI, EP will improve a lot. In fact, today's coffee production enterprises are very diverse in products, supply sources as well as markets, so improving the integration of green supply chains will help these businesses develop much more, especially environmental performance improvement. The group of enterprises that received the weakest impact were rubber manufacturers with an impact coefficient of 0.340. This is an industry group that is neither new nor prominent today, so most impacts on improving GSCI will have less impact on environmental performance than other groups of businesses. In the middle are rice production enterprises with a relatively large impact coefficient of 0.592. Although the product may not be diversified with mainly raw rice, the current trend of developing rice products as well as the rice market (such as through the EVFTA agreement) helps the rice industry to become more potent.

Assess the moderate role

The results of testing the role of the moderate variable through Bootstrapping technique on Smart PLS are given in Fig. 4.

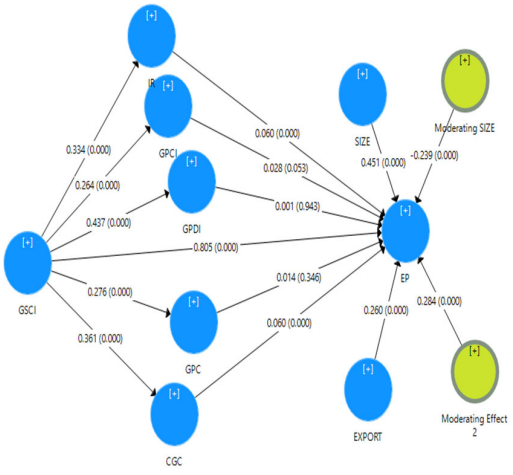

Fig. 4. Results of testing the moderate role

Source: Authors

The t-test p-value of the relationship SIZE and EXPORT affecting EP are equal to 0.000 < 0.05, showing that two modifiers SIZE and EXPORT have an impact on EP. In which, the moderator variable SIZE has a regression coefficient of -0.239 < 0, demonstrating the negative relationship between firm size and environmental performance. The larger the enterprise size, the worse the environmental performance and vice versa. With the EXPORT moderator, a regression coefficient of 0.284 shows a positive relationship of exports with environmental performance. The more businesses promote exports, the more environmentally efficient they will be. This is completely reasonable in enterprises producing agricultural products in general and rice, coffee and rubber in particular in Vietnam. In order to have the opportunity to penetrate into difficult and potential foreign markets, businesses need to promote the trend of green production to achieve the goal of quality and environmentally

friendly output. Exporting more products requires businesses to meet international environmental standards and thereby change the green production process towards higher environmental efficiency.

Enterprise size

Work experience is measured on the number of employees of the enterprise.

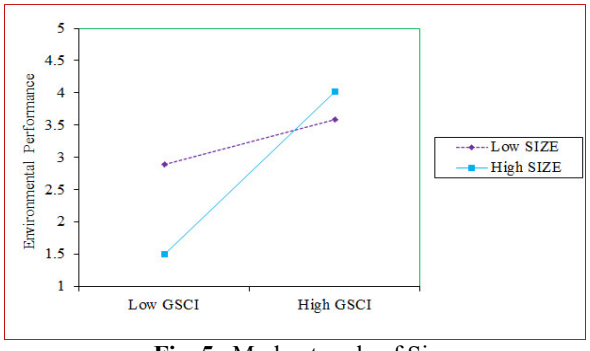

Fig. 5. Moderate role of Size

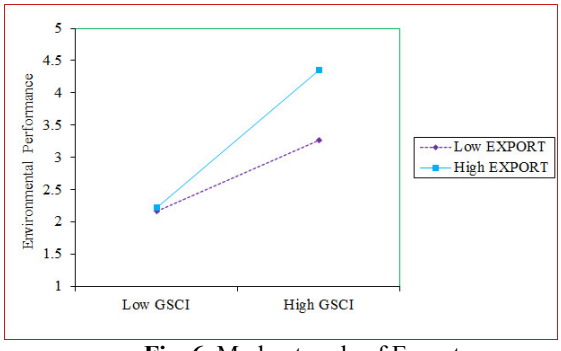

Fig. 6. Moderate role of Export

Source: Authors

Export Rate

The ratio of exported products is based on the proportion of products that enterprises produce according to foreign orders.

5. Conclusion

This study shows that green supply chain integration has a positive impact on the environmental performance of businesses, especially those producing rice, coffee, and rubber in Vietnam. Using the multi-group analysis method, the study shows the difference in the impact of mediating factors on the environmental performance of enterprises. In addition, moderate analysis shows that both firm size and proportion of exported products play a role in moderating the impact of Green Supply Chain Integration on environmental performance. Finally, this study hopes to provide an overview of the environmental impact on the import and export activities of rice, coffee, and rubber producers in Vietnam.

First, to increase the accuracy when assessing the impact of GSCI on environmental performance, the study analyzes GSCI in 3 groups: rice, coffee, and rubber. Research results show that GSCI has a positive effect on the environmental performance of all 3 types of rice, coffee and rubber enterprises. Impact factor analysis for each group shows that coffee producers are the group of businesses that receive the greatest impact due to their abundant product resources and large market, and rubber producers will receive the weakest impact because there are not many outstanding points. Indeed, when businesses have diverse products, sources of supply as well as markets, improving the integration of green supply chains will help these businesses develop much more, especially improving environmental performance. This finding is consistent with the results of previous studies (Berman et al., 2018; Fombrun & Shanley, 2009). Turban & Greening (2015) showed that GSCI had a great influence on the environmental performance of the enterprise in the condition that the enterprise has many outstanding points.

Similar to GSCI, the competitive advantage also shows a strong impact on environmental performance through analysis of variables: investment cycle, green process innovation, green product innovation, green purchasing, and customer green cooperation. The recovery of excess inventory, raw materials, scrap, and equipment helps to minimize the amount of waste released into the environment, thereby improving environmental performance. Green purchasing can effectively green inputs, thereby reducing the negative later effects of materials and components throughout the product's life cycle. In fact, Green Purchasing can effectively green inputs, thereby reducing the negative later effects of materials and components throughout the product's life cycle. This result is completely consistent with and consistent with previous studies by Carter and Carter (1998), Rao & Holt (2005), and Zhu et al. (2005, 2013).

Finally, and also the most prominent point in this research model, green supply chain integration also shows a positive impact on environmental performance through the moderate factors of size and exports of enterprises. Research shows that firm size has a negative effect on environmental performance, the larger the firm size, the worse the environmental performance and vice versa. In addition, the study shows that the export variable has a positive impact on environmental performance. It can be said that the more businesses increase the number of exports, the more environmentally effective they will be. This is completely reasonable in enterprises producing agricultural products in general and rice, coffee, and rubber in particular in

Vietnam. Therefore, in order to export goods to difficult markets, businesses need to promote the trend of green production to achieve the goal of quality and environmentally friendly output.

Recommendations

For Businesses

First, improve internal supply chain management (ISCM)

ISCM focuses on internal business: ISCM includes all processes involved in planning and meeting customer needs. It includes the following processes: Strategic Planning, Demand Planning, Supply Planning, Order Fulfillment, and Market Service. A successful ISCM software vendor has helped improve decision-making in the ISCM process. Good integration between ISCM and SRM is still not strong enough at the organizational level. The future opportunity is to create process improvements. ISCM process and further integration with CRM and SRM

The second is to improve supplier relationship management (SRM).

SRM includes processes that focus on the interaction between the company and its upstream supplier in SC. There is a very natural correspondence between the SRM process and the ISCM process. Restrictions on integration with vendors are important when creating an in-house plan. SRM processes and the impact of information technology are collaborative design, sourcing, negotiation, and purchasing processes. Significant improvements in SC performance can be achieved when the SRM process is properly integrated with the CRM and ISCM processes. When designing a product, a general rule is to include supplier information to improve the design. This requires information from CRM processes of sourcing, negotiation, purchasing, closer cooperation within ISCM, if required supplier input, and optimal project execution.

Finally, advanced customer relationship management (CRM)

The overall CRM process includes the follow-up processes that take place between the company and the customer. The goal of the overall CRM process is to create customer demand and make it easier to deliver and track orders. The weakness of this process leads to loss of demand and poor customer experience because orders are not processed and fulfilled efficiently.

6. Limitations and future research

Although some progress has been made in research assessing the impact of supply chain integration on the environmental performance of Vietnamese rice, coffee, and rubber producers, the study itself does not have limitations that can be completely avoided. The recognition of limitations in research is the premise, the basis for developing new directions for other research in the future.

Firstly, this study was only conducted for the research subjects who are rice, coffee, and rubber production enterprises in Vietnam. As can be seen, the scope of the study is relatively small. Therefore, the research results are not highly representative, not highlighting the generality of the study.

Second, another limitation of this study is that it does not objectively measure organizational performance. The difficulties in collecting actual financial data from different organizations result in corporate performance being assessed on the basis of perceived and self-reported data coming from senior management.

Third, another limitation mentioned here is the difficulty of surveying all agribusinesses in Vietnam. Due to the limitation of the study time, the study only conducted the survey based on the rice, coffee, and rubber sectors with a great reputation and market demand.

Finally, another important barrier is that some enterprises are reluctant to participate, which is why they are not willing to disclose potentially sensitive organizational data or they do not really pay attention to answering the questionnaire that research is doing in the most accurate way.

Realizing the limitations and shortcomings of the research, the research team proposed a number of new research directions in the future for more comprehensive and progressive studies. Future studies can expand the scale and reach of customers by developing from different angles. In particular, future research may focus on research and development for these companies in many fields such as real estate, manufacturing or medical services, tourism, etc., giving an overview of the process of business organization in the world. Another area of research that needs future attention is the influence of organizational processes on the performance of non-profit organizations. Another development direction proposed by the research team is to consider other factors in integrating green supply chains into business operations. As mentioned in the limited section, the

study found supply chain integration. The response can have a positive effect on reducing business costs in domestic and international markets, thereby improving business performance. The aim is to reduce unnecessary costs. The strategy that all companies strive for. However, due to limited time and resources, the research team has not been able to confirm this issue in the study. Therefore, the research team hopes that the problem of this topic can be analyzed more clearly in the future. Furthermore, future studies are expected to bring many practical benefits to the management and administration of enterprises, while emphasizing the importance of further research in the agricultural field and the possibility of direct application in the future. Further future studies are needed, which contribute to building a comprehensive theoretical basis for developing the future environmental performance of enterprises against the ever-changing context of the times. The research team hopes that on the basis of the above orientations, studies can comprehensively develop the relationship between organizational culture and business performance in many aspects in the future.

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Appendix

Variables	2nd order factor	Items	Sources	Code
Green Supplier Integration	Green Supply Chain Integration	1. Achieving common environmental goals. 2. Develop a mutual understanding of responsibilities related to environmental performance. 3. Work together to reduce the environmental impact of our operations. 4. Conduct joint planning to anticipate and solve environmental problems. 5. Make joint decisions about ways to reduce the environmental impact of our products	Kong, T., Feng, T., Huang, Y., & Cai, J. (2020)	GSI
Green Internal Integration	Green Supply Chain Integration	1. Achieving common environmental goals. 2. Develop a mutual understanding of responsibilities related to environmental performance. 3. Work together to reduce the environmental impact of our operations. 4. Conduct joint planning to anticipate and solve environmental problems. 5. Make joint decisions about ways to reduce the environmental impact of our products.	Kong, T., Feng, T., Huang, Y., & Cai, J. (2020)	GII
Green Customer Integration	Green Supply Chain Integration	1. Achieving common environmental goals. 2. Develop a mutual understanding of responsibilities related to environmental performance. 3. Work together to reduce the environmental impact of our operations. 4. Conduct joint planning to anticipate and solve environmental problems. 5. Make joint decisions about ways to reduce the environmental impact of our products.	Kong, T., Feng, T., Huang, Y., & Cai, J. (2020)	GCI
Investment Recovery		1. Invest in recovery of excess inventory/materials. 2. Recovery of used scraps and materials. 3. Recovery of excess equipment capital.	Jawaad, M., & Zafar, S. (2020)	IR
Green Process Innovation		1. Our company's production process effectively reduces the emission of harmful substances or waste. 2. Our company's production process recycles waste and emissions allowing them to be treated and reused. 3. Our company's manufacturing process reduces the consumption of water, electricity, coal or oil. 4. Our company's manufacturing process minimizes the use of raw materials.	Kong, T., Feng, T., Huang, Y., & Cai, J. (2020)	GPCI
Green Product Innovation		1. Our company chooses the materials of the product that create the least pollution to proceed with product development or design. 2. Our company selects product materials that consume the least energy and resources to conduct product development or design. 3. Our company uses the least amount of materials to form products to conduct product development or design. 4. Our company will carefully consider whether the product is easy to recycle, reuse and decompose to proceed with product development or design.	Kong, T., Feng, T., Huang, Y., & Cai, J. (2020)	GPDI
Green Purchasing		1. Provide design specification to suppliers including environmental requirements for purchased items. 2. Partnering with suppliers for environmental goals. 3. Environmental audit for the supplier's internal management. 4. Suppliers need ISO14001 certification. 5. Assess the actual level of environmental friendliness of the supplier. 6. Suppliers are selected according to environmental criteria. 7. Eco-label the product.	Yubing Yu, Min Zhang & Baofeng Huo (2017)	GPC
Customer Green Cooperation		1. Provide design specification in accordance with environmental requirements for customers. 2. Cooperate with customers for environmental goals. 3. Cooperate with customers on eco-design. 4. Cooperate with customers for cleaner production. 5. Cooperate with customers for green packaging. 6. Cooperate with customers to use less energy during product transportation. 7. Cooperate with customers to receive products back.	Yubing Yu, Min Zhang & Baofeng Huo (2017)	
Environmental Performance		1. Green supply chain integration helps businesses reduce emissions. 2. Green supply chain integration helps businesses reduce waste water. 3. Green supply chain integration helps businesses reduce solid waste. 4. Green supply chain integration helps businesses reduce the environmental impact of products/services.	Yubing Yu, Min Zhang & Baofeng Huo (2017)	EP

		5. Green supply chain integration helps businesses reduce consumption of hazardous/harmful/toxic materials. 6. Green supply chain integration helps businesses reduce the frequency of environmental accidents 7. Green supply chain integration helps businesses reduce energy and material consumption.