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Critical Success Factors for Green Supply Chain Management Implementation in Building Products Manufacturing Industry

Mapei Vietnam Case Study

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ABSTRACT:
The building products manufacturing industry currently makes a significant impact on environment in terms of energy use, carbon emissions and waste worldwide. Companies in the emerging market must improve with limited resources and varied supplier capabilities. In Vietnam, the ongoing urbanisation and implementation of the National Green Growth Strategy has further increased the urgent needs for credible sustainability actions. At the same time, Mapei Vietnam - the case company for this study must align with Mapei Group's global sustainability ambitions in terms of carbon neutrality, circularity and waste reduction while to be local subsidiary, Mapei Vietnam is operation with local constraints and uneven supplier capability. Therefore, this study examines how Mapei Vietnam strengthen Green Supply Chain Management (GSCM) by identifying Critical Success Factors (CSFs), evaluating their impact on current practices, and proposing feasible strategies for GSCM adoption.
This study follows a mixed-methods, single-case study framework. Data were collected from internal employees and external stakeholders through questionnaires that included prioritized tasks as well as open-ended questions. The study bases on those literatures of GSCM and a CSFs framework that considers the internal enablers, external collaboration, operating practices, and regulatory alignment. The GSCM and CSFs such as top management commitment and supplier collaboration, environmental product declarations, life cycle assessments, and key performance indicators for transparency about environmental good or bad performance are the core concepts. Findings show that while top management commitment and supplier collaboration are two main enablers, and they increase accountability and facilitate practices such as material substitution and logistical redesign, the regulatory compliance supports credibility in markets, access to funding supports initiatives, and employee training needs to reorganize to improve the efficiency of daily work. The research observed gaps in situation assessments and supplier compliance.
A resourced-light roadmap was proposed, with focused indicators, simple dashboards, supplier guides, modular trainings, and product documentation. While there are some limitations to the study, such as its single case study and small sample, it provides helpful recommendations to align global goals and compliance with local lived situations, push Vietnam's green growth agenda, and prompt important implications for other subsidiaries working in a similar emerging market to be aligned with global ambitions.

KEYWORDS: green supply chain management, critical success factors, sustainability performance, building products manufacturing, Vietnam, Mapei Vietnam, emerging markets, case study

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TIIVISTELMÄ:
Nykyään, rakennustuotteita valmistavalla teollisuudella on merkittävä vaikutus ympäristöön, energiankulutuksen sekä hiilidioksidipäästöjen ja jätteiden osalta maailmanlaajuisesti. Kehittyvien markkinoiden yritysten on parannettava toimintaansa rajallisilla resursseilla ja vaihtelevilla toimittajakyvyillä. Vietnamissa jatkuva kaupungistuminen ja kansallisen vihreän kasvun strategian toteuttaminen ovat entisestään lisänneet uskottavien kestävän kehityksen toimien kiireellistä tarvetta. Samaan aikaan Mapei Vietnamin – tämän tutkimuksen kohdeyrityksen – on yhdenmukaistettava toimintansa Mapei-konsernin globaalien kestävän kehityksen tavoitteiden kanssa hiilineutraaliuden, kiertotalouden ja jätteen vähentämisen suhteen. Paikallisena tytäryhtiönä toimiva Mapei Vietnam toimii paikallisten rajoitusten ja kyvyiltään vaihtelevien toimittajien kanssa. Tässä tutkimuksessa tarkastellaan, miten Mapei Vietnam vahvistaa vihreän toimitusketjun hallintaa (GSCM) tunnistamalla kriittiset menestystekijät (CSF), arvioimalla niiden vaikutusta nykyisiin käytäntöihin ja ehdottamalla toteuttamiskelpoisia strategioita GSCM:n käyttöönotolle.
Tämä tutkimus noudattaa yhdistelmämenetelmien, yksittäisen tapauksen tutkimuskehystä. Aineisto kerättiin sisäisiltä työntekijöiltä ja ulkoisilta sidosryhmiltä kyselylomakkeiden avulla, jotka sisälsivät sekä priorisoituja tehtäviä että avoimia kysymyksiä. Tutkimus perustuu vihreän hankintaketjun johtamisesta ja kriittisistä menestys tekijöistä löytyvään kirjallisuuteen, joissa huomioidaan yrityksen sisäiset osapuolet, ulkoiset yhteistyökumppanit, toiminnalliset käytänteet sekä säädösten yhdenmukaisuus. Ylemmän johdon sitoutuminen ja toimittajien yhteistyö, tuotteen ympäristöselosteet, elinkaarianalyysi ja keskeiset suorituskykymittarit ympäristönsuojelun suorituskyvyn läpinäkyvyyden mittaamiseksi ovat keskeisiä käsitteitä vihreän hankintaketjun johtamisessa ja kriittisten menestystekijöiden määrittelyssä.
Tulokset osoittavat, että ylimmän johdon sitoutuminen ja toimittajien kanssa tehtävä yhteistyö ovat kaksi tärkeintä tekijää, ja ne lisäävät vastuullisuutta ja helpottavat käytäntöjä, kuten materiaalien korvaamista ja logistista uudelleensuunnittelua, sääntelyiden noudattamista joka lisää uskottavuutta markkinoilla, rahoituksen saatavuutta joka tukee aloitteita ja työntekijöiden koulutustarpeiden uudelleen järjestelyä päivittäisen työn tehokkuuden parantamiseksi. Tutkimuksessa havaittiin aukkoja tilannearvioinneissa ja toimittajien vaatimustenmukaisuudessa.
Ratkaisuehdotus on resurssitehokas etenemissuunnitelma, joka sisältää kohdennettuja indikaattoreita, yksinkertaisia koontinäyttöjä, toimittajaoppaita, modulaarisia koulutuksia ja tuotedokumentaatiota. Vaikka tutkimuksella on joitakin rajoituksia, kuten sen yksittäistapaus tutkimus ja pieni otanta, se tarjoaa hyödyllisiä suosituksia globaalien tavoitteiden ja niiden noudattamisen yhdenmukaistamiseksi paikallisten säädösten kanssa, Vietnamin vihreän kasvun ohjelman edistämiseksi ja tärkeiden johtopäätösten tekemiseksi muille samankaltaisilla kehittyvillä markkinoilla toimiville tytäryhtiöille globaalien tavoitteiden yhdenmukaistamiseksi.

AVAINSANAT: vihreä toimitusketjun hallinta, kriittiset menestystekijät, kestävän kehityksen suorituskyky, rakennustuotteiden valmistus, Vietnam, Mapei Vietnam, kehittyvät markkinat, tapaustutkimus

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1. INTRODUCTION

As cited in many recent studies and research, since established in 1972, the United Nations Environment Programme (UNEP) has called for governments, as well as industries, to adopt and implement sustainable practices. According to the Brundtland Report (1987), sustainable development is defined as "the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Report of the World Commission on Environment and Development, 1987). Especially, global growth based on sustainable goals have made a great increase since the Kyoto Protocol was valid in 2005, which emphasized the necessity to mitigate the environmental impacts of industrial practices (Wang et al., 2013). The increasing identification of issues related to resource scarcity, skyrocketing energy prices, carbon emissions, climate change consortium (Dadhich et al., 2015), and waste have compounded prohibitive lawful governmental requirements upon businesses. Although there have been many voices of protest speeches to the need for a consideration of issues over time, the growing emissions of greenhouse gas and recent international climate agreements have elevated concerns around climate variability, ecosystem service stability, and resource limits, which incite geopolitical competition (Harvey, 2011). Eventually, sustainability has moved from being just a nice idea to something companies really need to pay attention to.

1.1 Background of the study

Currently, numerous organizations and industries globally are placing a greater emphasis on environmental responsibility or setting sustainability as a goal in their development strategies (Srivastava, 2007). Today, sustainability has become a focus of business strategies in a competitive eco-conscious marketplace. Striving for sustainable development can achieve a compromise in environmental, social, and financial performance (Joyce & Paquin, 2016; Krajewski & Malhotra, 2022). The shift in management's commitment to the sustainability paradigm shift must be carried out through the allocation of resources and setting environmental goals that facilitate or motivate progress in implementing sustainability practices (Zhu & Sarkis, 2004).

According to Global Alliance for Buildings and Construction Report, 2022 and Seman et al., 2012, the building products manufacturing sector particularly and construction industry generally, has a significant environmental impact, producing about 39% of global CO_2 emissions and large amounts of waste due to resource-intensive consumption. According to Alves & Stenberge (2022), these supply chains in the construction industry are especially damaging to the environment because of its inefficient operations. Numerous multinational enterprises are investing in researching and developing green products, establishing standards restricting the use of hazardous substances, and requiring suppliers to provide products that are free of hazardous materials at all levels of the supply chain. Green Supply Chain Management (GSCM) thus has emerged as a strategy for some leading companies in the building industry, including BASF, SIKA, LATICRETE International, HENKEL, etc. This phenomenon implies that companies are now starting to recognize that environmental awareness can be a source of competitive advantage (Walton et al., 1998). Identification of critical success factors for implementation of GSCM helps decision makers allocate time, budget and efforts to the most impactful drivers, the overcome barriers to integrate environmental concerns into core business functions and improve sustainability and competitiveness (Sarkis & Dou, 2018). In fact, GSCM implementation offer firms the opportunity to minimize their harm on the environment while maintaining focus on broader economic goals and social goals (Awaysheh & Klassen, 2010). Networking relationship with the supplier and providing green KPI's (e.g., carbon footprint and energy used) are equally important elements with auditing emphasizing improvements on overall company environmental performance (Vachon & Klassen, 2006; Zhu & Sarkis, 2006).

Moreover, the growing urbanization throughout Vietnam and an increase in infrastructure projects have created additional demand for products made in the building products manufacturing industry. As a result, there is an increased need to examine sustainability for the required demand. Hui (2021) conducted a study that identified positive variations mainly from green design and manufacturing processes in building products and a limited variation from green procurement. In this regard, the National Green Growth Strategy from the Vietnam Government (Decision No. 1658/QD-TTg, 2021) instructs industries to comply with international environmental standards and utilizes

government support to develop capabilities in sustainable action. Core activities of the Green Supply Chain Management framework, including green procurement, green manufacturing and green distribution, and reverse logistics, are displayed in figure 1.

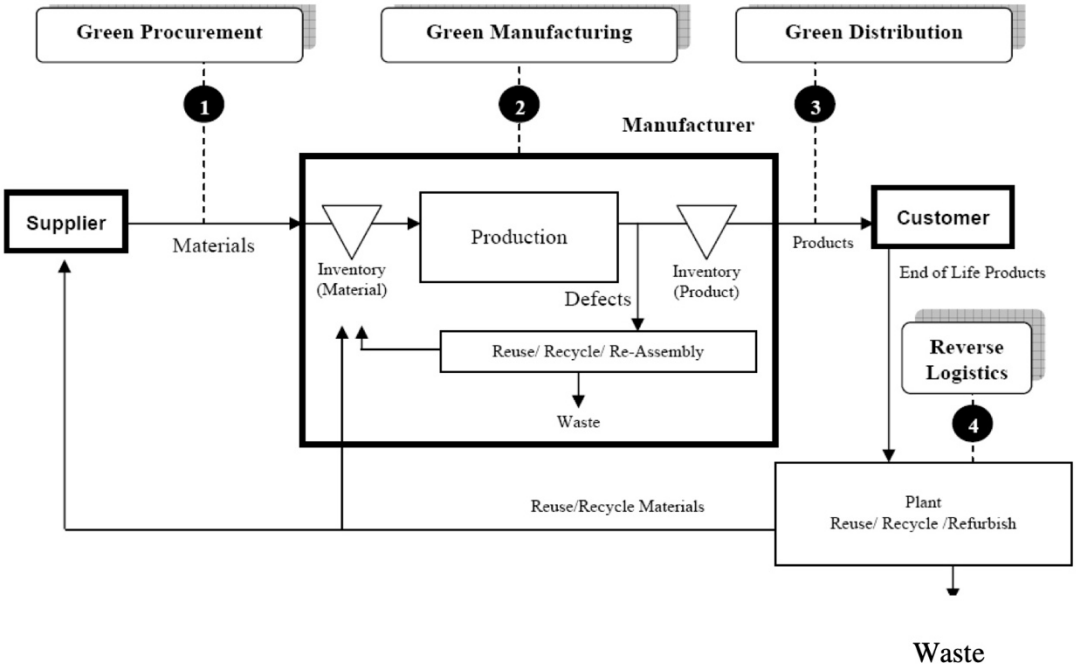

Figure 1 Activities in Green Supply Chain Management (Source: Ninlawan et al 2010)

From the diagram above we can see four principal categories of activities in GSCM process including Green Procurement, Green Manufacturing, Green Distribution and Reverse Logistics.

1.2 Rationale for Selecting the Case Company

Mapei Vietnam Ltd. acts as a compelling example for exploring the application of Green Supply Chain Management (GSCM) because of its unique positioning. As a subsidiary of the globally recognized Mapei Group, the company has good chance to access to leading-edge technologies, global sustainability interventions, and effective corporate governance. In contrast, the realities of Vietnam as a developing economy provide additional challenges in terms of local processes that differ from the policies in an industrialized nation. It can be said that difficulties supporting GSCM in Vietnam may include variations in local legislation and regulatory implementation, infrastructure deficits such as lack of networks and inadequate waste management infrastructure, different stages

of maturity proactively supported by the supply chain partners, and political issues. These opposing perspectives related to GSCM make Mapei Vietnam an excellent opportunity to explore how critical success factors (CSFs) enabled the implementation of GSCM in an emerging economy context. Moreover, as an industry leader in building products manufacturing ranked as one of the highest industries contributing to environmental issues, the lessons from this case study likely can be transferred beyond them, to similar firms in similar industries, struggling with the same global and local tension.

1.3 Problem Statement

While there has been a good deal of attention to GSCM in industries like automotive and electronics manufacturing, little research has been developed that is specific to the building product manufacturing industry, especially in Vietnam (Zhu & Sarkis, 2004; Malviya & Kant, 2015; Green et al., 2012; Vachon & Klassen, 2008). In addition, most of the current researches in the construction or building product manufacturing industry only pays attention to part of the process, such as green purchasing or is targeted at specific players such as contractors' inspection of construction projects or part of production but does not look at the full supply chain and all the critical factors affecting GSCM implementation (Varnäs et al., 2009; Qi et al., 2010; UNEP-SBCI, 2016). However, greening the supply chain is very diverse and incorporates a number of factors that must work together from developers, consultants, suppliers to contractors in a complex series of networks and participants that must effectively collaborate across the supply chain that lacks enough integration (Abidin, 2010; Drohomeretski et al., 2014; Vachon & Klassen, 2008).

This research gap is felt acutely in Vietnam where various local realities exist. Research has reported that obstacles include funding deficiencies, capability of suppliers, and the varied enforcement of environmental regulations, each of which can hinder the adoption of GSCM (Ngoc, 2010). For example, in construction sector of Vietnam, contractors often emphasize costs and do not embrace sustainability, even despite a developer's interest in taking a sustainability initiative. This resulted in a delay to a unified GSCM strategy (Le, 2020; UN Global Compact, 2010). In line with this, researchers have

suggested that while the GSCM for Vietnamese electronics manufacturing is influenced by their internal environmental management processes, pressures from customers, supplier collaboration, and supplier mapping in external environmental management processes, may be weak. As a result, researchers have suggested the Vietnamese electronics manufacturing sector needs to build stronger partnerships with their suppliers to develop a more sustainable future (Do et al., 2020; Nguyen, 2020). Furthermore, CSFs have also received relatively limited attention, for example, top management, the significance of employee training, and technological capability (Luc, 2021). The phenomenon of establishing a shared understanding of these issues/tactics (CSFs) locally restricts both firms and policymakers to locate salient conditions and determine the effectiveness of the strategy or develop their strategy for sustainable supply chain transformation as they will become unable to identify priority actions or the most effective courses of action.

Although some multinational companies like the Mapei Group may develop very progressive sustainability strategies, the reality of deploying them in Vietnam is influenced by current atrophy of local infrastructure and developing embracement of green practices. Mapei Vietnam's continued strive to align global expectations with local context to recognize the varying difference, such as supplier readiness and capabilities allow it to be a useful case to identify and assess varied aspects of its GSCM and ultimately CSFs for their GSCM success.

1.4 Research Significance

This research has both important academic contribution and practical value for Green Supply Chain Management (GSCM) in the building products manufacturing industry. From an academic perspective, this study contributed to an underexplored area of GSCM that relates to the building products manufacturing in Vietnam, a field with limited academic investigation. In observing the ways that the CSFs impacted sustainability outcomes, new knowledge that would be applicable for other emerging economies with similar challenges was also provided. This research also contributes to the

understanding of stakeholder alignment as an enabler of GSCM, contributing to the sustainability discussion on the collective working of stakeholders within and across the supply chain.

This research also identifies more great opportunities for Mapei Vietnam Ltd to develop its Green Supply Chain Management (GSCM) practices to help facilitate the Group's ambitions towards carbon neutrality by 2050 and lessen waste (Mapei Sustainability Report, 2023). Establishing and prioritizing the key common success factors of supplier engagement, regulatory compliance, and technological innovation provides the company with avenues of dealing with issues locally whilst taking into account the issues related to the logistics sector in Vietnam and establishing the role of the green knowledge exploitation process about environmental performance from a developing country perspective, which includes the contribution towards the green agenda (Gualandris & Kalchschmidt, 2016; Gimenez & Tachizawa, 2012; Vo & Nguyen, 2023). The measurable contributions align with Vietnam's Green Growth Strategy about green strategies focussing on high-carbon intensity industries including construction (Vietnam Government, 2021). In addition, it allows all local policymakers to consider the opportunity to plan and establish more effective policies and incentive programs in addition to this study identifying the local policies and design of governmental support mechanisms. This will be supported by research from Nguyen et al., (2020) and Hand-field et al., (2005) which identified key areas of attention towards policy support and financial justification in GSCM adoption.

1.5 Research Questions and Objectives

This thesis examines the instance of applying Green Supply Chain Management in the building product manufacturing industry in Vietnam through a case study of Mapei Vietnam Ltd. with aiming to investigate the following research questions:

1. What are the major CSFs for GSCM in Vietnam's building products manufacturing industry?

2. How do these CSFs impact the GSCM practices and sustainability outcomes of Mapei Vietnam?
3. What challenges does Mapei Vietnam face in GSCM adoption, and how can CSFs address them?

The research questions will be answered to reach the following objectives defined in the study:

1. Identify key CSFs for GSCM in Vietnam's building products industry.
2. Evaluate the impact of CSFs on Mapei Vietnam's GSCM practices and sustainability outcomes.
3. Propose strategies to address key GSCM adoption challenges using CSFs.

1.6 Scope and Delimitations of the Study

The goal of this research is to identify and evaluate the critical success factors (CSFs) for Green Supply Chain Management (GSCM) in the context of Mapei Vietnam Ltd, a subsidiary of Mapei Group, which is a multinational corporation in the building product manufacturing industry. Furthermore, the outcome will attempt to contribute to local relevance in terms of GSCM practice but will in part not escape the limitation of being a single-case study, and may not be fully populated in terms of diversity across the industry. Lastly, the study limits it scope to internal employees and selected external stakeholders, and not a mapping of the firm supply chain across tiers and geographies. The relatedness of these findings to firms will likely depend on a firm operating in a similar way to Mapei Vietnam Ltd in terms of size, structure and sustainability ambitions.

1.7 Thesis Structure

This thesis comprises six Chapters. The introductory chapter presents the background, the reasons to choose Mapei Vietnam as a case company, problem statement, research significance, research questions and objectives of the study. It also mentions Scope and Delimitations of the Study and thesis structure for the readers having overlook of the thesis. The second Chapter consists of a review of the literature on Green Supply Chain

Management (GSCM), critical success factors, Barriers and Challenges in GSCM Implementation, Adoption of Green Supply Chain Management for the Construction Industry and Summary and Framework Basis, primarily related to the building products industry. Chapter three is the Research Methodology which provides a detailed overview of the case company, Mapei Vietnam Ltd. and its current GSCM practices, Research Design, Data Collection, Survey and Questionnaires Development, Data Analysis and the limitation of the study. The Chapter four is where the findings and results are discussed, followed by Chapter five which provides some discussion about the empirical findings. The practical recommendations about how Mapei Vietnam Ltd. can improve its implementation of GSCM was Chapter 6. This chapter also summarizes the key findings from the study and implications for practice and highlights further research opportunities.

2. LITERATURE REVIEW

2.1 Green supply chain management

Green Supply Chain Management (GSCM) is one of the popular strategies to deal effectively with environmental issues by integrating them with traditional supply chain management. The study of Kumar & Chandrakar 2012 stated that this approach not only attempts to fight for environment but also enhance the economy. Green supply chain management is the integration of environmentally sustainable practices into supply chain operations, including product design, material sourcing, manufacturing, and distribution, to minimize environmental impact and enhance resource efficiency.

The environmental impact of supply chains from the extraction of raw materials until the disposal of products is an area of study under research. According to Clift and Wright (2000), life cycle analysis (LCA) is a very important consideration for a variety of environmental impacts throughout the supply chain. The approach emphasizes that the environmental destruction caused by these primary resource industries is greater than the economic value generated (Bowen et al., 2001). Businesses can reduce negative effects while also increasing sustainability levels by utilizing the environmental supply chain management.

The GSCM strategies are key factors that improve both the environmental and economic performance of organizations. One strategy is to combine competitive priorities with GSCM practices leading to better environmental outcomes although this practice may not seem very profitable (Laari et al., 2018). Green Supply Chain Management emphasizes operational excellence and brand strength which are paramount to the advancement of GSCM initiatives. Moreover, there is a substantial positive impact of performance by reverse logistics and compliance with environmental regulation practices being proactive and reactive, respectively. Nonetheless, the effectiveness of these strategies depends upon the organization's focus and pressures from outside the organization (Taylor & Francis., 2013). These plans point to the importance of matching business objectives with sustainability so that the company can use it as a competitive advantage.

Sustainable performance can be enhanced with the integration of GSCM and Green Human Resource Management (GHRM) which creates a balance between the economy, environment and society. According to Zaid et al. (2018), this synergy not only enhances environmental practices but also fosters economic growth and social responsibility, contributing to the triple bottom line. In the future, this research outcome should be extended to various spheres for sustainability.

The construction industries are increasingly using green supply chain management (GSCM) for aid in sustainability. According to Ali and his team (Ali et al., 2020), the Construction Sector can easily adopt Green Supply Chain Management practices, that are, Green Design, Green Procurement, Green Production, Green Warehousing, Green Transportation and Green Recycling, which will result in the mitigation of pollution from the Construction Sector. As a result of the China-Pakistan Economic Corridor (CPEC), adoption of GSCM practices will improve the social, economic and environmental benefits of construction projects. It will help in achieving sustainability. However, it is not so easy to implement these practices. In Vietnam, the construction industry is responsible for a large share of air pollution, climate change, and landfill. Even though GSCM practices can benefit the environment, Vietnam construction companies have not yet adopted these practices due to several barriers such as lack of awareness and regulatory framework (Le, 2019). To deal with these challenges, there is a need to understand the drivers, enablers, and barriers to GSCM adoption. Further, there is also a need to formulate a framework for the transition to greener practices.

2.1.1 Evolution and conceptual foundations of GSCM

The development of GSCM is an important step that will change how businesses operate in any industry. GSCM refers to the adoption of sustainable practices in the supply chain, from upstream management to management of the end-of-life. It emphasizes 4R1D: Reduce, Reuse, Recycle, Reclaim and Degradable. Thanks for these adoption practices, businesses can reduce significantly pollution, deforestation, and other environmental harm. It also helps fight climate change on a global level. Through smart packaging and electric fleets, businesses can reduce carbon emissions and improve efficiency.

Integration of green practices into supplier selection indicates the importance of environmentally conscious supply chain strategies (GEP, n.d.).

First is about the Evolution of GSCM. The developments of green supply chain management have taken a sharp rise over the last two decades notably owing to rising environmental concerns and sustainable businesses. At first, the emphasis of supply chain management was on efficiency. They note that there is growing awareness regarding environmental issues. Moreover, this awareness has ensured the integration of green practices with supply chain operations. Whether by adopting green technology or sustainable raw materials, this has changed traditional supply chains to more sustainable ones (Singh and Trivedi, 2016). The development of these shifts consists of practices such as eco-design, internal environmental management, and green purchasing to minimize environmental impact at the lowest cost possible (Balon, 2020).

From mid-third industrial revolution till now we have seen huge momentum for GSCM which got accredited with the fourth industrial revolution. Researchers have identified key pressures that drive this evolution, including government regulations, corporate social responsibility, and demand for green markets. Companies now need to work towards making their supply chain sustainable (Balon, 2020). Even with these advancements, challenges still remain – for instance, reverse logistics, closed loop supply chain management and more. Moreover, Singh and Trivedi (2016) state that these require more research for overall environmental sustainability.

For Conceptual Foundations, the idea behind inspiring the green supply chain management is integrated with the concept of traditional supply chain management. Supply chain activities consume resources, generate waste, and release emissions, all of which necessitate the integration of sustainability considerations throughout their processes. Often associated with the systems theory, the knowledge-based view is believed to be useful for GSCM theory development. Essentially, GSCM knowledge refers to the degree of communication, interaction and cooperation of member organizations (Dubey et al. 2017). These frameworks state that a sustainable supply chain is not just economically efficient but also environmentally friendly, socially just and compliant with the triple bottom line.

Additionally, GSCM frameworks can also be developed based on the balanced objectives of economics, environment and social, which is referred to as the triple bottom line (TBL). This means that supply chains have to not only be cheaper and smarter but also have to cause less harm to the environment and society. TBL framework helps organizations make decisions that are economically, environmentally and socially viable (Brandenburg et al., 2019). Thus, GSCM frameworks present a guide to organizations in moving toward a better sustainable framework that must be continuously changed and improved according to the purpose and objectives.

Supply chains have been getting sustainable due to evolution in Green Supply Chain Management. GSCM combines the benefits of lean, resilient, and green principles to improve the sustainability's three dimensions. The multimodal effort would decrease pollution and waste generation, in addition to increasing competitiveness (Govindan et al., 2014).

2.1.2 Principles of GSCM

Green Supply Chain Management (GSCM) refers to the management of supply chain that incorporates environmental considerations into supply chain management in relatively new ways. GSCM incorporates principles such as Life Cycle Assessment (LCA), eco-efficiency, and stakeholder participation which are critical for sustainable development (Dheeraj & Vishal, 1992).

The principles of LCA and eco-efficiency are critical to both introducing and adopting GSCM since they offer a framework to evaluate and improve resource use and environmental impact. LCA is a systematic analytical tool for identifying environmental issues in a product's life cycle from the extraction of the raw material through disposal (Arvanitoyannis, 2008). The ISO 14040 standard upon which the methodology is based offers a comprehensive overview of the environmental burdens a product has, and the methodology can inform the organization of areas for potential improvement (Horne et al., 2009). LCA has the potential to help firms achieve both reduced waste and emissions as

well as vibrancy in their brand by incorporating environmental considerations, creating sustainable advantages.

Eco-efficiency emphasizes sustainable practices that use resources and energy in a way that creates economic growth that is completely separate from environmental degradation. In another word, it focuses on the creation of more value with less. This concept motivates people to think creatively about both products and processes. Consequently, it leads to saving costs and decreasing the negative environmental impact. When companies take on eco-efficiency, they can greatly improve their environmental performance while still making money. Supply chain sustainability is defined through life cycle assessment (LCA) and eco-efficiency which drives economic benefit with environmental benefits.

Stakeholder engagement is crucial for effectively implementing Green Supply Chain Management (GSCM). Involvement of the various stakeholders such as suppliers, customers and employees of the internal operations is essential for framing, development and execution of sustainable policies and practices in the supply chain. As per Rane et al. (2021), stakeholder engagement is achieved through advanced technologies like blockchain and IoT. These technologies help to enhance engagement capabilities of stakeholder in light of supply chain with transparency, trust and communication. Technologies can help integrate critical success factors such as cooperation with buyers for green initiatives which is significant for the greening of supply chains (Rane et al., 2021).

In addition, stakeholder engagement is about participating as well as aligning the interest and responsibilities of all involved parties. Stakeholders generally want business partners to be socially responsible. Wu and Li (2020) state that the stakeholder involvement theory suggests that the partners' social responsibility can moderate the specific investment – green supply chain innovation performance relationship. Involving the stakeholders and sharing the ownership of sustainability significantly improves the performance of the green innovations in organizations. As Wu and Li (2020) mentioned, it is very important to make the stakeholders participative, and contributors realize GSCM objectives.

To sum up, Life Cycle Assessment (LCA) incorporation can play an important role in Green Supply Chain Management (GSCM) development. According to Crenna et al., (2018), LCA is a useful tool that assists in the assessment of the environmental impacts of biotic resources. By utilizing our natural resources wisely, we improve our eco-efficiency and sustainability overall. We can better complement our global trends. The implications of this converging process are essential in helping humanity towards a bioeconomy, moving away from fossil fuel dependence, and creating a new economic model. In the end, LCA adoption in GSCM processes can help it to be manufactured ecologically viable and sustainable over the longer term.

2.1.3 Practices of green supply chain management

Currently, Green Supply Chain Management (GSCM) has emerged as a competitive and crucial strategy for companies pursuing sustainable development through the integration of environmental and social considerations within the supply chain process. Sustainability has become a worldwide trend, and consequently organizations are using GSCM to foster pollution reduction while enhancing social and economic efficiency.

Green procurement consists of indicating involvement in GSCM behaviours and buying products that are environmentally friendly. It engages suppliers in the context of your environmental goals, meaning you take environmental considerations into account in the buying decision. It also entails having suppliers provide evidence of certification such as ISO 14001 or ISO 9001. Further, it means ensuring purchased goods comply with eco-design capabilities. Companies that work with suppliers are better able to assess their environmental performance and contribute to a more general set of sustainability goals.

Green design emphasizes minimizing environmental impact throughout their life cycle. This means designed to use minimum material, energy, allow recyclability and reusability, and not use hazardous substances. By focusing on eco-design, you'll reduce waste and recycling costs as well as increase sustainability, since a significant proportion of the effect on the environment is determined at the design stage. When companies focus on

green design, they can lessen their impact on the environment and look more socially responsible.

In reality, when companies practice green manufacturing, it means they are focusing on having production processes optimized. Such practices help to reduce the consumption of resources and waste generation. In addition, the more cleaner production technology and best practices are utilised, the more efficiency and negative impacts are efficiently reduced. Green manufacturing means to use the inputs with high efficiency and having low effect on the environment. The resulting emissions and waste are treated using environmental control equipment. Various innovative processes like recycling, reusing etc are adopted. These methods help to improve the environment and lower prices while raising profits.

Green distribution stands for the transportation and logistics of goods in an eco-friendly way. It is part of GSCM. We coordinate with customers for green packaging, upgrade freight logistics systems, and monitor product distribution emissions. Even though green distribution focuses on environmental gain mainly, it can help the economy by lowering expenses on packing and moving stuff around.

Eco-design and reverse logistics are effective tools of GSCM (Green Supply Chain Management) with which one can achieve GSCM. Reverse logistics refers to the moving of things from their final destination back to the manufacturer. The things that are moved back are moved for a proper disposal or for capturing value. Reverse logistics has the potential to enhance the environmental, social and economic performance of the supply chains. Actually, by implementing reverse logistics, companies will not only demonstrate reduced waste, recycling of materials and being environmentally friendly (Mutingi, 2014) , helps the environment but also makes money by recovering value from things that consumers returned. Eco-design focuses on designing products that do the least damage and cause the least pollution to the environment. This method promotes the use of materials that are sustainable, energy-efficient production, and design that allows for recycling. According to Marsillac (2008), companies can help decrease their carbon footprint and resource use by using eco-design principles. When eco-design is combined with reverse logistics, it helps improve overall sustainability and the sustainability of the

supply chain, both environmentally and economically. This dual strategy is key for firms that want to achieve long-term sustainability and competitive advantage on a global level.

Remarkably, sustainable packaging has been becoming one of the significant factors in practicing green supply chain management. So, as popular understanding, sustainable packaging means the usage of the packaging with leaving less impact on the environment but still make sure that those packaging still assures the quality of product packed inside it. In response to the increasing awareness of consumers and legislation, such as the United Nations Sustainable Development Goals (SDGs), which encourage the use of materials for sustainable packaging, which will take effect by 2030 (Asim et al., 2022). Sustainable packaging is using recyclable, biodegradable or renewable materials that uses less non-renewable materials and produces less waste (Morashti et al., 2022). Eco-friendly packaging is not easy to implement. It will require technological innovations as well as the formulation of infrastructure for recycling and composting and high cost. Regardless of all these challenges, the advantages are many, such as lower carbon footprint and competitiveness for businesses. The presence of sustainability trends and acceptance globally, encourage companies to take up sustainable packaging as a strategic manner. In relation to sustainable packaging, it relates to the materials it uses, and the packaging may optimize with the minimum use of that packaging material, and logistics (Morashti et al., 2022). To enable a circular economy where materials are reused, reducing the impact of supply chains on the environment, a systemic approach to packaging is key. Green supply chain management as the integrated reverse logistics eco-design and sustainable packaging in society as it concerns environmental sustainability Through these practices, waste and resource consumption along with the corporate reputation of the companies will enhance compliance with environmental regulations. The wider implications mean a dramatic shift to more sustainable business models that promote long-term ecological balance.

The use of GSCM practices can ultimately lead to sustainability in supply chain management. In fact, practicing the green their procurement, green design, green manufacturing and distribution, it means that is when the companies start to improve their economic, environmental, social performance and competitiveness. Vietnam belongs to

one of the developing countries so the practices of GCSM still limited. However, such practices can be a stepping stone to aligning with global sustainability trends and enhancing overall supply chain performance. In order for GSCM to be successfully implemented there has to be cooperative and collaborative efforts made by the supply chain partners (Le., 2019).

Lastly, when organizations employ GSCM practices, all aspects of performance show a positive trend. Research shows that the economy and social performance improve through green procurement and design. Environmental performance benefits from green manufacturing and distribution. Still, this interconnectedness means that not all practices impact performance the same. In fact, some practices can influence multiple performance dimensions.

2.1.4 Trends in GSCM

Changes taking place in the GSCM increasingly are carbon neutrality, digitalization, and so on. Trends are reshaping the operations of supply chains and their organization in line with sustainability goals and objectives. On the contrary, carbon 'neutrality' concentrates on minimizing one's carbon 'footprint' via new and better practices and technologies. The incorporation of digital technologies like IoT, AI, Blockchain, and 3D printing improves green supply chain management. According to Singh and Trivedi (2016), all these trends necessitate supply chains to adapt to environmental and eco-logical complexities which are on the rise.

About Carbon Neutrality in GSCM, the current scenario of Green Supply Chain Man-agement includes carbon neutrality. Incorporating CSR into GSCM system can enhance sustainability and firm performance. Internal and external CSR initiatives can help the business to implement the green practices across the supply chain. These programs help to reduce harmful effects while meeting stakeholders' needs. In turn, this creates a sustainable business (Wang et al., 2020). The companies' ability to optimize the utilization of resources and also manage stakeholder relations is enhanced by the help of big-data analytics in the role of CSR in GSCM (Wang et al., 2020). Carbon neutrality as a goal

within GSCM is to minimize Carbon footprint and be operationally sustainable. The introduction of green policies and technologies is important in this connection to lower greenhouse gas emissions and gain efficiency in energy use. The strategic implementation of carbon neutrality goals into supply chain activities not only provides environmental benefits but also enhances competitive advantage by lowering costs and improving brand image (Bhardwaj, 2016). Consequently, the drive for social responsibility and carbon neutrality in GSCM is not merely a compliance issue but also a performance and sustainability enhancement issue.

About Digitalization impact on GSCM trends, the introduction of digitalization into GSCM is bringing in opportunities and challenges that can help reshape how it works. The use of technologies like the Internet of Things (IoT), big data, cloud computing, blockchain and Artificial Intelligence helped to improve supply chain ability and sustainability. According to Wang, et al. (2023), when smart sensors, satellite technology, and machine learning techniques are combined, this helps us capture and analyze data in real time. Thus, it prevents bad decision making and resource wastage. An example of how technology helps the supply chain is the ability to easily track goods with IoT that reduces - waste and making the logistics process more efficient. - Big Data helps in knowing the buyer pattern that can be used for demand forecasting and stock managing.

Nevertheless, adopting digitalization in GSCM brings about several challenges. Some organizations may find it prohibitively expensive due to the high initial costs and the complexity of integrating. Furthermore, while digitalization has the potential to significantly reduce environmental harm, it brings on other risks such as further electronic waste, and energy usage at data centers (Sarkis et al., 2021). These challenges notwithstanding, digitalization can offer good opportunities to attain carbon neutrality and improve supply chain social responsibility. This will of course require extensive research and development.

In conclusion, incorporating social responsibility and carbon neutrality or gaze into the global supply chain management (GSCM) is crucial for sustainability. Social responsibility will help mitigate risks and improve resilience across the chain. With the environmental sustainability trends, enterprises must learn the ‘Why’ and ‘How’ of GSCM or Green Supply Chain Management.

2.2 CSFs in Green Supply Chain Management Implementation

Efficient implementation of Green Supply Chain Management (GSCM) is determined by a number of enabling conditions referred to as Critical Success Factors (CSFs). These CSFs are very important to reduce corporate environmental risk, abide by compliance obligations, and assure supply chain activities are consistent with sustainability goals. Since 1979, Rockart, J. F defined Critical Success Factors as the few key areas where satisfactory performance is essential to ensure the success of the organization. Through this research, he emphasized that the managers should focus on the critical areas where "things must go right" to increase the organizational competitiveness.

In the context of GSCM, CSFs are targeted to the strategic, operational, and collaborative practices that promote the uptake and diffusion of green supply chain concepts across an organization and its network. There have been many research and studies about CSFs in GSCM implementation which has identified Critical Success Factors typically fall into two primary categories, internal organizational factors, including leadership, employee involvement, internal processes; and external environment or collaborative factors, including relationships with organizations that work with and/or through the firm, compliance with regulations or laws, and stakeholder expectations (Zhu et al., 2008, Rao at al., 2005, Luthra et al., 2011). However, in some other studies conducted by Lamming & Hampson (2002) or Luthra et al. (2011), a more nuanced framework was constructed in order to better characterize the functional and strategic aspects of GSCM implementation. This further developed categorization sorts CSFs into four dimensions that have relationships within them: internal organization factors, external collaboration factors for stakeholder engagement, integrated operational and technological enablers, and finally strategic and policy integration.

In this study, the extended, four-part framework is used as the literature review foundation for the data collection and the findings: (1) internal organizational factors, (2) external collaborative factors, (3) operational and technological enablers, and (4) strategic and policy integration. Critical factors for GSCM practices under the extended framework have been identified by various authors; they are briefly summarized as Table I.

Table 1. Critical factors for GSCM implementation emphasized by selected authors

Category	CSF	Description	References
Internal Organization	Top Management Support	Commitment to sustainability from leadership	Lippmann (1999); Handfield et al. (2005)
	Employee Training	Environmental education and skill-building	Zhu & Geng (2001)
External Collaboration	Supplier Collaboration	Joint problem-solving and compliance improvement	Yuang & Kielkiewicz-Yuang (2001)
	Regulatory Compliance	Adherence to environmental laws and standards	Evans & Johnson (2005)
Operational & Technological	Green Procurement & Eco-design	Preference for environmentally sound products and designs	Lamming & Hampson (1996); Rao (2002)
	Environmental Monitoring	Systems to track emissions, waste, and resource use	Evans & Johnson (2005)
Strategic Integration	Cross-functional Coordination	Collaboration across departments for GSCM implementation	Luthra et al. (2011)
	Environmental Policy	Formal guidelines promoting green values and actions	Yuang & Kielkiewicz-Yuang (2001)

This extended classification will allow for a thorough assessment of the multidimensional difficulties facing the case company: Mapei Vietnam Ltd., a subsidiary of Mapei Group that works in the building products manufacturing sector, as they attempt to implement GSCM. An extended framework will help shape recognition and review of the key success enablers for GSCM implementation across the functional areas and stakeholder

interactions. Remarkably, this classification provides an appropriate structure for developing data collection, such as surveys, and questionnaire guides. The classification also supports the connection of empirical results to theoretical constructs and practical applications. It is a part of this broader perspective that can be effectively applied in the Vietnamese context, where institutional voids and resource constraints, as well as the growth of market expectations, have not generated wholesale commitment towards a research-based contextual evaluation of how to drive effective GSCM implementations.

2.3 Barriers and Challenges to GSCM

Although there is such worldwide increasing awareness of environmental sustainability, significant barriers and challenges for Green Supply Chain Management (GSCM) are still common, particularly in developing countries and high resource utilization industries such as building products manufacturing. In fact, businesses' experience of various hinders in implementing GSCM practices in their businesses have been presented in research through specific studies in countries or industries and those barriers and challenges could be categorized into different categories. However, so far most of the scholars have consistently identified that both internal and external barriers hinder the successful adoption of GSCM practices (Luthra et al., 2011). Internal barriers and challenges tend to arise from organizational limitations such as commitment from leadership, and resources or technical capability. On the contrary, external hinders are mentioned as the market conditions or environmental limitations from regulation and the complexity of the supply chain or resistance from stakeholders. Besides, Kumar and Joji (2023) recommended classifying barriers into seven main categories; technology and infrastructure constraints, governance limitations, economic limitations, and lack of knowledge, regulatory and policy environment, market constraints, and managerial issues. This study presents and discusses the foundation literature basing on those seven main categories as below:

About Technological and Infrastructure Constraints, they are considered to be one of the most frequently outstanding obstacles to green supply chain managements. In reference to the previous Trends section, these elements, which were the hinders, included the

limited access to advanced information systems, lack of digital integration among supply chain partners, and low levels of technology readiness (Luthra et al., 2011; Govindan et al., 2014; Sarkis et al., 2021). Therefore, without having appropriate systems for tracking and sharing environmental data, it is hard for companies to be able to track sustainability metrics and make data-driven decisions. These issues are worse, as the same manufacturing industries are using old legacy systems.

Governance Limitations involve weak coordination mechanisms in the supply chain and a lack of standardized green practices across the suppliers. For example, suppliers could resist environmental protocols because they do not perceive or see that it would cost them, or simply do not understand the protocols (Giannakis & Papadopoulos, 2016). A poorly integrated green governance structure may undermine collaboration required for closed-looped supply chains and eco-design.

Economic Limitations also serve as a key barrier to GSCM implementation. Many green initiatives - including eco-labelling, sustainable packaging, cleaner production technologies, and third-party certification require a lot of up-front capital to adopt. For small and medium-sized enterprises (SMEs), constrained access to financing and narrow operating margins make implementation of green practices all that more difficult and slower the pace of overall GSCM implementation (Luthra et al., 2011; Govindan et al., 2014; Nguyen & Le, 2020). Larger firms may also experience opportunity costs, where integrating green practices competes with other business priorities; this is particularly manifest in practice when profitability is positioned as a primary priority, often short-term, for example. Even in cost-sensitive industries, management may be reluctant to approve initiatives that, even in the longer term, represent indirect or uncertain returns, especially when environmental outcomes cannot be directly tied to a financial incentive or commercial gain.

Lack of Knowledge and Skills refers to internal awareness, expertise, or training in GSCM practices within the organization and among its supply chain partners. Externally, logistics providers or upstream suppliers may not have adequate knowledge of standards for the environment, which makes it challenging to align practices across supply chains (Hervani et al., 2005). Internally, employees may have the lack of technical knowledge and lack of desire to implement green initiatives. Those gaps in knowledge narrow the

firm's ability to pursue sustainability beyond functional (cross-functional) boundaries and outside (cross-organizational) the organization.

Regulatory and Policy Environment are most obviously experienced in countries that are developing environmentally as these regulations may not yet be a consistent part of business or may not be in place at all. Firm's complete environmental compliance in developing countries is often unknown as there are many expectations in determining compliance. As such compliance is often treated as symbolic rather than substantive (Christmann & Taylor, 2006; Ferrón-Vílchez, 2017). An absence of sustainability auditing frameworks and government incentives make long GSCM strategies less attractive (Ullah et al., 2021; Huang et al., 2022).

Market Constraints arise from low demand for green products or qualities, particularly in price-sensitive markets. Customers in these areas are just not able (or willing) to pay a premium for green alternatives; as such, the business case for organizations and firms to pursue sustainability is compromised (Nguyen & Le, 2020). Notably, in the building construction sector, procurement processes are almost always dominated by a cost perspective and, thus, environmental attributes are often not the priority.

Managerial Issues is one of the significant hinders. Weak Leadership to recognize that commitment from leadership as well as alignment for sustainability outcomes with corporate strategy is critical to driving GSCM implementations (Dube & Gawande, 2014). In many organizations, sustainability is not commitment – as one of the key areas that is limited to a single agenda item and only occurs once its scheduled or cyclical, it is often not built into performance measures or responsibilities that managers consider when setting individual accomplishments. While it is also exacerbated through poor levels of communication (interdepartmental), poor seeing the value of cross-functional teamwork, and silo-like organizational structures.

We need to keep in mind that barriers and challenges to GSCM are not just barriers that need to be hopped over but can also be used strategically as a focus for developing capabilities. A few authors have suggested that firms must develop critical success factors (CSF's), in order to deal with barriers effectively (Zhu & Sarkis, 2004; Luthra et al., 2011). Examples of CSF's include, but not limited to, leadership support, employee support,

suppliers support, and technology willingness or readiness to adapt. Thanks for identifying of critical success factors like the specific barries and challenges, it helps organizations convert operationalization issues into opportunities for innovation, resilience, and long-term sustainability performance.

The discussion findings presented in this section illustrate the complexity and interrelated nature of the barriers for GSCM in a developing economy and in a resource-intensive sector, such as the manufacturing of building materials. This section has established the conceptual basis for this research, which is to investigate the influence of critical success factors in overcoming the barriers of managing GSCM, related to the multinational subsidiary Mapei Vietnam.

2.4 Adoption of Green Supply Chain Management in the Building Products Manufacturing Industry

In the face of regulations and pressures on environmental safety, many industries are facing and adopting Green Supply Chain Management (GSCM) is an appropriate strategic response across the entire supply chain, including construction products and building materials. The adoption of GSCM initiatives in the construction and building materials industry can play an important role in promoting risk management. It can lead to improved operational efficiency and balance industrial development with environmental and sustainability goals (Zhu, Sarkis, & Lai, 2008; Dadhich et al., 2015).

2.4.1 Environmental Impact and Industry Responsibility

The building product manufacturing sector specifically and the construction industry more generally has significant effects on the environment and climate variability by emitting large quantities of attained emissions, production solid waste, and water pollutants from clerical raw material extraction and processing, like cement and steel, to finished product manufacturing and distribution of products (Rey-Álvarez et al. 2022;

Zhang et al. 2024). The capacity of the sector is echoed in the report, which stated that in 2022, 34% of global energy demand came from the building and construction industries, which generated almost 37% of global CO_2 emissions, which indicates the need for systemic change on how sourcing and distribution in the building and construction industry operates (UNEP/GlobalABC, 2024).

The industry exhibits characteristics that are resource-dependent and its environmental effects are often long-lived, particularly in the case of embodied carbon in the use of construction materials; and there are significant opportunities for sustainable supply chain management. Green supply chain management (GSCM) provides a framework for improving the environmental performance of industry by embedding environmental concerns in all aspects of the supply chain, from the product design stage to the sourcing of materials, manufacturing, distribution, use and the end of a products life (Srivastava, 2007).

2.4.2 Rationale for GSCM Adoption in the Sector

The implementation of GSCM in the building products manufacturing sector is increasingly driven by regulatory obligation, market expectations, stakeholder pressure, and corporate social responsibility for the environment (Wang, & Benitez-Amado, 2020). Many studies have demonstrated that GSCM practices - such as eco-design, green procurement, closed-loop material flow, and cleaner production - have the potential to improve firm competitiveness, while also generating environmental benefits (Rao & Holt, 2005; Luthra et al., 2011). Particularly impactful for manufacturers, GSCM practices provide opportunities to respond to green building certifications, for example, LEED, EDGE, government climate targets, and growing consumer demands for sustainable construction alternatives.

The GSCM-related practices have the advantages of and carry environmental benefits, and operational efficiencies, generate savings through waste reduction, improved regulatory compliance, enhanced brand value and resilience - a potential competitive advantage for long term success (Testa & Iraldo, 2010; Hsu , Zailani, & Ramayah, 2013). Such advantages and benefits help manufacturers to be well-operated regardless of the

emerging markets, where there are a lot of pressures from global competition and environmental obligations.

2.4.3 Sector-Specific Challenges and Drivers

As now reviewed in the summary of barriers and challenges section generally, this section is more concerned with sector-specific constraints. While the benefits of the GSCM model may seem visible, companies involved in the building materials industry are still faced with certain issues as they develop GSCM frameworks. For starters, technological constraints hinder the adoption of GSCM due to the limitations of production systems used in clean technologies which are low in automation (Kouhizadeh, Sarkis, & Zhu, 2021). Secondly, the additional financial factors involved in sustainable materials, such as certification and increased costs, also hinder the investment in sustainable materials, especially in price-sensitive markets where profitability, the benchmark for the boom-and-bust cycles, is viewed more favourably than sustainability (Lambert, Cooper, & Pagh, 1998; Abbasi & Nilsson 2012).

One more significant challenge is the fragmentation of the supply chain. Specifically, in the supply chain for building materials, different organizations, including manufacturers, subcontractors, logistic providers, and retailers, often lack organization and a focus on sustainability (Vrijhoef & Koskela, 2000). Also, inconsistent regulatory framework is another obstacle; therefore, many developing economies (such as Vietnam) will have environmental regulations, but these regulations are often poorly enforced or vaguely defined (World Resources Institute, 2007; Bui, 2018).

Another critical issue is that of supply chain fragmentation. Specifically, within the building materials supply chain variety of actors, including manufacturers, subcontractors, logistics providers and retailers, experience a level of disorganization and lack of focus on sustainability (Vrijhoef & Koskela, 2000). Also, regulatory inconsistency is an additional hurdle; many developing economies, Vietnam for example, may have environmental regulations, but those regulations are poorly enforced or vaguely defined (World Resources Institute, 2007; Bui, 2018).

Still, companies also face drivers for change through external drivers like green procurement policies, stakeholder pressure, and MNCs which shape the sustainability of local firms supply chain as they require environmental compliance from the entire value chain upstream (sourcing), midstream (production), and downstream (distribution and/or marketing) (UNEP, 2022; Zhu & Sarkis, 2007; Zhu & Geng, 2013; Hsu et al., 2014).
Figure 2 includes the broad context of the construction value chain and shows the potential ways green practice (green design, green materials, green marketing, etc.) is undertaken in the upstream, midstream, and downstream areas**.**

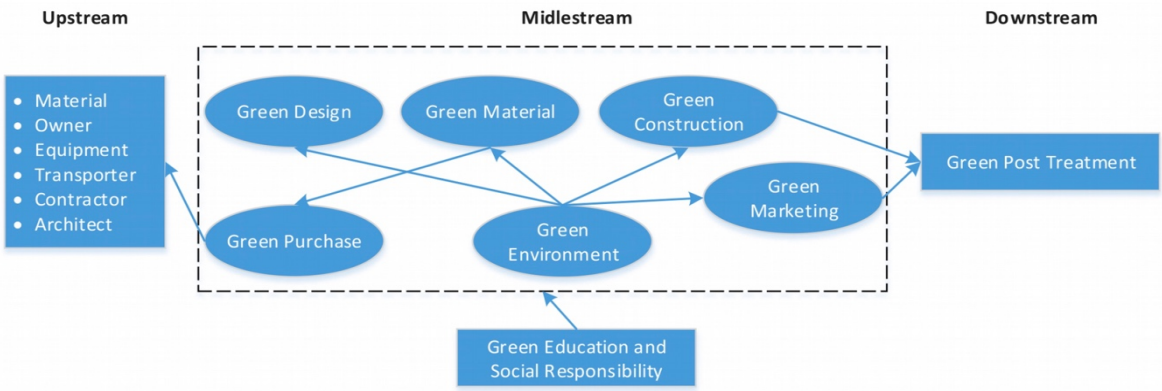

Figure 2: Value chain construction industry (Ghobakhloo et al., 2013)

2.4.4 GSCM Frameworks for the Building Products and Construction Industry

Although there are several GSCM frameworks available for the construction and building-products sector, in this thesis, we adopt a six-stage process-based framework attributed to Ghobakhloo et al. (2013) and follows the version reproduced by Wibowo et al. (2018). The summaries of the stages described below build on the original model with additional information taken from the literature published after 2013:

• Green initiation: The establishment of sustainability goals at the start of the project or product lifecycle.
• Green design: The implementation of Life Cycle Assessment (LCA) and sustainable features of products and processes (Zhang, Shen, & Wu, 2011);

• Green materials management: The use of low impact, recyclable, or renewable materials in development; for procurement, schools need to select products in alignment with green sourcing standards (Choi & Hwang, 2015);

• Green construction/production: Reduce waste and emissions in construction/production through technology and process controls (Shi et al., 2013; Balasubramanian & Shukla, 2017);

• Green operations and maintenance: Operational sustainability and efficiency throughout the products' useful life (Hong et al., 2015);

• Reverse logistics: To enhance circularity and reduce post-use waste recovery and reuse of materials (Sarkis, Zhu, & Lai, 2011; Sobotka & Czaja, 2015).

Figure 3 exemplifies the phases in their flow, interconnectivity, and considerations of energy and waste.

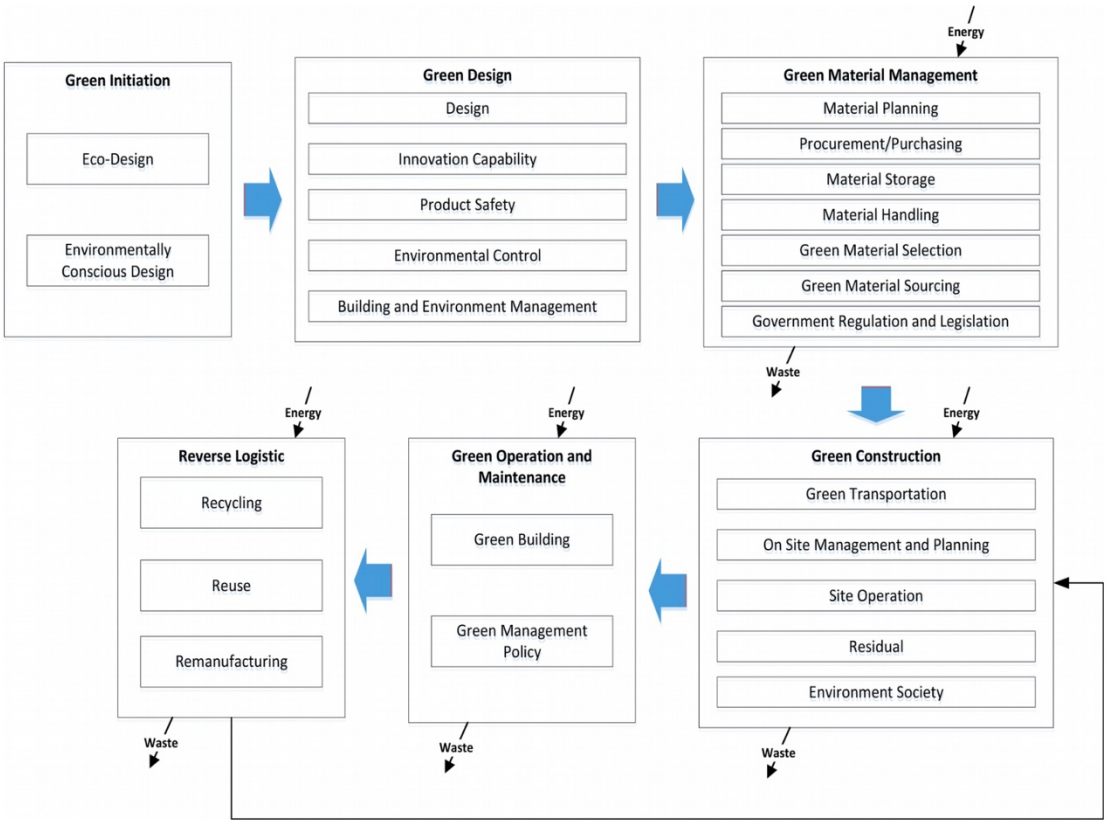

Figure 3: Framework of green supply chain processes for implementation in the construction industry (Ghobakhloo et al., 2013)

These frameworks provide a theoretical foundation in identifying relevant Critical Success Factors (CSFs) to implement GSCM in the building products manufacturing industry and can be used to develop the survey and analysis tools for empirical findings.

2.4.5 Implications for the Building Products Sector in Vietnam

The construction and manufacturing sectors in Vietnam are being subjected to increased environmental pressures from rapid urbanisation and infrastructure development. While national policies, such as the Vietnam Green Growth Strategy, are in place, their inconsistent implementation creates barriers to full GSCM adoption (Tran Trong Duc et al., 2025). Limited availability of clean technologies and green financing, as well as a lack of transparency and collaboration in many supply chains, further complicates the issue for many of Vietnam's supply chains.

Nonetheless, the improved policy climate and participate from foreign-invested enterprises creates opportunities to make changes. International companies doing business in Vietnam including subsidiaries of MNCs are well-placed to take the lead on GSCM initiatives using global sustainability frameworks and influencing their suppliers. Using models proposed by Ghobakhloo et al. (2013), with local modifications to account for context-specific barriers, such as low consumer awareness, minimal institutional pressure to change and a fragmented supply chain, will help promote GSCM.

3. RESEARCH METHODOLOGY

This thesis investigates Critical Success Factors (CSFs) that are necessary in the implementation of Green Supply Chain Management (GSCM), through a case study of Mapei Vietnam Ltd - a subsidiary of Mapei Group.

3.1 Case Company: Mapei Vietnam Ltd.

Founded in 1937 in Milan, Italy, Mapei Group is the world leading manufacturer specializing in manufacturing building chemical products such as adhesives, waterproofing, concrete Admixtures, Flooring products, Products for Underground constructions, and repair materials. As of 2023, Mapei Group has over 80 countries in operation with 83 plants and approximately 12,500 employees, generating €4.2 billion of turnover. Mapei Vietnam, founded in 2005 plays a vital role in this company's expansion process in Southeast Asia with a manufacturing facility located in Chu Lai Industrial Zone, in Nui Thanh District, Quang Nam Province, which follows European quality standards and ISO 9001:2015 certification. Mapei Vietnam's operations include Procurement, Production, Logistics/Warehousing, QA/QC, Sales/Customer Support, to Health and Safety (EHS) sections that are engaged in part of the supply chain activities and are significant for this research. Over the past few years, Mapei Vietnam has implemented a more diverse range of green supply chain practices to minimise environmental impact (in terms of emissions and waste) and utilise resources (energy, water, etc.) more efficiently, comply with environmental-needs legislation, and respond to customer requests for sustainability. Along with these changes, Mapei Vietnam would also be supporting the Mapei Group ambition for carbon-neutrality by 2050, and to meet the company's ongoing global mission to develop more eco-friendly products, create and adopt renewable energy procurement, and engage in carbon credit trading. Mapei Vietnam will also be the local implementation of the Group's Global Sustainability targets. Mapei Vietnam offers a compelling case for pursuing GSCM in a developing economy, given the company's vast supply chain operations experience, demonstrated commitment to sustainability, and experience with actors like suppliers and logistics partners. It provides a real-world context to study internal and external CSFs affecting GSCM practice.

The case's overall objective was for applied research to present the internal and external perspectives and to identify the important enablers and barriers to the implementation of GSCM of a subsidiary of Mapei Group in the building products manufacturing industry in Vietnam.

3.2 Research Design

This research uses an embedded, single-case study design (Yin, 2018) at Mapei Vietnam Co., Ltd., a subsidiary of a multinational group practicing Green Supply Chain Management (GSCM), in a developing economy context. A single case is suitable because the fact that researching for critical success factors (CSFs) for GSCM in building products manufacturing in Vietnam requires a depth of context specific approach. Mapei Vietnam is purposely informative theoretically, and accessible as a data case, at the intersection of global sustainability aspirations and local constraints. The design is embedded in order to capture multiple units of analysis from internal departments (Procurement, Production, Logistics/Warehousing, QA/QC, Sales/Customer Support, to Health and Safety (EHS) to selected external stakeholders (suppliers, logistics partners) to create a comprehensive understanding of the implementation process.

The research methodology is mixed methods, collecting quantitative and qualitative data to improve the results (Creswell & Plano Clark, 2018). Quantitative data (e.g., Likert scale questionnaire items) allow for an overview of the perceived importance of the CSFs and the GSCM practices and qualitative data (e.g., open-ended responses and a short questionnaire to external stakeholders) gives explanations and examples of the CSFs and their consideration for GSCM. The mixed-methods triangulated datasets are used to generate findings by comparing and contrasting responses that support and strengthen convergence and credibility through data triangulation - corroborating results using multiple sources and methods.

As previously discussed in the Literature Review, Vietnam, as a rapid industrializing country, is exposed to global supply chain pressures and developing environmental

regulation and makes Mapei Vietnam a suitable context to examine the opportunities and challenges to implementing GSCM in a multinational corporation (MNC) subsidiary. This research involves inductive reasoning; for example, it allows themes, patterns, and relationships to emerge from the data and does not test a predetermine hypothesis and develops an empirically grounded representation of CSFs for GSCM at Mapei Vietnam.

3.3 Data Collection

This research used a mixed-methods approach, combining with quantitative and qualitative data to gain an understanding of critical success factors (CSFs) for Green Supply Chain Management (GSCM) at Mapei Vietnam. For the quantitative approach of the study, a structured Likert-scale survey was used with internal employees of Mapei Vietnam working in Procurement, Production, Logistics/Warehousing, QA/QC, Sales/Customer Support, to Health and Safety (EHS). The survey solicited the ratings of the importance of selected CSFs and the extent to which the related GSCM practices are employed. The survey also contained a small number of open-ended questions, so respondents could elaborate on their ratings and provide examples. The thesis included a short survey consisting of open-ended questions were sent to selected suppliers, and logistics partners, as an external view which asked opinions on collaboration, capability, and external pressures.

To involve participants directly engaged in the Mapei Vietnam supply chain operations, purposive non-probability sampling was employed. This strengthens the relevant data obtained and enables the identification of critical success factors (CSFs) that ultimately influence GSCM performance.

Participation was voluntary, and informed consent was received from every participant at the time of the survey distribution. Respondents were informed of the study purpose, that the data would be handled in a confidential manner, and that there was the option to withdraw from participating at any given time without consequence. A copy of the consent script can be found in Appendix 3. This procedure was designed to ensure that the study adhered to guidelines for expected research ethics standards.

3.4 Surveys and Questionnaires Development

The comprehensive data needed to address the research questions and objectives was obtained through the development of two parallel instruments**.** One of the instruments targeted internal staff and the other targeted external stakeholders. Both the staff and stakeholder instruments were designed to seek insight into the Critical Success Factors (CSFs) for implementing Green Supply Chain Management (GSCM) at Mapei Vietnam from both an organization-specific and an external perspective. Data were collected using two online questionnaires which were administered concurrently via Webropol. They were available in Vietnamese (primary language) and English. The Vietnamese version was translated and checked by bilingual reviewers together to confirm clarity and consistency of the instruments. The instruments were sent through an email with an anonymous link to the online survey on Webropol with no names or contact info collected.

For the Internal Staff Survey, internal employees participated in both Part A and Part B of the survey tool. Part A consisted of background information such as department, years of experience) and asked respondents to rate the importance and the current level of implementation of the various CSFs in four categories:

a. Internal organizational factors
b. External collaboration factors
c. Operational and technological enablers
d. Strategic and policy integration

The questions used a five-point Likert scale that is well established for measuring perceptions and attitudes in organizational studies (Likert, 1932; Joshi et al., 2015).
Part B asked internal employees to estimate the contribution of each CSF to GSCM outcomes e.g. emission reductions, cost savings, or improved environmental compliance. There were also open-ended questions in this section to allow the respondent to provide additional information based on their experiences, obstacles, and ways to improve GSCM at Mapei Vietnam.

A total of 11 employees from Procurement, Production, Logistics/Warehousing, QA/QC, Sales/Customer Support, to Health and Safety (EHS) departments completed the survey.

These employees were selected based on their hands-on involvement with the company's supply chain management and sustainability practices.

For the External Stakeholder Questionnaire, a slightly modified version of Part B was sent to selected stakeholders with which Mapei Vietnam has an ongoing relationship. These were long-term suppliers, logistics partners and strategic customers.
External stakeholders were only asked to complete the external Part B, which was adapted for their role and level of engagement with Mapei. This was done deliberately to prevent them from having to evaluate internal activities that they otherwise may not have any familiarity with, and to increase the validity and appropriateness of the data obtained.
Part B for external stakeholders was adapted for respondents to:

- Evaluate CSFs contribution to GSCM outcomes from an external view (e.g., leadership commitment, supplier collaboration, regulatory compliance etc.),
- Describe their experiences and observations when collaborating with Mapei Vietnam,
- Offer suggestions that could improve GSCM effectiveness in the company's supply chain ecosystem.

The external partner selection included a total of 6 partners based on their business relationship with Mapei Vietnam and their sustainability focused activities of sourcing, transport, or distribution of eco-friendly products.
The opportunity to combine reaction from both internal and external stakeholders provides a multi-dimensional perspective so that a better understanding of CSFs can be achieved and how they can be realized not only in the organization, but in Mapei Vietnam's entire supply chain ecosystem.

3.5 Data Analysis

The data in this research is examined through a mixed-method design which includes both quantitative measures from surveys and qualitative measures from open-ended answers. Adopting this mixed-method approach helped evaluate statistical trends along with real-world perspectives of the participants.

To quantify the responses from the survey, we used 5-point Likert scale (1 = very low, 5 = very high) to evaluate the importance of each critical success factor (CSF), and how much the related practices were being implemented. After confirming that the responses were complete, we summarized them in Excel using averages (means) and standard deviations for the overall sample, and for internal staff and external stakeholders. We did not run statistical tests because the sample was small and non-random. Rather, we presented simple differences between the average scores for the two groups. We also included a 100-point constant-sum question wherein each person allocated 100 points across the five CSFs and reported the average, how much they spread out their scores, and the minimum–maximum values. For several of the practice-adoption items where we used “Yes / No / Not sure” we presented the percentages to make stronger or weaker uptake more apparent. Using Excel we constructed all tables and figures.

In the qualitative aspect of the analysis the open-ended responses were all exported into an excel spreadsheet and read a number of times until the content was familiar. These representations of meaning were then grouped into similar statements into short codes and in turn developed that grouping into a small number of clear themes in preparation for Chapter 4. In short, coding responses produced three themes. The first theme, Key CSFs for Mapei Vietnam and their impact, essentially reflects how respondents were describing the important factors for GSCM and impact they perceived these factors to have. Next, SCM outcomes and stakeholder perspectives brings together statements about perceived outcomes of supply-chain practices which were also informed by how internal staff and external stakeholders view and respond to supply-chain outcome. Finally, Challenges and strategies for improvement encompassed statements about barriers to implementation and the practical responses that participants think will be workable within the case context. As a lightweight quantitative measure in addition to these themes we also quantified responses in terms of selected themes along with counts or percentages.

After creating a quantitative summary and the qualitative themes, we compared them side by side to establish where they had the same conclusion, where one provided useful explanatory detail for the other, and where they differed from one another. This allowed us not just to be able to report what CSFs and practices appeared important in the

survey, but how participants discussed their practice their CSFs in practice. We then linked the combined understanding back to the framework we developed in the literature review (internal, external, operations/technology, and strategy/policy), so the work in Chapter 4 is consistent with the rest of the thesis.

We centered our attention throughout the focus on clarity and transparency instead of complex methods. For example, we displayed simple averages and standard deviations, very clear group contrasts, simple percentages, reading and grouping comments closely, and presenting numbers compared with words. This level of analysis is appropriate for the purpose of the study and the sample size and provides readers with a very explicit basis for understanding the results that follow.

3.6. Limitations of the Research Method

Although this study provides very practical knowledge on how to implement Green Supply Chain Management at Mapei Vietnam Ltd., It is inevitable that there are a number of limitations that should be acknowledged. Firstly, this is a single-case study scope. It means the study only emphasizes one specific company-Mapei Vietnam Ltd., to represent the building products manufacturing industry. This provided a way to conduct deeper levels of analysis of internal and external Critical Success Factors (CSFs), but the findings may not be completely generalizable for other companies, industries, and countries. The organizational culture, level of maturity, and operational environment of Mapei Vietnam may differ from other firms - more so if the firm is not manufacturing or located in a more developed economy. Secondly is the sample size constraints. There was a relatively small size sample for the research, 10-15 individuals from internal staff, and 4-6 from external stakeholders. Although those selected were active participants in supply chain and sustainability related roles, the small number of participants may limit perspectives, especially from the category of external stakeholders. With this in mind, the data could not reflect the full experience and opinions that could be present across supply chain network as part of Mapei Vietnam's broader context. Thirdly is self-reported data bias. Because as mentioned above, not only the survey but also the open-ended questionnaire was reliant on self-reported data which easily led to the likelihood

of response bias, with participants unaware of their own potential biases to exaggerate or downplay their views due to social desirability, misunderstanding the questions, or recall limits. Although some actions were taken to prevent or mitigate this limitation such as such as anonymity and non-judgmental questions, some bias will likely remain. Finally, it belongs to the dynamic nature of GSCM practices. In detailed, GSCM practices and associated CSFs can change over time as a result of shifts in corporate strategy, regulations, technology or market demand. Therefore, the findings from this research provide a specific point in time and do not necessarily consider future circumstances or long-term sustainability outcomes for either Mapei Vietnam, or the wider industry.

Having articulated the methods and data collection tools and approaches, the next chapter presents the significant findings and analysis from stakeholders both internal and external to Mapei Vietnam.

4. EMPIRICAL FINDINGS AND RESULTS

This chapter shares the empirical results from the Mapei Vietnam Ltd case since it combines descriptive statistics from the survey with a qualitative analysis of the open-ended survey responses. The analysis follows the mixed method design in Chapter 3 and is arranged to answer the research questions while maintaining the context of Mapei Vietnam as a subsidiary of Mapei Group and aligned with Mapei Group's sustainability goals. The final analytic sample is N=17 (11 internal staff; 6 external stakeholders). External respondents are included as a single aggregate group since the information of roles was not captured in a structured field. Each theme includes both strands of evidence. Sections 4.2 (Key Critical Success Factors for Mapei Vietnam and Their Impact), 4.3 (Supply Chain Management Outcomes and Stakeholder Perspectives), and 4.4 (Challenges and strategies for improvement) provide the relevant quantitative indicators alongside coded qualitative findings from the open-ended survey responses. Chapter 5 will then provide a discussion of these findings, as well as the groundwork for the recommendations framed in Chapter 6.

4.1 Respondent profile

The final analytic sample consists of 11 internal employees and 6 external stakeholders. External stakeholders were purposively selected, as outlined in our design in Chapter 3, in order to allow for upstream and downstream perspectives in Mapei Vietnam's supply chain including the suppliers of raw and packaging materials, logistics partners involved in domestic transport and warehousing, and strategic customers in targeted categories. The finished dataset does not have a structured field for type of external stakeholder and the role, optional open-text field, was left blank. For this reason, the external analyses in this chapter treat the six external respondents as a single, aggregate external stakeholder group. We also acknowledge this aggregation as a limitation of the study by seeing Limitations (Chapter 6). This strategy is consistent with an embedded single-case design which means it maintains the internal–external contrast built into the design while protecting anonymity and avoid over-interpretation of very small subcells. In terms of the internal subsample, the representation captures the key functions in the supply

chain from Procurement, Production, Logistics/Warehousing, QA/QC, Sales/Customer Support, to EHS, while the experience indicated by tenure and role suggests a good combination of junior and senior perspectives.

Table 2: Respondents by role group (full sample, N = 17)

Group	Number of responses (n)	% total sample accounted
Internal employees	11	64.7
External stakeholders	6	35.3
Total	**17**	**100**

Table 3: External stakeholders

Stakeholders type and role	Number of responses (n)
No structured field in responses*	6
Total	**6**

*Note. There was no structured field in the survey for type of external stakeholders. All six external respondents left the optional open-text role field blank. Invitations were sent to suppliers, logistics partners and strategic customers in line with the pre-sample plan; individual affiliations are not identifiable from the realized responses. Therefore, both external analyses discussed in this chapter present this group in the aggregate.

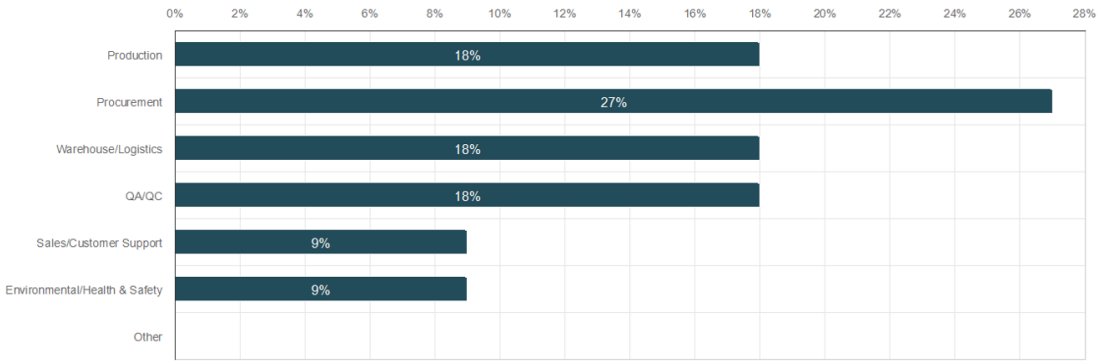

Figure 4: Respondents by department (internal, n=11)

Table 4: Respondents by department (internal, n=11)

Department	Number of responses (n)
Production	2
Procurement	3
Warehouse/Logistics	2
QA/QC	2

Sales/Customer Support	1
Environmental/Health & Safety (EHS)	1
Total	**11**

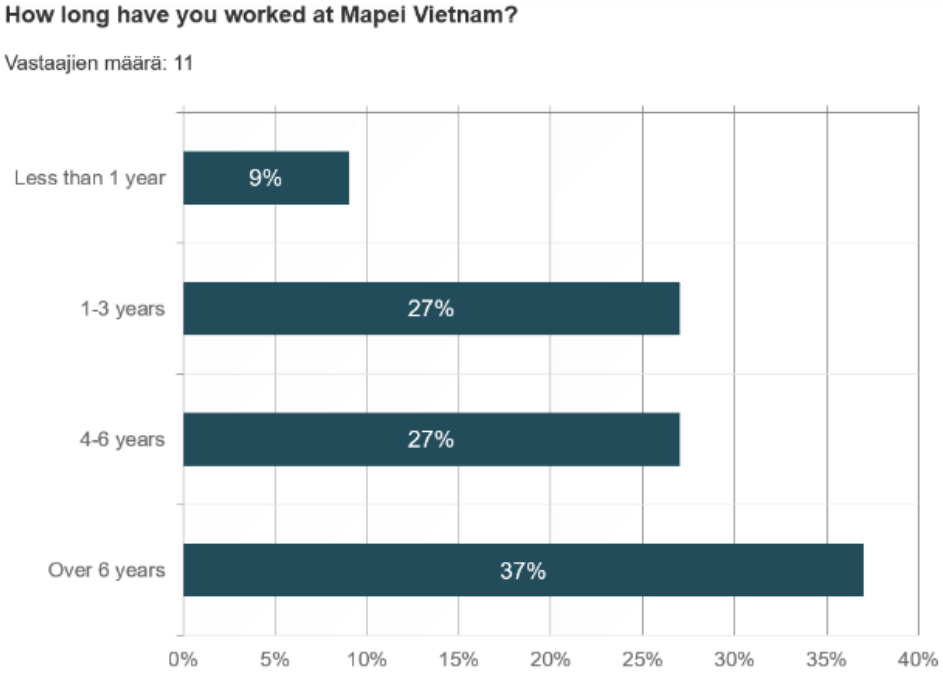

Figure 5: Years of working at Mapei Vietnam (internal, n = 11)

Table 5: Years of working at Mapei Vietnam (internal, n = 11)

Years at Mapei Vietnam	**Number of responses (n)**
< 1 year	1
1–3 years	3
4–6 years	3
> 6 years	4
Total	**11**

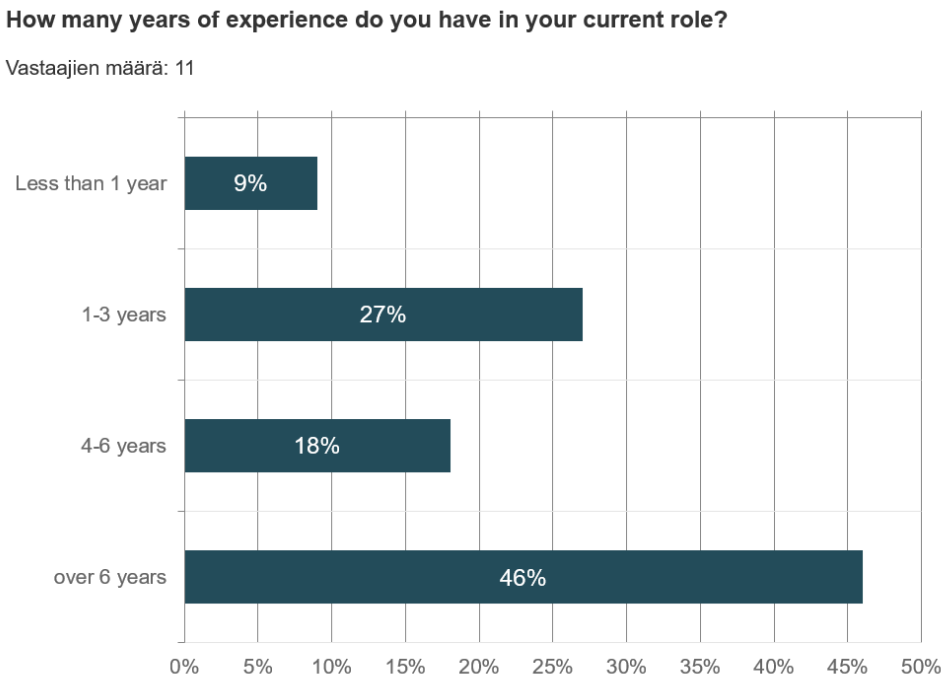

Figure 6: Role experience in current position (internal, n = 11)

Table 6: Role experience in current position (internal, n = 11)

Role experience	Number of responses (n)
< 1 year	1
1–3 years	3
4–6 years	2
> 6 years	5
Total	**11**

Based on Table 6, internal respondents have a solid amount of experience in their current role: 7/11 (63.6%) report ≥ 4 years (2 with 4–6 years; 5 with > 6 years), 1/11 (9.1%) report < 1 year, and 3/11 (27.3%) report 1–3 years. The amount of experience reported bolsters the credibility of their judgments about day-to-day practices and constraints. On the other hand, the considerable influence of longer tenured views may under-represent the views of a more novice tenure. Therefore, readers should view findings as the assessments made by increasingly experienced practitioners, within the context of the subsidiary.

Based on the illustrations above, the distributions demonstrate evidence reflecting both operational and managerial perspectives, rather than typically reflecting a single view.

4.2 Key Critical Success Factors for Mapei Vietnam and Their Impact

Respondents rated five important critical success factors (CSFs) on a five-point scale based on a Likert-type questionnaire.

Table 7: Average importance ratings of CSFs (1–5)

CSF	All (N=17) Mean (SD)	Internal (n=11)	External (n=6)	Δ (External – Internal)
Top management commitment	4.40 (0.50)	4.36	4.45	+0.09
Supplier collaboration	4.20 (0.75)	4.09	4.45	+0.36
Regulatory compliance	4.10 (0.72)	3.91	4.60	+0.69
Financial support	4.00 (0.63)	4.18	3.60	−0.58
Employee training	3.10 (0.25)	3.09	3.00	−0.09

According to Table 7, the pattern is clear and theoretically consistent with Top management commitment rated highest positively on average (4.40, SD 0.50), followed by Supplier collaboration (4.20, SD 0.75) and Regulatory compliance (4.10, SD 0.72); Financial support rated moderately high (4.00, SD 0.63), and Employee training rated lowest (3.10, SD 0.25). Differences between groups provide some insights. External stakeholders place a lot more weight on regulatory compliance than internal staff, which takes on a new meaning not only from the challenges to find access to, and to manage risk in, the broader building-products supply chain but also in the context of customer and regulator demands with conversely, the internal respondents reported more positive responses to financial support than externals, which contextualizes how budgets enable day-to-day implementation of plans.

Table 8: 100-point allocation across CSFs (overall contribution to GSCM)

CSF	Mean %	SD	Min	Max
Supplier collaboration	23.5	5.8	15	30
Top management commitment	22.4	3.6	20	30
Financial support	21.0	3.9	15	30
Regulatory compliance	20.0	4.0	15	25
Employee training	13.5	3.4	10	20

As showed in Table 8 above, respondents allocated 100 points across the five CSFs using a constant-sum approach, to provide a relative-contribution perspective to the importance ratings. The pattern is noticeable: Supplier collaboration (23.5%) and Top management commitment (22.4%) claim the largest contributions, a stable and not overly different middle tier of contributions came from financial support (21.0%) and Regulatory compliance (20.0%), while Employee training (13.5%) is the least.

Table 8 provides an overview of the distribution of the 100 points. Mean % indicates the average percentage assigned to each CSF. SD indicates how uniform the responses are in relation to that mean (lower SD = greater agreement; higher SD = greater variation). Min - Max indicates the lowest and highest percentage assigned by any individual. Overall, the results show some variation between respondents, as indicated by the SD and Min - Max, but not enough to change the overall ordering. Therefore, we will use the ordering as is but allow some minor adjustments to accommodate the local context in the implementation plan in Chapter 6.

4.3 Supply Chain Management Outcomes and Stakeholder Perspectives

In examining how CSFs evolve from intent to practice and outcomes, descriptive adoption indicators with stakeholder input were triangulated to reveal mechanisms and effects. The picture of internal implementation demonstrates uneven maturity: while several practice items are commonly adopted, the areas of capability that were more closely related to both digital monitoring and logistics in sourcing and upstream logistics coordination attracted the most uncertainty. In particular, green technologies showed a very high "Not sure" share, with about 73% (see Figure 7), and supplier compliance with green standards was torn (45.45% Yes / 36.36% Not sure / 9.09% No) (see Figure 8 - suggestive of constraints in tools and data and uneven readiness upstream.

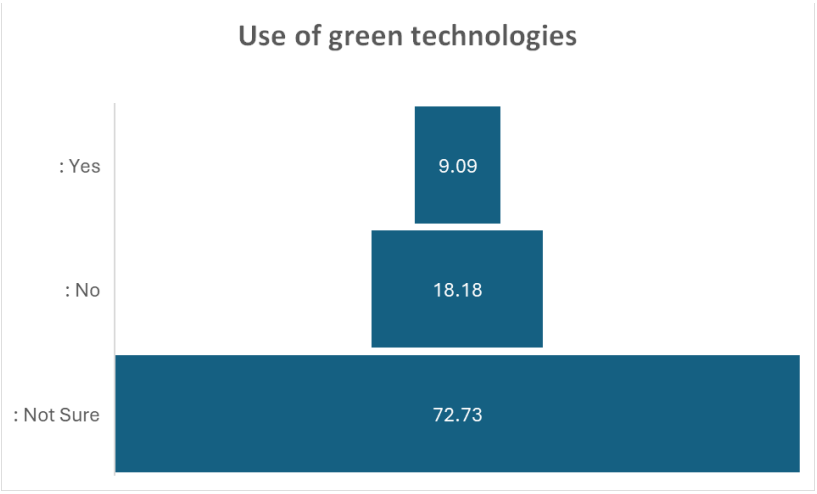

Figure 7: Use of green technologies

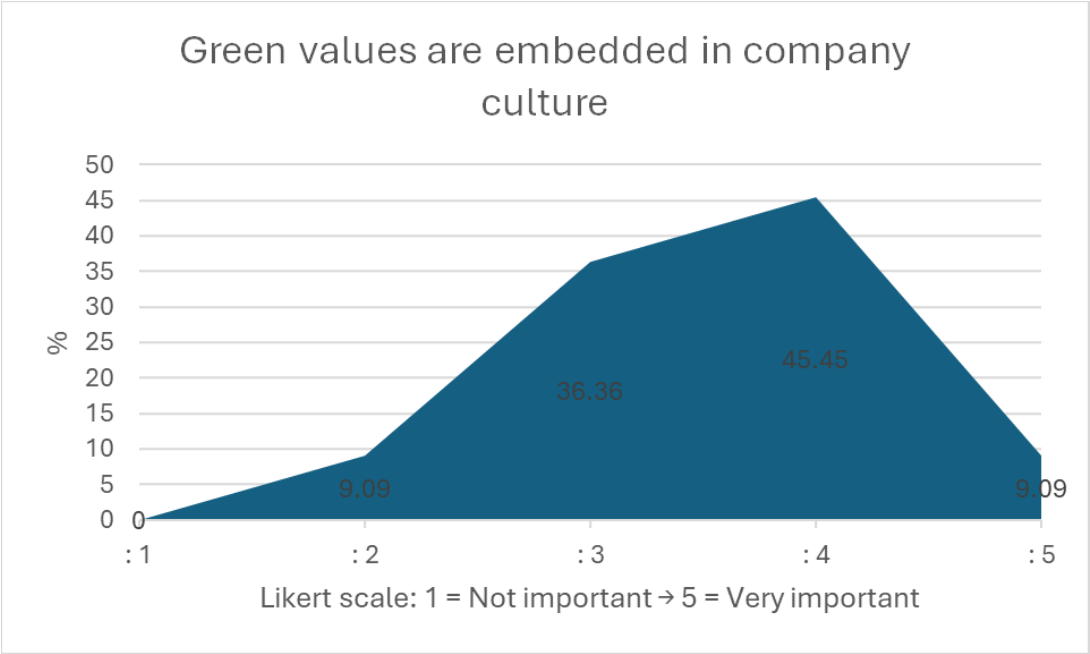

Figure 8: Suppliers meet green standards- internal respondents

Qualitative data sheds light on how the priority CSFs are connected to daily practice at Mapei Vietnam. One area of evidence for leadership accountability is the translation of departmental goals into manager's KPIs at the departmental level and ongoing monitoring. Supplier collaboration has permitted various forms of physical action - material substitutions, returnable-packaging loops, cleaner-production changes, load consolidation, etc. - all of which are positive for the environment and could provide market positioning. Regulatory compliance brings rigor to process and documentation (e.g., Environmental Product Declarations (EPD)/ Life Cycle Assessment (LCA) and certificates) that provides

customer confidence and access to monitored tenders and markets. The external stakeholders explicitly referred to collaboration and compliance as linked to customer specifications and certification systems and rated compliance to regulation higher than the internal staff (Table 7).

Table 9: Most influential CSF nominations

CSF	Number of responses (n)	Account %
Supplier collaboration	6	35.3
Top management commitment	4	23.5
Regulatory compliance	3	17.6
Financial support	2	11.8
Employee training	0	0
Other / not specified	2	11.8
Total	**17**	**100**

As can be seen in Table 9, the open-ended question about the "most influential CSF" in the survey, which indicates support for this interpretation. For that item, we found that 6/17 (35.3%) of respondents mentioned supplier collaboration, 4/17 (23.5%) mentioned top management commitment, 3/17 (17.6%) mentioned regulatory compliance, 2/17 (11.8%) mentioned financial support and, 0 mentioned employee training. The remainder mentioned "other/ (not specified)" at 2/17 (11.8%). The lack of nominations for employee training indicates issues of design and ease of implementation rather than lack of relevance.

In totality, the converging evidence suggests that all of the prioritized CSFs are already influencing practice and outcomes at Mapei Vietnam, with the evidence also pointing towards possible shortcomings in their capability regarding data, monitoring, and coordination upstream. These motivations will influence the performance-improvement-enhanced models/strategies in the next section, as well as the time-phased implementation plan we present afterwards.

4.4 Challenges and Strategies for Improvement

This section connects every challenge with its suggested response to empirical evidence from two sources (as shown in Table 10). The first source consists of quantitative indicators (relative importance ratings, 100-point allocations, and proportions adopted presented in Tables 7-8 and Figures 7-8), and the second source comprises the qualitative analysis of the open-ended responses. Taken together, these sources point to capability gaps that undermine impact and where probable critical success factors (CSFs) may be used to address these gaps in Mapei Vietnam's context.

The table was constructed into 4 steps and read from left to right. For Step 1, Challenges were established from the thematic coding of open-ended responses, and then cross-checked against quantitative trends (e.g., lower mean ratings, high "Not sure," or uneven adoption). Step 2 is Supporting Evidence. For each challenge, the table provides the key quantitative indicators (from Tables 7-8; Figures 7-8) and the outstanding qualitative statements that indicate the nature of the gap. Step 3 is Interpretation. The interpretation column describes this evidence means in practice (the operational/managerial meaning of gap). Step 4 is suggested CSF-aligned response. The response column identifies practical actions aligned with the study's CSF's (top management commitment, supplier collaboration, regulatory compliance, financial/resource support and training). Actions are based on both: (a) the significance of the CSF' s in the findings and (b) feasibility for a resource-constrained subsidiary.

Table 10: Challenges, supporting evidence and interpretations, and CSF-aligned responses

Challenges	Their supporting evidence	Interpretation	Suggested CSF-aligned response
Supplier readiness & certification costs	Quantitative: Suppliers meeting green standards: 45.45% Yes / 36.36% Not sure / 9.09% No [Fig. 8];	Upstream capability and proof vary; non-recurring certification	Supplier collaboration + Regulatory compliance + Financial support: issue short bilingual qualification guides and common audit templates; run quarterly supplier

	externals rate Regulatory compliance higher than internals (Δ = +0.69) [Tbl. 7]. Qualitative: unclear requirements, burdensome certification, uneven documentation.	costs hinder consistent visibility of compliance.	clinics (focused support sessions); co-fund priority certifications for high-impact suppliers; track a light supplier dashboard (compliance, delivery reliability, returnable packaging). Offer alleviations on contract agreements, if green targets are met. (longer contract periods, better invoice terms)
Monitoring / instrumentation (incl. recognition of "green" tech)	Quantitative: Use of green technologies: ≈73% "Not sure" [Fig. 7]; monitoring reported not used; perceived importance modest (mean ≈ 3.18) [Tbl. 7]. Qualitative: limited dashboards; practices not labelled "green".	Gaps are instrumentation and recognition, not intent; some solutions are not deployed, others are not visibly tagged as "green".	Top management commitment + Financial support: cascade KPIs to departments; install a minimal monitoring stack (energy, water, waste, renewable energy percent, output; weekly transport loads/routes); label SOPs/tools as "green"; hold a monthly operating review to trigger action.
Training design & transfer to daily work	Quantitative: Employee training lowest by mean (3.10) and constant sum (13.5%) [Tbl. 8]; about one-fifth report no training; 0 "most influential CSF" nominations [Tbl. 9]. Qualitative: sessions long/generic; weak task linkage.	The problem is design and application, not relevance.	Training (under leadership sponsorship): replace long lectures with 45–60 min workflow-specific micro-modules; add on-the-job coaching; assess application in the workplace rather than attendance. Benchmarking visits inside group other locations who are ahead in GSS.

Price sensitivity & proof of value	Quantitative: Externals emphasise compliance/collaboration; internals emphasise finance [Tbl. 7]. Qualitative: price sensitivity in some segments.	Buyers require specification-grade evidence to justify greener options.	Regulatory compliance + Supplier collaboration + Leadership: develop EPD/LCA for 1–2 anchor product families; prepare short case briefs for bids/specs; consider volume-tier incentives where appropriate.

Note. Δ is computed as External − Internal (Table 7).

These actions use Mapei Vietnam's advantages (e.g., top management commitment) to counter local limitations (fragmentation of suppliers, changing regulation), and to ensure alignment with Vietnam's green-growth approach. The phased implementation plan shown in Chapter 5 below is designed to help Mapei move forward in a feasible way.

4.5 Summary and limitations

The results are practical in the way that leadership, supplier collaboration and compliance are the main drivers of change; funding influences the extent to which pilots are lived or scaled; and training is most effective when redesigned to be short, usable, and embedded in workflow. Statistical generalization is limited by the single-case, purposive sample and the self-reported nature of the data, and findings are time-bound in that policies and technologies develop over time. Credibility is enhanced by triangulation across methods and stakeholder groups and transparent accounting of context and boundary conditions for interpretation.

5. DISCUSSION

The study's results indicate that Top management commitment **(**mean 4.40, Table 7) and Supplier collaboration (constant-sum 23.5%, Table 8) are the primary CSFs for GSCM adoption at Mapei Vietnam. This focus on leadership supports previous work indicating the importance of senior commitment to pushing sustainability programs (Zhu & Sarkis, 2004), and is consistent with KPI cascades, and review routines described in Section 4.3, and even with internal workshops, in which managers emphasized their accountability. Supplier collaboration supports some practical levers that were already observable at the case site—material substitution, returnable packaging, and load consolidation—even though these all align with previous discussion around collaboration largely enabled eco-efficiency (Rao & Holt, 2005). Regulatory compliance (constant-sum 20%, Table 8) also plays an enabling role concerning EPD/LCA documentation requirements and access to specification-based tenders; external stakeholders rate regulatory compliance slightly higher than internal staff (Δ = +0.69, Table 7). It is worth noting that alignment here follows previous research considering regulations as a key GSCM driver (Zhu et al., 2008).

At the same time, the considerable proportion of responses such as "Not sure" (~73%) toward green technologies (in Figure 7) together with mixed supplier compliance (45.45% Yes, in Figure 8) suggest there are gaps in monitoring and recognizability. As usual, respondents described practices that were "in place" but did not describe them as clearly labeled or instrumented, which suggests there may be barriers around visibility and measurement that reflect the limits of technology-adoption in emerging manufacturing contexts (Zhu & Geng, 2013; Luthra et al., 2011). Employee training ranked lowest (constant-sum 13.5%, in Table 8) which suggests design and translational issues rather than irrelevance, and also consistent with the literature that emphasized training which is linked to practice in GSCM rollouts (Hervani et al., 2005).

These findings are appropriate within the context of Mapei Vietnam as a subsidiary, where it attempts to balance global sustainability objectives with local limitations on things like supplier readiness (Section 4.4). The four-dimensional framework (Section 2.2) provides suitable organization of the findings: internal (top management commitment;

training), external (supplier collaboration), operations/technology (monitoring and recognizability of “green” tools), and strategy/policy (regulatory compliance through EPD/LCA). The credibility was further strengthened through triangulation of the findings through survey data and stakeholder comments, although the single-case and few participants (N=17) limits further generalizability.

6. CONCLUSION, RECOMMENDATION AND IMPLICATIONS

Through this chapter, from the empirical findings presented in chapter 4, to the study purpose, objectives and questions detailed in chapter 1 will be connected. It strives to tell a coherent picture that highlights how the critical success factors (CSFs) from the literature review were applied and explored in an empirical study and how they affect the implementation of Green Supply Chain Management (GSCM) in Mapei Vietnam Ltd. The chapter provides an overall summary of the empirical findings, answers the research questions, and provides recommendations that are practical to a multinational subsidiary of in the building products manufacturing industry in Vietnam. Its scope includes speculative implications, in terms of policy and localization, acknowledges limitations to the study and possibilities for future research.

6.1 Summary of Key Findings

The survey and qualitative feedback confirmed five major critical success factors (CSFs) associated with GSCM including top management commitment, supplier collaboration, regulatory compliance, financial support and employee training. The quantitative results show that, top management commitment had a mean score of 4.40/5 followed by supplier collaboration scored 4.20/5 while training received the lowest score of 3.10/5. Also, there were differences among stakeholders. In particular, external stakeholders prioritized regulatory compliance while internal staff prioritized financial support. Notably, 73% of respondents selected 'Not sure' to the green technology adoption question indicating uncertainty and lack of awareness. Additionally, monitoring and measuring actions tends to be inconsistent across the departments and training is mostly seen as generic and not connected to practice. All in all, results indicate while leadership and collaboration may be strong factors that enable GSCM, the identified discrepancies in monitoring, supplier compliance, and training that is practice-based diminishes effectiveness of GSCM efforts.

In relation to the major CSFs for GSCM in Vietnam's building products industry (research question 1), our research confirmed the findings that top management commitment,

supplier collaboration, regulatory compliance, financial support, and employee training are the five key CSFs. Among these, top management commitment and supplier collaboration were highlighted as the most important.

For how these CSFs impact practices and outcomes at Mapei Vietnam, the evidence shows that Top management commitment shapes accountability and provides direction by linking sustainability to key performance indicators. Supplier collaboration enables material substitutions, packaging recycles, and improved logistics. Regulatory compliance drives the adoption of environmental product declarations (EPDs) and lifecycle assessments (LCAs), which are essential for market access. Financial support determines the scope and continuity of initiatives, while training influences employee awareness and engagement, though its current effectiveness is limited by design and application issues.

The study has revealed four resilience obstacles that Mapei Vietnam faces in adopting GSCM, and CSFs that can support overcoming the obstacles. The barriers include Supplier Readiness & Costs for certifications, Instrumentation / monitoring of compliance (e.g., "green" technologies), Training design and transfer to the workplace, and Customer price sensitivity. To ease the identified obstacles, the authors introduce specific applications of CSFs: Top management commitment can help with accountability through monitoring and reporting; supplier collaboration can reduce the barriers with respect to compliance; financial support can help the implementation costs; and training can help engage the workforce more meaningfully. Further, regulatory compliance/involvement EPD/LCA can provide some basis for the company to rationalize and justify their investments in sustainability in today's price sensitive markets.

6.2 Alignment with Research Objectives

Objective 1 aimed at identifying the key context-specific critical success factors (CSFs) for green supply chain management (GSCM) in Vietnam’s building products manufacturing industry. The research confirmed based on both survey findings and qualitative feedback

the most relevant CSFs were top management commitment, supplier collaboration, regulatory compliance, financial support, and employee training.

Objective 2 aimed to assess the linkage of CSFs and their effect on GSCM adoption and sustainability outcomes in Mapei Vietnam. Based on data analysis it showed top management commitment, supplier collaboration, regulatory compliance, financial support, and employee training all affected GSCM practices for example KPI adjustments, supplier capacity building, and sustainability reporting but the effect was variable due to the gaps in monitoring and employee-training-transfer to daily work.

Objective 3 aimed to provide approaches to mitigate the barriers to GSCM adoption with CSFs. The study produced general recommendations aligned to leadership accountability, supplier engagement, basic monitoring, applied employee training, and external stakeholder communication of sustainability performance. These recommendations were contextual and tentative to implement with current constraints.

6.3 Recommendations for Mapei Vietnam

This part provides some significant recommendations for Mapei Vietnam as a subsidiary that operates in an emerging market environment. One initial step in sustainability that will be incorporated into the company governance structures is incorporating environmental and social indicators into monthly and quarterly review meetings to facilitate focus, accountability, and continuity of effort. This recommendation is based on the result that top management commitment is a critical success factor (CSF). Embedding the indicators into management routines is useful in keeping management engaged, accountable, and taking action. Second, it is suggested that Mapei Vietnam improve its engagement with suppliers via continued dialogue, simpler compliance processes, and progressively increasing capacity building. This recommendation is based on the CSF of supplier collaboration, along with mixed success with supplier readiness and consistency. Mapei Vietnam may be in a better position to collaborate upstream with suppliers that are consistent with a sustainable agenda through better dialogue and assistance. Third, it is

recommended that a baseline monitoring system be established to monitor environmental performance, including energy, water, waste, and suppliers' compliance. Implementing basic monitoring on a regular basis will lead to improved decisions associated with performance and expectations. Fourth, employees training should be reframed that emphasizes practicability and real-life application. It means training should connect sustainability principles to people's day-to-day responsibilities. This addresses the conclusion that the training should be the least strengthened CSF and many training programs proved to be too generalized and poorly connected to employees' actual work. With practical learning, situated in context, there should be improved engagement with the employee and the transfer of relevant sustainability concepts more easily transferred to an operational practice. Finally, Mapei Vietnam must share an agenda in the form of EPDs, LCAs, sustainability briefs. Implementing the recommendations occurs in a phased manner. In the short term (0–6months), Mapei Vietnam should define baseline data, begin asset-based monitoring, set expectations for suppliers' sustainability goals, and test redesigned training modules with employees. In the medium term (6 - 12 months), the monitoring features should be scaled, departmental practices added, supplier programs organized, and at least EPD or LCA should be prepared for a major product line. In the long term (beyond 12 months), Mapei Vietnam should transition toward clearly defining successful practices, move toward more closely aligning with the overall Mapei Group global sustainability strategy, and begin continuous improvement using the EPDs and LCAs.

6.4 Implications, Limitations, and Future Research

About Policy and local implications, the proposed evidence-based recommendations are aligned with Vietnam's green-growth trajectory. Considering Mapei Vietnam's status as a multinational subsidiary, its organizational structure could serialize a link between global practices and local realities through the gradual adoption of possible practices and communication of knowledge upwards, to suppliers.

For limitations and sources of transferability, due to situating this research as a single-case study in a modest sample, the possibility for statistical generalization is low. However, the findings can be transferrable to other similar (i.e. country-based, and emerging economy) subsidiaries with comparable supplier readiness, monitoring capability, and training hurdles. In addition, as mentioned in the Methodology Chapter, in this thesis, because external stakeholders were treated as an aggregated group due to the small number of respondents so, even though this method simplified analysis, it may have limited insights into specific stakeholder perspectives

Future studies could broaden the single case study to multiple firms in the constructions and building products sectors in Vietnam. Comparative studies in other ASEAN countries would provide better clarification of how CSFs differ by context and parent company governance. Longitudinal studies would shed light on the endurance of sustainability over time and supplier studies would demonstrate the economic and operational changes resulting from certification status and compliance. Lastly, digital monitoring technologies could be studied for their application to address resource limiting factors in performance measurement and compliance.

6.5 Conclusion

This thesis has demonstrated that the Top management, supplier collaboration, regulatory compliance, financial support and employee training play as important factors in furthering GSCM at Mapei Vietnam. Although there are still challenges, practical solutions were identified that are feasible and appropriate for the resources and context of the subsidiary. By adopting a phased implementation, Mapei Vietnam is in a position to strengthen its sustainability agenda, support Vietnam's green growth strategy, and contributing to the Mapei Group's overall sustainability strategies. The findings are particularly relevant to all similar subsidiaries operating in a developing market context and looking to find some semblance of balance between the sustainability expectations of society and the local realities. In summary, this research provides both theoretical and practical implications for how multinational subsidiaries in emerging markets engage in

localized implementation of global sustainability goals through focused, resource efficient actions.

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8. APPENDICES

Appendix 1. Survey and Questionnaires.

Critical Success factors for Green Supply Chain Management Implementation"> Critical Success factors for Green Supply Chain Management Implementation">

Critical Success factors for Green Supply Chain Management Implementation

Pakolliset kysymykset merkitty tähdellä (*)

This survey supports the thesis research: "Critical Success Factors for Green Supply Chain Management Implementation in the Building Products Manufacturing Industry: A Case Study of Mapei Vietnam Ltd."
Your participation is voluntary, confidential, and will take approximately 10–12 minutes.

1. Do you consent to participate? *

- ◯ Yes
- ◯ No

2. Please select your role *

- ◯ Internal employee of Mapei Vietnam
- ◯ External stakeholder

3. What is your current department or role? *

- ☐ Production
- ☐ Procurement
- ☐ Warehouse/Logistics
- ☐ QA/QC
- ☐ Sales/Customer Support
- ☐ Environmental/Health & Safety
- ☐ Other _____

4. How long have you worked at Mapei Vietnam? *

- ◯ Less than 1 year
- ◯ 1-3 years
- ◯ 4-6 years
- ◯ Over 6 years

5. How many years of experience do you have in your current role? *

- ◯ Less than 1 year
- ◯ 1-3 years
- ◯ 4-6 years
- ◯ over 6 years

How important are the following factors for effective green collaboration with Mapei Vietnam? (Likert scale: 1 = Not important → 5 = Very important)

A) Internal Organizational Factors

Top management supports green goals

6. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not sure

1 = Not important → 5 = Very important

7. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

Staff receive sustainability-related training

8. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not Sure

1 = Not important → 5 = Very important

9. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

Green values are embedded in company culture

10. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not Sure

1 = Not important → 5 = Very important

11. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

How important are the following factors for effective green collaboration with Mapei Vietnam? (Likert scale: 1 = Not important → 5 = Very important)

B) External Collaboration Factors

Suppliers comply with green standards

12. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not sure

1 = Not important → 5 = Very important

13. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

Customers demand eco-friendly products

14. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not Sure

1 = Not important → 5 = Very important

15. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

Regulations support green practices

16. Is this currently practiced at Mapei Vietnam? *

◯ Yes
◯ No
◯ Not Sure

1 = Not important → 5 = Very important

17. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

How important are the following factors for effective green collaboration with Mapei Vietnam? (Likert scale: 1 = Not important → 5 = Very important)

C) Operational & Technological Enablers

Use of eco-friendly material in production

18. Is this currently practiced at Mapei Vietnam? *

◯ Yes
◯ No
◯ Not sure

1 = Not important → 5 = Very important

19. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	○	○	○	○	○

Use of green technologies (e.g., LifeCycleAnalysis, energy-saving systems)

20. Is this currently practiced at Mapei Vietnam? *

- ○ Yes
- ○ No
- ○ Not Sure

1 = Not important → 5 = Very important

21. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	○	○	○	○	○

Use of environmental monitoring and tracking systems

22. Is this currently practiced at Mapei Vietnam? *

- ○ Yes
- ○ No
- ○ Not Sure

1 = Not important → 5 = Very important

23. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

How important are the following factors for effective green collaboration with Mapei Vietnam? (Likert scale: 1 = Not important → 5 = Very important)

D)Strategy & Policy Integration

Company communicates green goals clearly

24. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not sure

1 = Not important → 5 = Very important

25. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	◯	◯	◯	◯	◯

Long-term planning for sustainability implementation

26. Is this currently practiced at Mapei Vietnam? *

- ◯ Yes
- ◯ No
- ◯ Not Sure

1 = Not important → 5 = Very important

27. How important is this for GreenSupplyChainManagement success? *

	1	2	3	4	5
*	○	○	○	○	○

Critical success Factors (CSF) For Green Supply Chain Management Practices at Mapei Vietnam

Please answer the following questions based on your collaboration or experience working with Mapei Vietnam Ltd.

Rate the contribution of each factor to Green Supply Chain Management success. (Likert scale: 1 = Very Low → 5 = Very High)

28. Top management commitment *

	1	2	3	4	5
*	○	○	○	○	○

29. Supplier collaboration *

	1	2	3	4	5
*	○	○	○	○	○

30. Regulatory compliance *

	1	2	3	4	5
*	○	○	○	○	○

31. Employee training *

	1	2	3	4	5
*	○	○	○	○	○

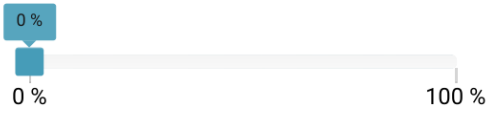
32. Financial support *

	1	2	3	4	5
*	○	○	○	○	○

Estimate the percentage (%) contribution of each factor to Green Supply Chain Management outcomes at Mapei Vietnam

33. Top management commitment *

34. Supplier collaboration *



35. Regulatory compliance *

36. Employee training *

37. Financial support *

Please answer the following questions based on your collaboration or experience working with Mapei Vietnam Ltd.

38. From your perspective, what is the biggest challenge Mapei Vietnam faces in implementing green supply chain practices? *

39. In your opinion, which critical success factor has been most influential in enabling green supply chain success at Mapei Vietnam? Why? *

40. Can you share an example where a specific success factor led to a positive result in Mapei Vietnam's green supply chain (e.g., reduced waste, emissions, or costs)? *

41. What improvements—such as policy changes, resources, or communication—would help Mapei Vietnam strengthen its green supply chain performance? *

42. Do you have any other suggestions or comments regarding Mapei Vietnam's green supply chain initiatives? *

This is the link for Vietnamese Survey and Questionnaires: https://link.webropolsurveys.com/S/DD6F0D5333549982

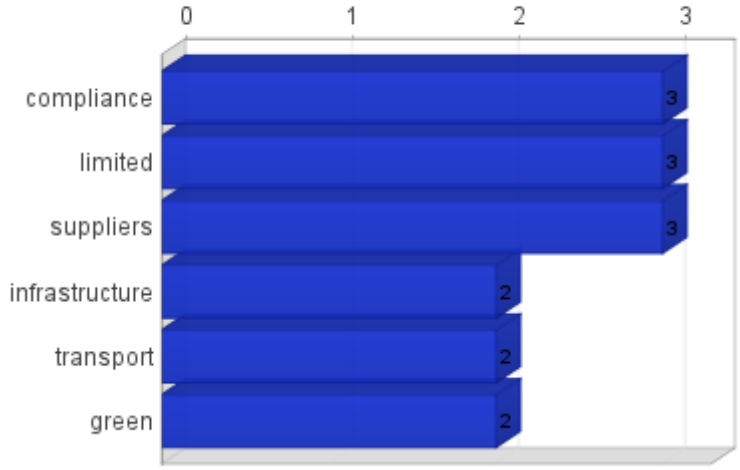
Appendix 2: Responses analyses

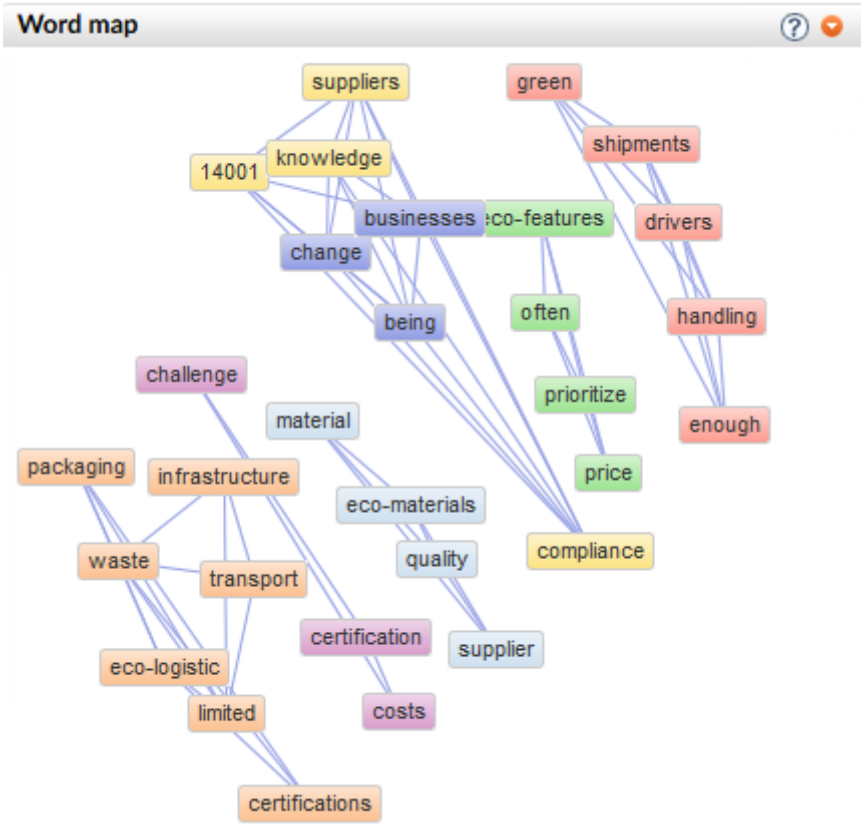
From your perspective, what is the biggest challenge Mapei Vietnam faces in implementing green supply chain practices?

Word cloud

Most commonly used words in answer

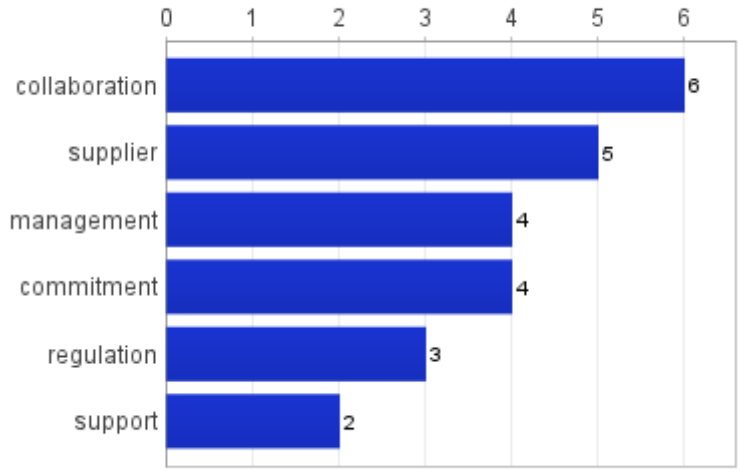
Number of answers: 17





In your opinion, which critical success factor has been most influential in enabling green supply chain success at Mapei Vietnam? Why?

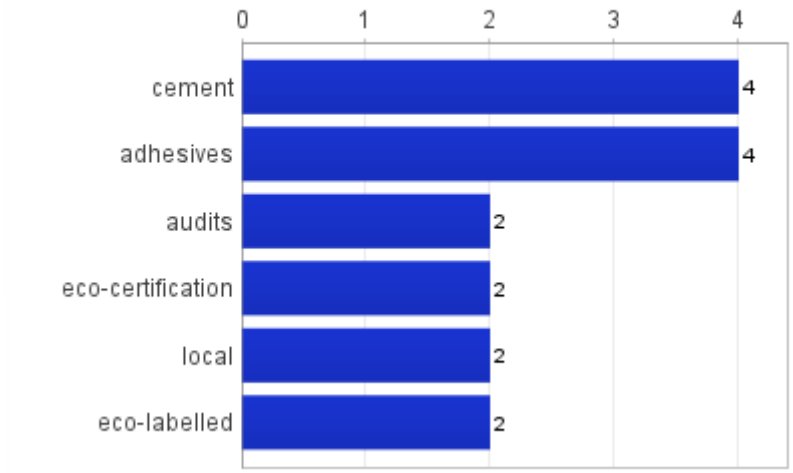
Number of answers: 17

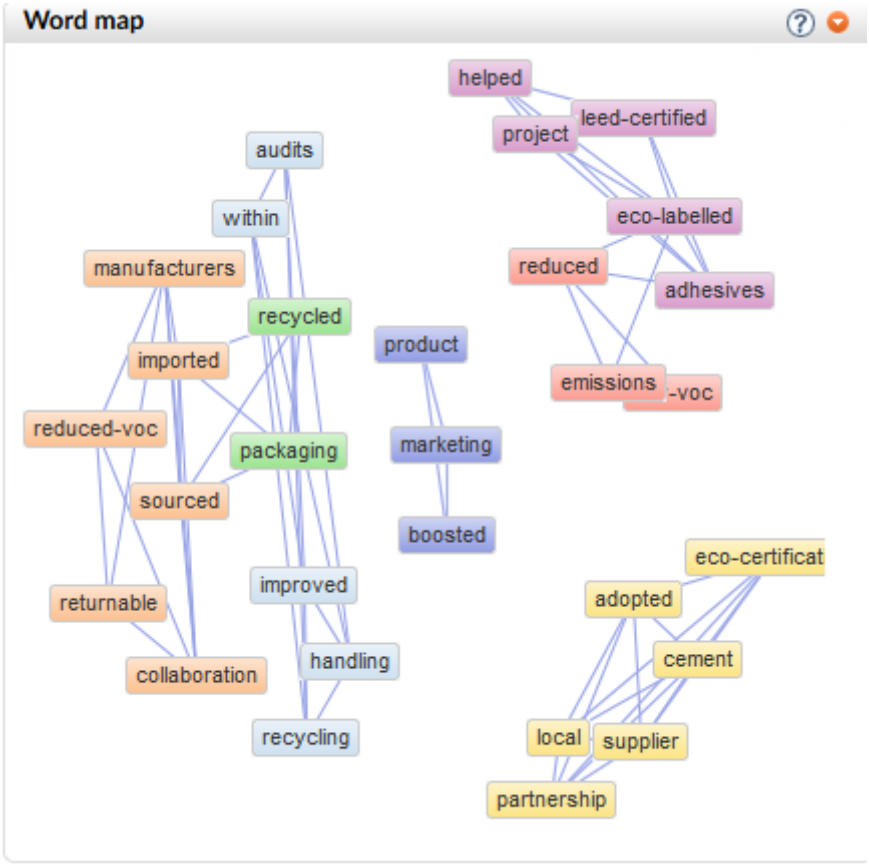


Word map

Can you share an example where a specific success factor led to a positive result in Mapei Vietnam green supply chain? (e,g reduced emissions, waste, costs?)

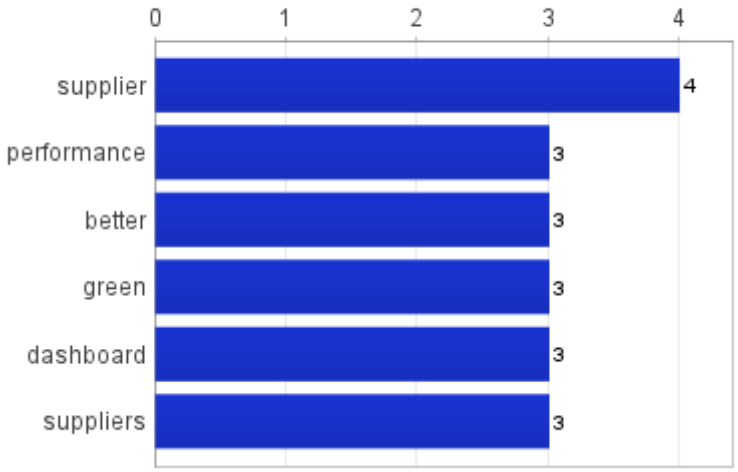
Number of answers: 17

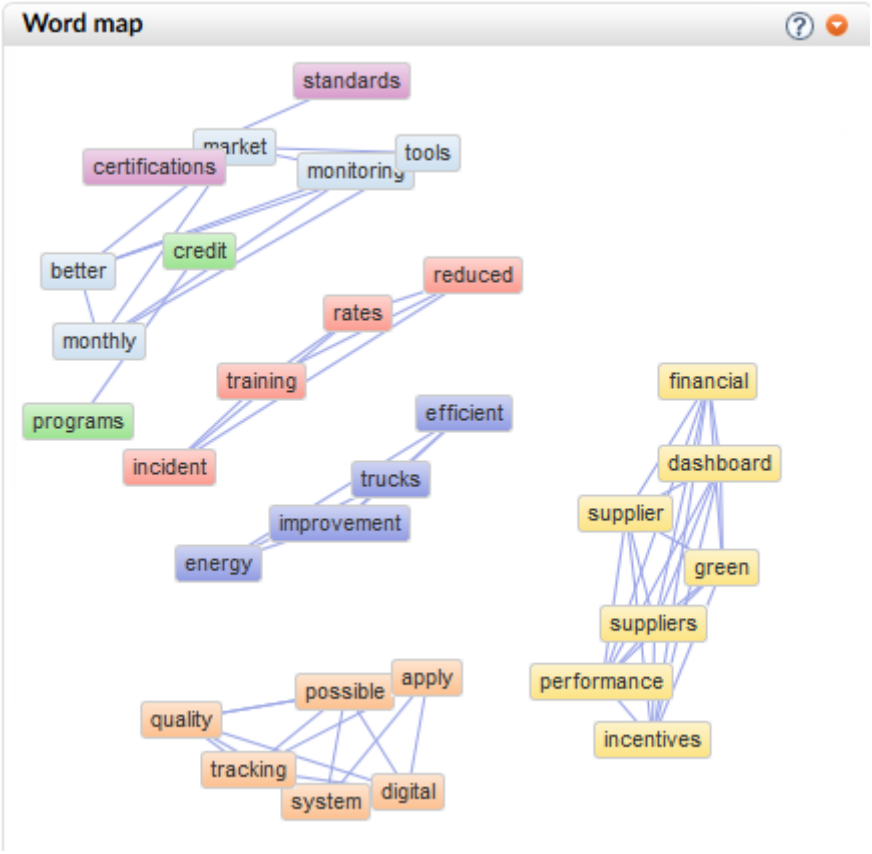




What improvements – such as policy changes, resources or communication – would help Mapei Vietnam to strengthen its green supply chain performance?

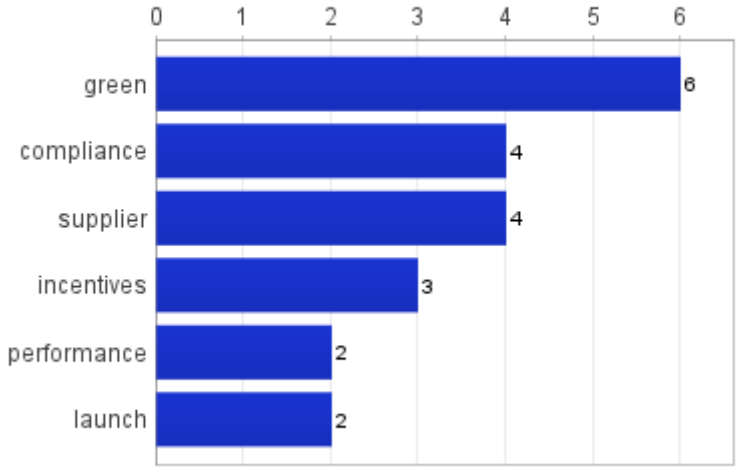
Number of answers: 17

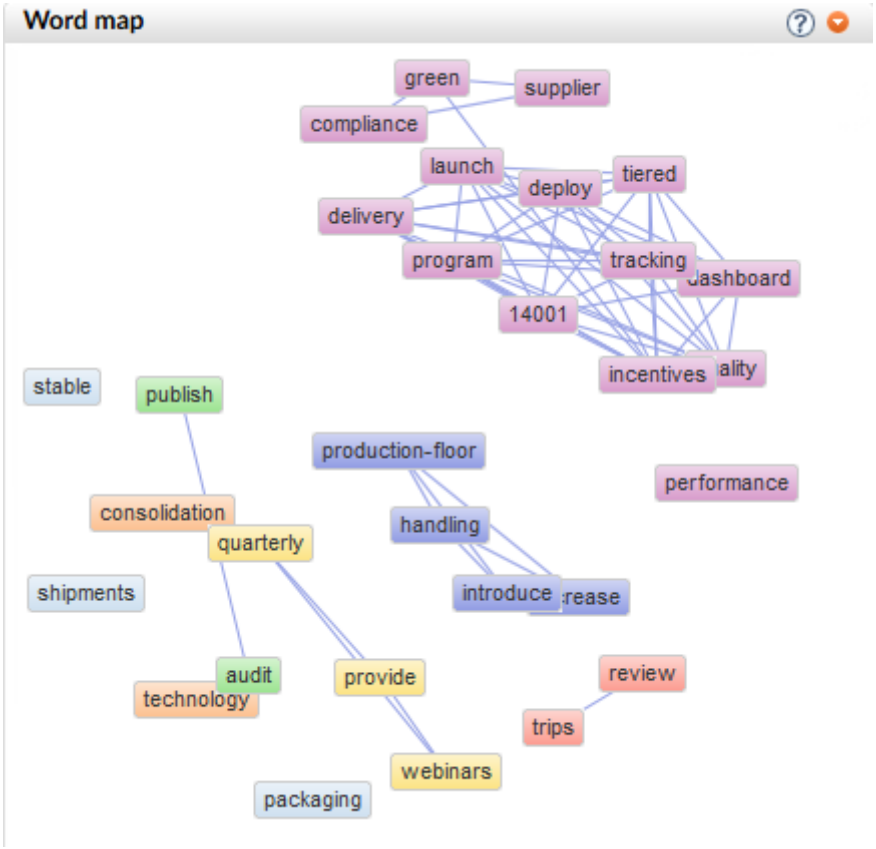




Do you have any other suggestions or comments regarding Mapei Vietnams green supply chain initiatives?

Number of answers: 17




Word map
green
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compliance
launch
deploy
tiered
delivery
program
tracking
14001
incentives
stable
publish
production-floor
performance
consolidation
handling
quarterly
shipments
introduce
audit
provide
review
technology
trips
webinars
packaging

Appendix 3: Informed-consent statement

University of Vaasa School of Technology and Innovations

Master thesis in Industrial Management

Informed consent - Survey and Questionnaire for Master's Thesis

Thesis Title: *Critical Success Factors for Green Supply Chain Management Implementation in the Building Products Manufacturing Industry: Case Company – Mapei Vietnam Ltd*

Thesis Author: Lauri Pullinen and Hanh Nguyen
Thesis Supervisor: Dr. Inês Peixoto

The thesis project is subject to the research privacy notice below to which respondents give their informed consent:

"I voluntarily consent to participate in this research project. I may withdraw at any stage without stating a reason. I may also withdraw my consent at any stage before the completion of the thesis. If I withdraw my consent, the data I have provided until that point in time may still be used in the thesis project, but new data may no longer be used for research purposes. (NB: It is not possible to omit data related to a single research subject from research results after they have been analysed and published.)"

Information for the research participant

This survey is part of a Master's thesis conducted at the University of Vaasa School of Technology and Innovations in Finland. The survey aims to identify and evaluate the Critical Success Factors (CSFs) for implementing Green Supply Chain Management (GSCM) in the building products manufacturing industry, using Mapei Vietnam Ltd as a case study**.** After analyzing the data, the aim is to identify the most influential CSFs, assess their impact on sustainability outcomes, and propose practical strategies to overcome current implementation challenges in Mapei Vietnam's supply chain operations.

The survey and questionnaire should take 10-12 minutes to complete. All survey responses are anonymous and will be used solely for the purpose of this thesis.

The open and anonymous survey is implemented online via Webropol. The responses collected will be stored on students' OneDrive folders. The data collected will not be shared with any persons except the thesis author and thesis supervisor. The survey data will be fully deleted from storage after successful completion of the master's thesis. Estimated at the end of 2025

Participants can contact the thesis author by e-mail for further information about the results of the thesis or access the thesis in http://osuva.uwasa.fi when published.

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