Impact Of Green Manufacturing Practices On Sustainable Performance In Seafood Industry

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Abstract:
The objective of the article is to build a model to assess the impact of Green manufacturing practices on Sustainable performance in seafood enterprises in Vietnam. The article has reviewed theories and studies related to the topic to build a research model. At the same time, the article also reviewed the measurement scales of variables in the research model so that it can conduct surveys to collect data and analyze the results, to test future research hypotheses.

Keywords: Green manufacturing practices, Sustainable performance, seafood, Vietnam

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1. Introduction

The topic of sustainability has recently taken on significant importance in the global industrial industry. As a result, manufacturing companies that previously primarily prioritized financial gains are gradually realizing the need of environmental protection through the adoption of sustainable supply chain management (SSCM) efforts (Chin et al., 2015). The idea of green manufacturing practices (GMPs) has been one of the important SSCM efforts that has been on the agenda of scholars, ethicists, strategists, and practitioners (Ghosh, 2017).

One of the most important environmental projects is the use of sustainable manufacturing techniques (Abdul Rashid et al., 2017). The adoption of sustainable manufacturing is often thought to result in better environmental performance. Rusinko (2007) looked at environmentally friendly manufacturing methods and how they related to competitive manufacturing outcomes, and the findings indicated that these methods lower manufacturing costs. The findings of Ramayah et al. (2013), who claimed that implementing green technologies and sustainable business practices can be used to establish a competitive position in the marketplace, are consistent with Porter and van der Linde's (1995) findings that any environmentally proactive practice can produce competitive gains.

Previous research has looked into the connection between green manufacturing practices and environmental performance. While Green et al. (2012) evaluated the effect of supply chain practices on operational, environmental, and organizational performance, Zailani et al. (2012) investigated the relationship between eco-design and environmental performance. The association between green manufacturing practices and production efficiency in SMEs was demonstrated by Ramayah et al. (2013). The literature has placed a lot of emphasis on servitization, and product service systems (PSS) introduced more than ten years ago have been one example. However, manufacturers' integrated product and service solutions should also be taken into consideration (Baines et al., 2007). In general, previous studies are focused on some of the aspects of sustainability and less of these studies present a simultaneous approach which takes into account the economic, environmental and social aspects of sustainability. Also, there is a lack of studies focused on the relationship between sustainable manufacturing practices and sustainability performance.

According to Gimenez et al. (2012), manufacturers should consider economic gains along with responsible social and environmental behaviors in order to attain sustainability. In this regard, Pullman et al. (2009) emphasized that considerable work is needed to expand the social aspect of sustainability. Hence, the objective of this study is to examine the relationship between sustainable manufacturing practices and sustainability performance, in which the three important dimensions of sustainability (i.e. economic, social and environmental aspects) are taken into consideration simultaneously.

In this paper, we explore how green manufacturing practices can be applied to the seafood industry in Vietnam to enhance sustainability and improve performance, highlighting some successful examples of companies that have implemented these practices. Ultimately, the goal is to support more environmentally-friendly practices across the industry and promote a more sustainable future for Vietnam's fisheries and aquaculture sectors.

2.Literature review and hypotheses development

2.1. Green manufacturing practices, Sustainable performance

Although the idea of green manufacturing has been around since the 1990s, it has only just begun to receive widespread attention as a result of demand from stakeholders on matters of sustainability. Green manufacturing has many different definitions, but it is typically understood to be an economically motivated, system-wide, and integrated approach to the reduction and elimination of all waste streams involved with the design, manufacture, use, and/or disposal of goods and materials. The

main goal of green manufacturing is to achieve sustainability in industrial production, and its essential elements include using eco-friendly energy during production, investing in eco-friendly technological equipment, and cutting back on energy and input consumption. Implementing GMPs enables organizations to attain operational efficiency, resulting in increased financial benefits, safeguarding the environment, and enhancing ecological performance. Green manufacturing standards demand that there be no potential safety hazards, health risks for operators or product consumers, and minimal environmental pollution through recycling and proper waste disposal processes during production. Despite the limited research on green manufacturing, numerous analytical tools and models have emerged from studies on product/process design for green manufacturing, emphasizing the importance of GMPs in sustainable production methods.

Over time, the importance of researching sustainable performance has grown. By balancing their objectives for economic, environmental, and social performance (SP), businesses can achieve sustainable performance. As a result, evaluating performance from a sustainable perspective enables businesses to evaluate their efforts, accomplish improvements in terms of environmental and social developments at all levels of their supply chain, and do so while also adding value for their shareholders (Ankaya and Sezen, 2019). Economic, environmental, and social factors are the three key components of gauging sustainable performance (Abdul-Rashid et al., 2017).

The adoption of green practices in the manufacturing sector is greatly influenced by the green innovation features. These characteristics of green innovation serve as assisting instruments for industries to change their operations into sustainable processes. Green innovation is a cutting-edge word that describes how businesses might transition to more environmentally friendly supply chain practices for long-term growth. Green innovation is mostly used in companies to operate sustainable supply chains and remove the harmful environmental effects of conventional supply systems. Additionally, enterprises must promote sustainable economic, environmental, and social development in order to meet sustainability goals. Only by including these three crucial sustainability criteria, which will also assist industries in lowering their contributions to air pollution, climate change, ecological hazard, and other negative industrial activities, can these industries achieve sustainability. Social pressures, market pressures, and the corporate reputation of the sector will be the driving forces behind the incorporation of green innovation and sustainability efforts into industrial supply chain processes created by the government's eco-friendly laws.

2.2. Green manufacturing practices and sustainable performance

In recent years, ethical managers and practitioners have begun to give SP the attention it needs. This is a result of heightened public awareness of worker health and safety issues as well as community quality of life (Wang and Dai, 2018). Despite being few in number, certain empirical research has found that implementing green business strategies like GM improves a company's social performance (Sezen and Cankaya, 2013). For instance, Abdul-Rashid et al.'s (2017) analysis of 443 factories in Malaysia revealed that SP has a significant impact on GMP. Zero risk to the health of employees and consumers, as well as zero chance of safety-related issues, were further mentioned by Gao and Bansal (2013) as some of the reasons for the implementation of GMP. Ankaya and Sezen (2019), who showed that GMP is focused toward achieving societal expectations as well as maintaining the natural environment, provide evidence for this claim. GMP can result in cleaner production, improving worker working conditions and community members' quality of life (Wang and Dai, 2018).

In the context of the Bangladeshi textile sector, a study by Muyeen et al. (2020) investigated the connection between green production practices and innovative green technologies. According to the study, green manufacturing practices were favorably influenced by green innovation since innovative businesses were

more likely to use green manufacturing methods. The study also discovered that adopting green manufacturing processes improved business performance, showing that there are unmistakable advantages to doing so. Feng et al.'s (2018) investigation into the connection between green manufacturing techniques and green innovation in the Chinese automotive sector. According to the study, organizations with more innovative green practices were more likely to embrace green manufacturing practices, proving that innovation is a major factor in the spread of green manufacturing practices. The study also discovered that environmentally friendly manufacturing techniques had a beneficial effect on performance, underscoring the critical function of environmentally friendly manufacturing in achieving environmental sustainability. Overall, the research points to a favorable relationship between green manufacturing practices and innovation, with innovation serving as a major catalyst for the implementation of green manufacturing techniques. In addition to helping the environment, putting these strategies into practice can improve business performance and environmental performance. These results highlight the significance of encouraging green manufacturing practices and green innovation in order to achieve sustainable growth in the manufacturing sectors.

Results from empirical studies linking GMP to EnP suggest that the implementation of GMP leads to improved EnP in terms of waste reduction, reduced emission of air pollutants, decrease in environmental accident frequency, among others. For instance, Wibowo et al. (2018) indicate that the most important target for implementing GMP is to reduce resource consumption and minimize waste via the use of optimal processes, appropriate inputs and cleaner technologies. Govindan et al. (2015) also established that the implementation of GMP helps firms to achieve a better economy without any damage to the natural environment. GMP takes into account product’s life cycle analysis which is aimed at improving EP (Sezen and Cankaya, 2013). A study undertaken by Soubihia et al. (2015) among Brazilian ISO 9001-certified firms revealed that GMP in terms of adopting green operational practices is a positive and significant precursor of a firm's green performance. Kalyar et al. (2019) further found that GMP, as a dimension of green supply chain management (GSCM), has a significant direct effect on the EP. The study further highlighted that firms implement green practices not just because of stakeholder pressure, but also due to the ability of such initiatives to elevate their EP. Moreover, the adoption and implementation of GMP to improve EP is supported by Sezen and Cankaya (2013).

Recently, managers of manufacturing companies have come to understand that the advantages of GMPs extend beyond long-term cost savings and serve as a crucial prelude to improving environmental, social, and economic performances. The extent to which a company may optimize its financial results is defined as EP. In this study, financial metrics such as profits, sales growth, return on asset, return on equity, and return on investment were used to evaluate EP (Agyabeng et al., 2020). On the other hand, according to Abdul-Rashid et al. (2017) and Singh et al. (2019), environmental performance (EnP) refers to a company's capacity to reduce solid waste and pollution as well as the usage of hazardous products.

While Dubey et al. (2015) opined that manufacturing firms that adopt green practices tend to enjoy higher investor interests, other studies (Yang et al., 2013; Laari et al., 2016; Roy and Khastagir, 2016) disclosed that manufacturing firms that successfully implement GMPs achieve higher profits and improve their EP. From resource-based view (RBV) theory, firms that adopt eco-friendly practices like GMPs carve a competitive niche for themselves and hence enhance their EP (Hami et al., 2015).

Sezen and Cankaya (2013) discovered that GMPs have a positive and significant impact on both environmental performance (EnP) and social performance (SP) when viewed from the EnP and SP perspectives. By implementing environmentally sensitive practices such as GMPs, a company can demonstrate

responsible behavior towards its stakeholders and improve both EnP and SP. This win-win situation often leads to improved business performance, as evidenced by Zhan et al. (2018).
Filho et al. (2019) conducted a study on the correlation between green innovation and economic success in the European Union. The research revealed that businesses that implemented green innovation techniques experienced increased profitability, improved product diversity, and enhanced overall innovation. This illustrates how crucial green innovation can be in driving economic progress while prioritizing sustainability.

Green innovation is a crucial aspect of modern-day businesses, where companies are constantly striving towards the development and implementation of new green technologies, processes, and practices. These innovative solutions enable businesses to operate with greater efficiency while minimizing their environmental impacts. As an example, businesses can adopt sustainable design principles or incorporate recycled materials in their production processes. Additionally, they can use renewable energy sources or develop new eco-friendly products that help reduce waste and minimize environmental impact. The incorporation of green innovation practices is essential for businesses looking to stay competitive in today's fast-paced marketplace.

Green innovation practices, including the development and implementation of green technologies and sustainable practices, leads to more efficient and effective ways of producing goods and services, which in turn, creates jobs and business opportunities. Investing in green innovation also helps to address social problems such as poverty and inequality by providing access to clean energy, sustainable food production, and affordable healthcare.

The adoption of green innovation practices has been found to have positive impacts on environmental performance in various industries. Studies have shown that companies that invest in green innovation tend to have better environmental performance outcomes compared to firms that do not. Improved environmental performance outcomes may include reduced energy consumption, greenhouse gas emissions, waste generation, and pollution levels.

The determination of EnP can be greatly improved through the adoption of sustainable practices such as green innovation, eco-friendly products, and the incorporation of green sustainability matters into a firm's operation (Singh et al., 2020). To leverage the impact of environmental challenges and improve EnP, manufacturing firms can implement models related to green supply chain management (El-Kassar and Singh, 2019). Studies conducted in Malaysia by Abdul-Rashid et al. (2017) show that manufacturing firms that adopt sustainable practices such as green innovation tend to experience an improvement in their sustainable performance.

H1a. GMPs have a significantly positive effect on the relationship between green innovation and EP.
H1b. GMPs have a significantly positive effect on the relationship between green innovation and EnP.
H1c. GMPs have a significantly positive effect on the relationship between green innovation and SP.

2.3. Green manufacturing practices and green supply chain integration

The supply chain is a crucial continuum that commences with suppliers and culminates with customers. Manufacturing firms depend on their suppliers for raw materials and other essential resources in the upstream supply chain, which is then transformed into finished products that are ultimately shipped to customers. To achieve organizational objectives, it has become increasingly vital for firms to form strategic partnerships with their supply chain associates, particularly in light of the escalating concerns surrounding sustainability issues. In the current landscape of growing environmental concerns, it is imperative to acknowledge and value the role of supply chain partners, particularly customers and suppliers, in driving the

operations of a manufacturing company. Their contribution to the supply chain cannot be overlooked or underestimated, succinctly described by Yuet al. (2014). In the pursuit of becoming environmentally responsible through sustainable initiatives like GMPs, firms must acknowledge that winning this battle will be challenging without the support and collaboration of key supply chain partners. Thus, it is urgent for firms to prioritize collaboration with their primary supply chain partners, including customers and suppliers, to achieve their sustainability goals. The integration of supply chains presents opportunities for firms to effectively achieve their eco-friendly targets and initiatives.. For example, giant firms like Coca Cola have successfully started an initiative which ensures that the company works jointly with bottling partners to develop plant bottles (recyclable plastic bottles made partly from plants) (Reuters, 2011). According to some, supply chain partners' participation and integration are crucial for the successful implementation of green practices. (Abdullahet al., 2014). Green practices, like GMPs, must therefore be complemented by effective collaboration of all important supply chain partners because they are crucial strategic variables that influence a firm's supply chain. (Chidambaranathan et al., 2015). Specifically, the supply chain becomes green when suppliers embrace a firm's environmental requirements (Singh et al., 2019).

Furthermore, green practices like GMPs have emerged as an eco-oriented strategy that not only improves EnP but also a firm's entire supply chain; therefore, there is a need to involve critical supply chain partners (Govindan et al., 2016). There are three dimensions of GSCI: green internal, green customer and green supplier integration, as consistent with prior literature (Van Hoek et al., 2001; Kang et al., 2018; Setyadi, 2019; Omara et al., 2019). However, in this study, GSCI was compositely measured by both green supplier and green customer integration.

Manufacturing companies can provide suppliers with environmental ideas for eco-inputs and collectively define environmental goals through green supplier integration (firms' strategic environmental links with upstream supply chain partners). Additionally, some businesses implement integration-based operations through environmental supplier training, information sharing, and collaborative environmental research. (Laosirihongthong et al., 2013). From a greening standpoint, green customer integration is characterized by regular environmental information sharing between a business and its key clients. Integrating green customers enables a business to pinpoint the precise environmental requirements of its clients and meet those needs accordingly. Wu (2013) asserts that customer integration may successfully achieve the reduction of production's negative environmental effects, cleaner production, and the identification of solutions to environmental problems. The arguments so far support the claim that GMPs have a positive impact on GSCI. Consequently, we hypothesize the following hypothesis:

H2. GMPs have a significantly positive effect on GSCI.

2.4.Green supply chain integration and sustainable performance

The positive link between GSCI and sustainable performance has been globally acknowledged in some studies (Zhu et al., 2012; Suheil, 2015; Omara et al., 2019). Specifically, manufacturing companies that embrace green practices like GMPs and pursue synergistic efforts by cooperating with important supply chain partners are likely to improve their corporate sustainability performance (EP, EnP, and SP). In the literature, various GCSI dimensions have been used to analyze the impact on sustainable performance. Suheil (2015) discovered, for instance, that GSCI factors (internal, external, and technology integration) and sustainable performance had a favorable link. According to Zhu et al. (2010), supplier integration has a major impact on sustainable performance since it might degrade performance in terms of sustainability. According to a 2018 study by Green Supply Chain Integration Longoni and Cagliano, environmental transparency and green practices, such as supplier integration, have an impact on a company's financial performance and EnP. Thus, an indication that

firms should leverage and align GSCI to support their environmental and financial objectives. By conducting a study among 174 rubber manufacturing firms in India, Dubey et al. (2015) disclosed that green supplier integration has a positive effect on EnP. Furthermore, Andiç et al. (2012) found EP to be contingent on firm's collaboration with their customers. Additionally, Choi and Hwang (2015) found the firm's collaborative capabilities to strengthen their financial performance and EnP. Finally, Setyadi (2019) conducted a study among oil and gas companies in Indonesia and found that green customer and green supplier integration have a positive effect on EP as well as on EnP. Drawing inferences from the abovementioned literature, the following hypotheses were developed:

H3a. GSCI has a significantly positive effect on EP.

H3b. GSCI has a significantly positive effect on EnP.

H3c. GSCI has a significantly positive effect on SP.

2.5. Green manufacturing practices, green supply chain integration and sustainable performance

This study offers empirical data to explain how the GSCI between GMPs and sustainable performance functions as an explanatory factor. As a result, GSCI acts as a bridge (indirect effect) connecting GMPs and sustainable performance. Evidence from both theory and empirical research indicates that businesses who embrace and use green supply chain strategies, such as GMPs, tend to improve their sustainability performance (Hami et al., 2015; Rehman et al., 2016; Abdul-Rashid et al., 2017). Successful implementation of GMPs is mainly dependent on the environmental collaboration that firms have with their supply chain partners (Abdullah et al., 2014). According to the research model (see Figure 1), when companies involve their supply chain partners in the adoption of GMPs, their EP, EnP, and SP will improve. GMPs therefore have an impact on a company's sustainable performance through forging beneficial connections with supply chain associates.

Owing to this, we present the following hypotheses:

H4a. GSCI mediates the relationship between GMPs and EP.

H4b. GSCI mediates the relationship between GMPs and EnP.

H4c. GSCI mediates the relationship between GMPs and SP.

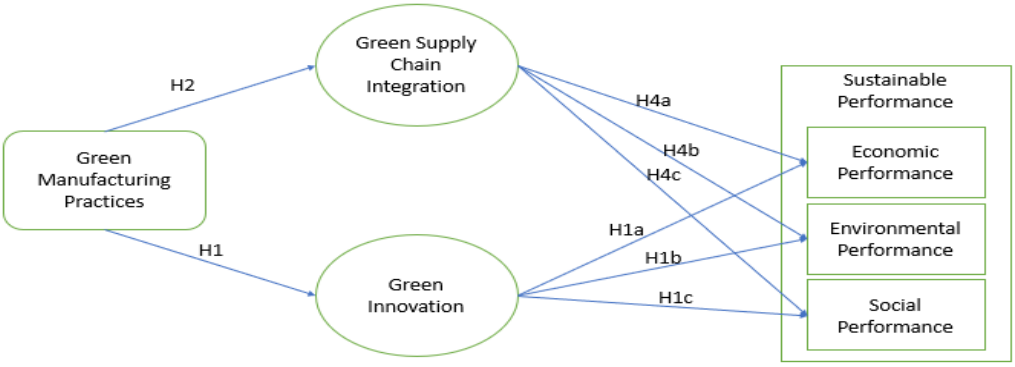

Figure 1: The research model

3. Research methods and measures

3.1. The research design, sample and data collection

The explanatory research design was used because the investigation was quantitative and predictive in nature. In order to clearly establish a causal connection between the exogenous and endogenous latent variables, the explanatory research design was predominantly used (Zikmund et al., 2012). We first personally called and emailed 464 manufacturing SMEs in Vietnam (including manufacturing and exporting businesses, manufacturing and distribution businesses, and

processing and packaging businesses) to gauge their interest in participating in the study. Only 321 manufacturing SMEs were approved to be included in the survey after waiting for around three weeks. As a result, a systematic questionnaire was created and given to these interested manufacturing SMEs by emails and personal distributions in addition to an introductory letter outlining the purpose of the study. The questionnaire was initially pretested among 27 manufacturing SMEs who had been following the guidelines of the Vietnamese Environmental Protection Agency and other international environmental organizations in terms of their environmental practices. The surveys' content validity, clarity, and general quality were all enhanced by the pretesting data. The respondents were given a three-month window (August 2019–October 2019) to complete the surveys. Email-based reminders and a series of follow-up phone calls were made to nonrespondents over the course of the three months. Finally, 178 valid questionnaires in total were gathered, yielding a response rate of 55.45%. A 35.5% response rate, according to Baruch and Holtom (2008), is enough for statistical analysis.

Table 1 provides a descriptive breakdown of the SMEs' demographic traits. Table 1 clearly demonstrates that 59% of answers came from companies with 51–100 employees, 23% from companies with 101–500 people, 12% from companies with 10–50 employees, and just 6% from companies with employee bases of less than 10. This shows that our sample fully captured the description of SMEs within the Vietnam context.

The majority (44%) of manufacturing enterprises were found to be involved in the production of food and beverages, followed by 24% in the processing of oil, 22% in the production of plastic, and 10% in the processing of chemicals. According to the respondents' positions, the majority (39%) were supply chain managers, 29% were purchasing/procurement managers, and 13% were logistics managers. The respondents' respective positions demonstrate that they were subject matter experts in the manufacturing industry who could be trusted to provide accurate information on the study, assisting the researchers in drawing valid conclusions.

3.2. Measurements

The primary means of gathering data for the study was through questionnaires. Based on a thorough assessment of the literature and recommendations from industry professionals, the questionnaire was thoughtfully created. The literature review and previous validated studies were used to compile and gather all indications linked to the latent variables. 28 indicators in all (GMP 5 7 items, GSCI 5 6 items, EP 5 5 items, EnP 5 6 and SP 5 4 items) were utilized to measure all of the structures. The measurements were selected and modified to reflect the context of manufacturing SMEs in Vietnam. A five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), was used to assess all latent variables as shown in Table 2

3.3.The analytical tool

The statistical analysis for the study was done using partial least square structural equation modeling (PLS-SEM) via Smart PLS, version 3. One of the most extensively used analytical tools in business research, particularly in the areas of operations management and supply chain management, is PLS-SEM (Peng and Lai, 2012). PLS-SEM was primarily employed due to its suitability in handling complex predictive relations. Several researchers (Bodoff and Ho, 2016; Hair et al., 2017) contended that in dealing with explanatory studies (as in this study), Since it helps to gauge the degree to which one portion of a given model accurately predicts the values of the other sections of the research model, PLS-SEM is regarded as the most suitable predictive analytical technique. PLS-SEM is thought to be particularly resilient in handling reflective (as in this study) and formative models, in contrast to other covariance-based analytical techniques.

3.4.Common method bias

The common method bias test is an exploratory factor analysis (EFA) that takes into account all observed variables. If a single factor explicates a value of 0.50 or higher (i.e., 50%), which is the majority of the cumulative variance among measures, then there is common method bias (Podsakoff et al., 2003). In ensuring that common method bias was verified, Harman’s

one-factor test (Herman, 1976) was applied. In this study, we performed the EFA on the variables and it was revealed that the first extracted factor explicated 0.47721 (i.e. 47.721%) of the variance. This is lower than the 50% cutoff point. Consequently, it can be realistically and adequately confirmed that common method bias is not found in this study.

Items	Source
Green manufacturing practices	Hsu et al. (2016), Abdul-Rashid et al. (2017)
GMP1: Produces products with reused and recycled contents such as recycled plastics and glass	
GMP2: Produces products that are free from hazardous substances such as lead, mercury and chromium	
GMP3: Produces products the reduce the consumption of materials and energy during use	
GMP4: Employs eco-technological equipment and process during manufacturing	
GMP5: Reduces power consumption in products during manufacturing and transportation	
GMP6: Designs products to ensure that they have reusable and recyclable contents	
GMP7: Uses life-cycle assessment to evaluate the environmental load of products	
Green supply chain integration	Wu (2013) and Omara et al.(2019) Van Hoek et al. (2001)
GSCI1: Achieving environmental goals through joint planning with customers	
GSCI2: Cooperating with customers for cleaner production, green packaging or other environmental activities	
GSCI3: Customers are actively involved in our new product development process	
GSCI4: Providing suppliers with environmental design requirements related to design specifications and cleaner production technology	
GSCI5: Collaborating with suppliers to set up environmental goals	
GSCI6: We work with our suppliers to seamlessly integrate our interfirm processes	
Sustainable performance	Sezen and Cankaya (2013)
Economic performance	Hami et al. (2015)
EP1: Considering the economic situation, our profit has increased	AbdulRashid et al. (2017)
EP2: Considering the economic situation, our market share has increased	
EP3: Considering the economic situation, our sales growth are higher	
EP4: The return on investment has increased	
EP5: The return assets have been higher, relative to competitors	
Environmental performance	
EnP1: Energy consumption considering the volume of production has decreased	
EnP2: Consumption for hazardous materials considering the volume of production has decreased	
EnP3: Conduct regular environmental audits	
EnP4: Minimizes the environmental impact of its activities	
EnP5: The firm relevantly decreases the frequency of environmental accidents	
EnP6: Reduction of smell/odour emissions and solid waste	
Social performance	
SP1: Improved work safety	
SP2: Improved living quality of surrounding community	
SP3: Improved work environment	
SP4: Improved relationship with the community and stakeholders	

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