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The effects of ESG management on process innovation: The case of cement industry

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Abstract
Purpose: In the past, companies placed significant emphasis on Earnings Per Share (EPS) financial performance, while Environment Social Governance (ESG) is now used to assess a company's comprehensive performance in the areas of environment, social responsibility, and corporate governance.
Research Methodology: This study employs qualitative research through in-depth interviews and utilizes the SWOT analysis method. This study aims to conduct an in-depth investigation into Taiwan Asia Cement's future carbon management strategy, anticipating and positioning itself to turn the crisis into an opportunity, ultimately becoming a major winner in the era of climate change and a low-carbon economy.
Results: The primary objectives are to understand the innovative process of promoting low-carbon cement manufacturing by Taiwan Asia Cement and to investigate consumers' willingness to use this cement. The study reveals that Asia Cement has established a low-carbon cement promotion team, actively collaborating with consumers to increase the adoption of low-carbon cement, resulting in a stable market growth rate.
Limitations: The marketing strategies in this study are more useful for the cement industry only and are not applicable to competitive marketing strategies in other industries.
Contribution: Additionally, interviews uncover that consumers using low-carbon cement are mainly located in eastern Taiwan. Many consumers in this region have not heard of or used low-carbon cement, indicating significant marketing opportunities.
Novelty: In an environment where the world is emphasizing ESG, it is important to enhance the corporate image of the cement industry through process innovation to contribute to environmental issues.
Keywords: *Environment Social Governance (ESG), Interview method, Low carbon cement, Portland cement, Process innovation, Business reengineering*
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1. Introduction

In recent years, the world has been consistently on the edge of high risks, ranging from climate change, pandemics, the Russo-Ukrainian War, to global inflation. The demands and expectations for sustainable development have shifted from a general consensus to specific regulations. The Environment, Social, Governance (ESG) performance of companies has become a fundamental evaluation indicator for many, requiring companies to disclose internal operational decisions. While in the past, companies heavily emphasized Earnings Per Share (EPS) financial performance, ESG is now used to assess a company's comprehensive performance in the areas of environment, social responsibility, and corporate governance (Yeye & Egbunike, 2023). It serves as a critical indicator for evaluating a company's

sustainable development. The ESG also ensures that companies meet the expectations of investors. Traditionally, investors primarily focused on financial information to assess investment value. However, in recent years, there has been a growing interest among investors in ESG information and its potential impact on companies, such as assessments of the effects of climate change and risk management issues. Research indicates that a company's commitment to green strategies, a green organizational culture, green organizational identification, and environmental values can effectively promote green innovation (Chang, 2011; Song & Yu, 2018; Yahya, Jamil, & Farooq, 2021). ESG practices can strengthen corporate governance through three channels, thereby promoting green innovation: (1) Improving board governance. (2) Enhancing management incentive arrangements. (3) Improving shareholder supervision mechanisms, such as the participation of professional institutional investors (He & Jiang, 2019; Usman, Javed, & Yin, 2020; Zhao, Pongtornkulpanich, & Cheng, 2022). To meet the demands of investors, the importance of disclosing corporate sustainability information has significantly increased. Moreover, effective and precise communication tailored to different stakeholders and topics is essential (PwC, 2023). Cement manufacturing is a high-energy-consuming industry, involving substantial fuel and electricity consumption during the production process, resulting in significant greenhouse gas emissions. To achieve effective energy savings and emission reduction, Asia Cement has placed a strong emphasis on resource efficiency since the establishment of its plant, actively adopting the latest energy-saving equipment and technologies. "High quality, high efficiency, high environmental protection, low cost" has always been Asia Cement's operational strategy in its core business. The Taiwan Sustainable Energy Research Foundation has observed that Asia Cement actively seeks innovation and transformation in technology, striving to evolve from a high-pollution, high-energy-consuming industry into an exemplary company that prioritizes environmental performance.

Far Eastern Group is a Taiwanese conglomerate spanning over ten industries, including petrochemical energy, polyester fibers, cement building materials, retail, financial services, transportation, communication networks, construction, tourism, social welfare, and medical services. With over 200 affiliated companies, it stands as the third-largest business group in Taiwan. As of the end of 2022, its total assets exceeded USD 101.4 billion, with an operating income exceeding USD 24.7 billion. In the aftermath of the global pandemic, the business operating environment has become increasingly challenging, with various ESG issues emerging as hot topics in corporate management. Far Eastern Group places significant emphasis on these issues. Through the assessment of various ESG indicators, the Group gains a comprehensive understanding of the risks and opportunities generated in its operations from different perspectives. Addressing ESG concerns is seen as crucial for enhancing the overall value of sustainable business operations. Ignoring ESG risks may result in governance blind spots, affecting the company's transformation and survival (PwC, 2023).

Asia Cement, adhering to its mission of building a green home, incorporates ESG principles – environmental, social, and corporate governance – into its corporate culture, aligning with the United Nations' Sustainable Development Goals (SDGs). This commitment is a significant affirmation for all employees. Asia Cement will continue to coexist with the environment and land, prosper with employees and society, lead the industry, align with international standards, and demonstrate a strong commitment to corporate social responsibility. With the rise of global environmental awareness, whether through the consumption of organic products for health and well-being or embracing eco-friendly approaches to tourism, consumers are increasingly demonstrating a sense of responsibility towards the environment. This reflects the growing trend of adopting a healthy and sustainable lifestyle. Asia Cement is part of the Far Eastern Group. The company's profitability is stable with EPS of NT$2-3 per year.

Cement is an indispensable material in construction, responsible for the foundation and supporting structures of buildings, providing strength and stability. "Masonry process" is a crucial and irreplaceable process in construction. After completing the foundation of a building, without the modeling, reinforcement, and decoration provided by plastering, the structure is merely a shell. Therefore, "Masonry process" is the key factor in transforming a building into a beautiful entity. For a long time, cracks in walls seem to be the common impression people have about cement. As a professional cement manufacturing factory, Asia Cement is dedicated to leading innovation in construction materials and

has taken the initiative to develop low-carbon cement. While low-carbon cement is already a well-established product in many countries, Asia Cement is pioneering innovative research and development in Taiwan. The motivation behind the development of low-carbon cement includes:

1. Low-carbon cement is a specialized type of cement that requires the addition of expensive chemical agents during production.
2. Changing the long-standing work habits of construction worker teams requires a considerable amount of manpower and time.

In recent years, global warming has intensified, leading countries worldwide to declare the goal of achieving net-zero greenhouse gas emissions by 2050. To reduce greenhouse gas emissions, Asia Cement has introduced the production of "Low-carbon cement." This product, distinguished by its excellent plastering properties and resistance to cracking, has received official recognition and been incorporated into the outline specifications for public construction projects. Currently, Asia Cement is the only domestic producer of this innovative cement. Compared to traditional Portland cement, this product can reduce greenhouse gas emissions by 16%, as well as decrease the consumption of natural minerals and coal by approximately 5% and 15%, respectively. The Hualien plant of Asia Cement anticipates that the future shipment volume of plastering cement could exceed 300,000 tons by 2030. The goal is for low-carbon cement to constitute more than 50% of the shipment volume by that year, replacing traditional high-carbon emission cement and gradually moving towards net-zero emissions. Purchase intention refers to a consumer predisposition or plan to buy a particular product or service in the future. As a key concept in consumer behaviour research, it indicates the likelihood of a purchase based on various factors such as attitudes, perceptions, and external influences. These three attitudes reflect the overall perception and liking towards the brand, product, or service, which can influence consumer buying behaviour and purchase intentions. Positive attitudes typically lead to a higher likelihood of purchasing or recommending the brand, product, or service, while negative attitudes can deter consumers from engaging with or purchasing the brand, product or service (Nguyen, Nguyen, & Luu, 2022). When consumers have a positive impression and attitude toward a particular product or brand, it may lead to purchasing intention, defined as the subjective probability of consumers buying a specific product or brand (Chekima, Chekima, & Adis, 2020).

Once consumers are familiar with a certain product and even develop loyalty, it becomes challenging to persuade them to switch to other products. Therefore, the promotion of plastering cement faces this dilemma. Singh Panesar and Markeset (2008) emphasize the shift in the focus of innovation management from early-stage product innovation, innovation behavior, and entrepreneurial spirit to contemporary service innovation. In the process of service innovation, the interaction and collaboration between customers, service providers, and suppliers have become increasingly important. While low-carbon cement offers energy savings and carbon reduction benefits and boasts excellent product features, the familiarity of construction worker teams with traditional Portland cement creates resistance to trying new products. This study aims to understand how Asia Cement promotes and establishes channels for low-carbon cement products, as well as the degree of acceptance among consumers (builders, construction companies, civil engineering contractors, etc.). Therefore, the objectives of this research are:

1. Consideration of potential factors in the initial promotion of low-carbon cement.
2. Evaluation of market recognition for low-carbon cement products.
3. Investigation into consumers' willingness to use low-carbon cement.

2. Literature Review

2.1 Case study- Taiwan Asia Cement

Asia Cement is part of the Far Eastern Group. Asia Cement adheres to the philosophy of "Industrial Development and Environmental Protection Go Hand in Hand" and has become the first cement factory in the global cement industry to simultaneously obtain the BS 8001 Circular Economy Maturity Optimization, ISO 14067 Product Carbon Footprint, and ISO 14046 Water Footprint certifications. As a leading player in the global cement and concrete industry, Asia Cement is planning to achieve the 2050 carbon neutrality pathway. According to the needs of buck cement used by concrete and bag

cement used by cement work, Asia Cement was leading the industry in Taiwan and launched low carbon products of masonry cement. In 2022, the Company started a new era of low carbon products in the industry in Taiwan with the outstanding results of actively promoting the products to customer groups. Asia Cement led the industry since 2011 to promote the sales of low carbon masonry cement. The cement is suitable for cement primer and finish on wall, brick laying, pebble treatment, pebble dashing, etc. plus superior constructability and anti-crack feature. Since it was difficult to ask cement workers to change their habbit, it was not easy to promote the product. Asia Cement participated "2022 Tainan International Green Industry Show" and "Taipei International Construction Material and Products Show" to promote masonry cement. In 2022, a total of 7,871 tons of low carbon masonry cement was sold by Asia Cement under its aggressive promotion, a growth of 5 times more than that of last year.

The low-carbon cement developed by Asia Cement involves reducing the proportion of high-carbon clinker in the cement production process, utilizing a high-performance formula that enhances workability. This innovation significantly addresses the drawbacks of traditional cement, reducing the need for additives, minimizing pollution in the production process, improving mortar water retention, and exhibiting excellent mortar cohesion. The low-carbon cement is adaptable to different sources of coarse and fine aggregates, minimizing issues such as expansion, cracking, and chicken feet patterns. Asia Cement initially introduced low-carbon cement at its Hualien plant in Taiwan, prioritizing promotion and usage in nearby counties and cities. The product has gained recognition and approval from numerous builders and construction worker teams. In response to the trends of carbon reduction, environmental protection, and low-carbon construction materials, Asia Cement is actively promoting low-carbon cement throughout Taiwan.

2.2 Environment Social Governance (ESG)

The term ESG was coined in a 2004 United Nations (UN) report titled "Who Cares Wins", aimed at raising awareness about the importance of environmental, social, and corporate governance issues for financial markets (Kempeneer, Peeters, & Compernolle, 2021). As such, a dual purpose can be identified in the use of ESG. Initially, investors focused on the value of ESG issues in and of themselves, stressing the environmental and social costs and benefits. Over time, other investors became interested in ESG from a more financially focused position, where sustainability is taken into account more rationally in function of its material costs and benefits (Eccles, Lee, & Stroehle, 2020; Yeye & Egbunike, 2023). ESG is a corporate assessment system that underscores the need for companies to seek the optimization of profits and focus on multiple objectives, including environmental preservation and social responsibility (Hamzah, Gozali, Annisa, & Pratiwi, 2022; Yuan, Li, Xu, & Shang, 2022). The climate change problem caused by the excessive emission of greenhouse gases, mainly carbon emissions, has emerged as a global quandary concerning the sustainable progress of human society. In particular, cement is a high-energy-consuming, high-pollution, high-carbon emission industry, and heavily polluting companies are the main culprits of carbon emissions, so it is important to understand the relationship between ESG disclosure and carbon performance of highly polluting listed companies.

Sustainability encompasses proactive corporate endeavors aimed at promoting economic, environmental, and social dimensions. These areas collectively form the sustainability acronym, encompassing three key aspects. The core of ESG components delineates environmental, societal, and governance aspects, playing a pivotal role in achieving sustainability impact. In broader terms, ESG encompasses a spectrum of non-financial aspects that influence a company's performance (Tettamanzi, Venturini, & Murgolo, 2022). A concept easily confused with ESG is CSR (Corporate Social Responsibility), meaning Corporate Social Responsibility, which is defined by the World Business Council for Sustainable Development (WBCSD) as the commitment of a company to contribute to economic development while improving the quality of life of its employees, their families, the local community as a whole, and society at large. While contributing to economic development, a company is committed to ethical behavior and improving the quality of life of its employees, their families, the local community, and society as a whole. CSR is a broad concept, and ESG is an indicator of how to implement the principles of CSR to assess the sustainability of a company in terms of the environment, society, and company operations. In other words, you can think of "Sustainable Management" as the general direction that enterprises should pursue, CSR is the main concept of sustainable management,

and ESG is one of the indicators (Taylor, Vithayathil, & Yim, 2018). In the past, enterprises only emphasized on financial data, however, if the financial report is beautiful, but behind the scenes, they are taking kickbacks, discharging wastewater, and infringing on consumers' rights and interests, the company's reputation will be in ruins, and investors will lose their confidence. Nowadays, companies that emphasize on the concept of ESG not only have transparent financial reports, but also include a stable and low-risk operation mode, and their long-term performance will be relatively stable (Peterdy, n.d.).

Heavy-pollution industry firms endure the pressure of higher environmental protection and technology transformation requirements, which have stronger peer effects in terms of green innovation input and environmental strategies. Tan, Yan, and Dong (2022) investigated the existence of the peer effect of green innovation among firms within high pollution, high energy intensity, and overcapacity industries. They find that green innovation in high-pollution enterprises not only promotes the green innovation of companies in the same industry but also positively influences the quality of peers' green innovation in non-high-pollution enterprises in the same peer group. Yang, Zhang, Zhang, and Liu (2022) found that other firms' green financing behaviors in the same industry or the same region significantly reduce external information uncertainty and increase a firm's green financing development. Siedschlag and Yan (2021) demonstrated that firms' environmental investments are highly correlated to peers' investments in environmental protection within the same industry or the same district. Currently, corporate ESG performance is being well-popularized in heavy-pollution industry firms' transformation management and corporate governance. Positive ESG news may reduce these firms' financing difficulties and cost in the secondary capital market (Capelle-Blancard & Petit, 2019; Innocent, Okafor, & Egolum, 2014). The cement industry is a labor-intensive and high-energy-consuming enterprise, so the organization should constantly innovate technology, develop green and energy-saving products, and think about organizational change to import excellent talents. The level of green innovation of the enterprise can present the environmental protection concept and competitive awareness of the enterprise director, which can show the technical strength of the enterprise, attract more investors' attention, and generate a positive reputation in the capital market, which will make the enterprise gain better public appraisal in the three aspects of environmental protection, social protection and governance. This will lead to better public appraisal of the enterprise in the environmental, social and governance aspects.

2.3 Market analysis of the cement industry

Cement is a national basic industry and a basic material for construction. Cement is an indispensable material for residential buildings, highways, bridges, wharves and other civil engineering and defense projects, and the boom of the cement industry is closely related to the promotion of public construction and the construction industry, etc. In addition, the cement industry requires huge capital expenditures, investment in machinery and equipment, and mining rights, land costs, and transportation costs, etc., which is considered a capital-intensive industry. Although there is not much technical obstacle, but under the huge capital demand, the threshold of entry is quite high, and the upstream and downstream changes of the industry are few, the industry is relatively stable, so the cement industry in Taiwan is not many manufacturers, thus constituting a typical oligopoly market, only the international price of raw materials and end demand is the main reason affecting the profitability of manufacturers. In 2020, global cement production will be 4.1 billion metric tons, with China accounting for 53.7% (2.2 billion metric tons) of the world's total cement production, followed by India with 8.3% and Vietnam with 2.3% (Huang, 2021). In 2023, geopolitical risks are high, with the U.S.-Russia war plus the Israeli-Harbinian war, and the global stalemate between high interest rate hikes and high inflation leading to weak terminal demand, low global consumer demand, and with the increase in the U.S. crude oil stockpile as well as the slow economic recovery after the lifting of the blockade of Mainland China, resulting in the decline of the price of crude oil, and the fourth quarter of 2023, the OPEC+ countries, including Russia, together with the Saudis and the Arabians, are appealing to the world to stabilize oil prices for the benefit of the global economy by cutting production. In the fourth quarter of 2023, OPEC+ countries, including Russia and Saudi Arabia, called for a global production cut to stabilize the oil price. Therefore, it is expected that the oil price will consolidate between US$70 and US$100 in 2024.

The key highlights of the cement industry are described as follows (GII, 2024):

1. The cement market was negatively impacted due to the COVID-19 pandemic, which resulted in decreasing demand across the construction industry and the closing of various manufacturing facilities. However, the market is recovering gradually and is likely to reach pre-COVID levels soon.
2. Over the short term, the growing residential constructions across the Asia Pacific region and the growing infrastructural activities in the Middle East and Africa region are some of the driving factors which are fueling the market demand. Moreover, the abundance availability of raw materials, such as fly ash, is also expected to drive the market forward.
3. However, government regulations on carbon emissions from cement manufacturing plants are hindering the market's growth.
4. Nevertheless, the shifting preference towards green construction and encouraging performance of HBC (High Belite Cement) in China are likely to provide opportunities to the market studied.
5. The Asia-Pacific region is expected to dominate the market and is also likely to witness the highest CAGR during the forecast period.

At present, the cement industry is also a circular economy, with low carbon and carbon reduction as the future vision of the enterprise, actively launching low-carbon cement and new types of building materials, and through the waste management and collaborative treatment capacity building, cement + energy + environmental protection three-in-one operation, so that the circular economy is no longer just a term; cement industry is actively oriented towards and the development of renewable energy, energy storage and intelligent power grid; both environmental conservation and industrial development, the cement industry The cement industry is characterized by sustainable development, the introduction of green production processes, energy saving and carbon reduction, the complete recycling of pollutants generated in the production process, and the use of kiln waste heat to recover high-temperature equipment, and the use of alternative energy to reduce the consumption of natural resources. Because the temperature of the cement kiln is quite high, it can process all kinds of biomass energy, including some new alternative fuels, so it can help the photovoltaic industry, semiconductor industry, paper industry, water purification plants, chemical plants, iron and steel mills and other industrial waste, and then convert the waste into resources to be reused as an alternative raw material for the cement production process, towards creating a "zero-waste, zero-pollution, zero-emission" circular economy, creating a sustainable enterprise. This is a new value towards creating a "zero-waste, zero-pollution, zero-emission" recycling economy and creating a sustainable enterprise, which can combine industrial development with the maintenance of a sustainable environment (Platform, 2024).

2.4 Process innovation and business reengineering

An innovation process generally consists of three phases aiming to transform an idea into an operable solution, creating value for the company. The three phases are front-end, development, and implementation (Garud, Tuertscher, & Van de Ven, 2013). Larsen, Lassen, and Schou (2023) pointed out that process innovation makes a significant contribution to the operation performance of businesses, making it a necessary means to maintain competitiveness. Hoerlsberger (2019) believed that service innovation involves providing customers with new solutions. The innovation processes and the new business models are being revolutionised. Service innovation represents a customer-oriented approach, developing new products and providing innovative service processes based on market demands (Eisingerich, Rubera, & Seifert, 2009). Innovation is defined based on its type, process, sectoral aspects, and other factors, such as product, process, market, business model, and organizational innovation (Cunningham & Walsh, 2019; Wang, Voss, Zhao, & Wang, 2015). Innovation is regarded as implementing a new, significantly improved product (or service), process, new marketing method, or organizational method in venture practice that creates value for the customer. Innovation involves identifying, generating, and exploiting ideas oriented to the market, product/service development, and business creation. As a result of an innovation process, a product or service is brought to market, or a new venture is launched (Acklin, 2010). Innovation is the process by which an organization uses its skills and resources to develop new products and services, or to develop new production and operating systems, so that the organization is better able to meet the needs of its customers, and innovation can lead to great organizational success.

Lean manufacturing can be regarded as a tool for identifying customer value and can be implemented in diverse areas, ranging from manufacturing to services, mass production to small-volume production, and labor-intensive industries to technology giants (Putri & Utama, 2024). Change management is increasingly becoming a crucial aspect of company daily operations. To ensure optimal control, special management techniques are employed that focus on the human factor, because the support of employees is vital for successful change implementation (Lauer, 2020). This study attempts to improve the productivity and efficiency of production through changes in organizational structure. Any organizational transformation must involve a change in work methods and the behavior of the majority of the employees. Therefore, they believe that organizational transformation is different from buying and selling a business, restructuring, and mergers and acquisitions. Therefore, they believe that business reengineering is different from buying and selling a business, restructuring, and mergers and acquisitions, and that successful business reengineering is restructuring that institutionalizes changes in the work behavior of employees, regardless of whether it is business process reengineering that helps a company to radically reshape its work processes. Manufacturing/service process is a series of logically sequential tasks to accomplish a specific manufacturing/service outcome. Process reengineering focuses on the overall realization of the firm's profitability goals, examines all service processes in relation to the firm's goals, and encourages comprehensive process shaping rather than improvement of minor processes. Therefore, when a new product is introduced in this case, it is not enough to have only 3-5 people responsible for the promotion process, a dedicated unit should be set up to promote product marketing and channel arrangements, and this measure involves business reengineering and manpower arrangements.

The masonry techniques in the construction industry are mostly passed down from generation to generation, including proportions and processes. These skilled artisans adhere to traditional products and construction methods, showing resistance to new products and technologies. Therefore, the concepts of service innovation or technological innovation need to be deeply communicated to these practitioners. Effective communication is crucial, as good products can save time and improve construction quality. Advancements in technology have made product functionalities more comprehensive and faster, enabling innovation in services. This innovation expands the scope of services, reduces the costs of manufacturing/services, and even brings services closer to individual customer needs or preferences.

3. Methodology

Research methodology can be divided into two types: quantitative and qualitative (Xiao, 2017). Quantitative research involves designing questionnaires, conducting surveys with customers, and using statistical analysis tools to verify the hypotheses. Qualitative research, which avoids numbers and emphasizes the interpretation of social facts, utilizes methods such as literature review, observation, and in-depth interviews to achieve research outcomes (Khan & Hossain, 2021; Xiao, 2017). According to Mey (2022), qualitative research helps to get a comprehensive view of a phenomenon from the perspective of the researcher. The natural surrounding facilitates a conducive space for the researcher to be exposed to a wealth of authentic experience from participants (Bans-Akutey, 2022; Creswell & Creswell, 2017). This study employs the qualitative research method of in-depth interviews. Through face-to-face communication and data recording, this method provides first-hand and authentic information. Both quantitative and qualitative research have their own advantages and disadvantages. Research validity in qualitative research is made through trustworthiness identification. A codebook developed through inductive and deductive approaches was used to establish rigor, validity, and inter-rater reliability (Roberts, Dowell, & Nie, 2019).

Traditional cement belongs to Portland cement, and its production process requires a significant amount of fuel and electricity, emitting substantial greenhouse gases. In order to effectively save energy and reduce emissions, low-carbon cement is a newly developed innovative product. This study first compares the characteristics of low-carbon cement and Portland cement, summarizing their features and differences as follows, characteristics of low-carbon cement:

1. Specially designed products for domestic masonry artisan teams.
2. Products comply with national standards and public construction framework specifications.

3. Reduces the issue of adding expansive powder quality.
4. Visible cost savings in mortar volume increase.
5. Low-carbon and environmentally friendly, promoting Earth conservation.
6. Adaptable to different coarse and fine sand sources.

To substantiate and illustrate the excellence and distinct characteristics of low-carbon cement compared to traditional cement, Asia Cement has conducted multiple quality and applicability tests in collaboration with masonry artisan teams. The differences between low-carbon cement and Portland cement are presented in Table 1.

Table 1. Differences between low-carbon cement and Portland cement

Category	Items	Low-carbon cement	Portland cement
Price		High	Low
Usage amount		Less usage	Used a lot
Construction performance	Feel of application	Easy to use	Difficult to use
	Add supplements	No	Supplements required
	Operating hours	Moderate	Shorter
	Mortar uniformity	Good	Yes
	Mortar agglomeration	Good	Yes
	Implementation process	Specific implementation process	No
Quality performance	Mortar water retention	Good	Yes
	Bulge	No	Yes
	Crack	No	Yes

The implementation of low-carbon cement follows specific procedures, and the traditional masonry artisan teams in the construction industry have been passed down through generations. Changing these procedures poses difficulties. This study identified factors to consider in the initial promotion of the product, including:

1. This product can meet the construction habits of masonry artisan teams

In the early development of low-carbon cement, the company conducted numerous laboratory tests using foreign materials and formulas, ensuring compliance with national standards. The product's bonding and crack resistance significantly outperform traditional Portland cement. Through extensive research and collaboration with masonry artisan teams, a formula and production technology were developed that cater to both local construction practices and product quality.

2. Exchange of concepts in traditional masonry artisan teams

Masonry artisan teams are traditionally passed down through generations, encompassing mix ratios and procedures. Considering the variations in practices between different regions and the current labor shortage in the construction industry, effective communication with masonry artisan teams are crucial to guide construction companies towards adopting the product.

3. Cost absorption through pricing strategy

Low-carbon cement is a high-quality cement for specialized applications, with high production formula and raw material costs. Internationally, low-carbon cement is priced higher than Portland cement. In order to expand the market for low-carbon cement, Asia Cement absorbs costs and reduces profits, setting the selling price equal to that of Portland cement.

4. Set up a temporary promotion team to promote this new product.

In this case, in order to promote the low-carbon cement, so set up a temporary promotional team of 3-5 people, due to the excellent quality of the product coupled with the team's hard work, revenue continues to rise, but unfortunately the members are too few than it is difficult to see the growth of the promotional performance, when the organization is faced with the development of a new product, the enterprise organization should be adjusted appropriately, especially in the market for this product to get

recognition of the word of mouth is not bad, the organization of the senior management must think about deploying additional manpower, and even The senior management of the organization should think about assigning more manpower or even setting up a special department to promote the product.

This study is based on the innovation of low carbon cement manufacturing process, it is necessary to understand the analysis of the internal and external environment of the industry, therefore, the SWOT analysis is used to identify the positioning of the product itself, by evaluating its "Strengths" - Strengths are the parts of the company that perform well, "Weaknesses" - Weaknesses are the parts of the company that it is not good at, "Opportunities" - the environmental factors that allow the company to improve its competitive advantage. Weaknesses - Weaknesses refer to the parts of a company that it does not specialize in, and Opportunities - Refers to the environmental factors that allow a company to increase its competitive advantage. "Threats" - These are external environmental factors that are beyond the control of the enterprise and may even affect its survival. Based on these factors, this study helps enterprises to formulate effective development strategies, conduct in-depth and comprehensive analyses of themselves, and position their competitive advantages. Based on the data collection, this study can organize the data as shown in Table 2.

Table 2. SWOT analysis of low-carbon cement

Strengths	**Weaknesses**
➢ Asia cement leading cement brand ➢ Fresh corporate image ➢ Convenient construction ➢ Excellent construction quality without cracking.	➢ Higher costs ➢ Special construction procedures ➢ Builder's consumption habits are not easy to change. ➢ Cement masonry artisan teams are accustomed to using traditional Portland cement. ➢ Cement industry is environmentally destructive.
Opportunities	**Threats**
➢ Compliance with ESG requirements ➢ Comply with energy saving and carbon reduction ➢ Continuously develop new products to replace Portland cement ➢ Obtaining international certificates (ISO 14067 Product Carbon Footprint, and ISO 14046 Water Footprint certifications.)	➢ Only suitable for a few applications in the construction industry, with little engineering use. ➢ Fewer product channels ➢ Cement has a shelf life and should not be store ➢ Highly energy consuming and polluting industry

4. Result and discussions

Low-carbon cement is an innovative and high-quality product, but the interview process resulted in somewhat disappointing outcomes. In this study, specific questions were designed regarding the demand for low-carbon cement, including brand preference, usage requirements, and purchasing intent. These interviewees are the key customers in determining the type of cement to use. Understanding the customers' voices is essential to developing products that meet their needs. Since the goal is to develop environmentally friendly cement, it is crucial to interview the primary users of the product. Various stakeholders were interviewed, including one construction company, one construction firm, three civil engineering contractors, and two building material suppliers. The key points from the interviews are summarized below:

1. To encourage consumers to use low-carbon cement, it is crucial to first identify the target audience. In this study, consumers are defined as construction companies, construction firms, civil engineering contractors, and building material suppliers.
2. In the western region of Taiwan, most consumers are unfamiliar with low-carbon cement and have never used it.
3. One building material supplier has heard of and ordered low-carbon cement, but due to its higher unit price and limited shelf life, they have not continued purchasing.

4. There are too few sales points (channels) for low-carbon cement compared to traditional Portland cement, which is readily available in various building material stores.
5. Regarding consumer habits and brand loyalty, civil engineering contractors are accustomed to using Portland cement, making it challenging to incentivize a switch to low-carbon cement.
6. Except for construction companies, the majority of consumers do not choose low-carbon cement based on environmental concerns.
7. In the early stages, due to cost considerations, consumers were hesitant to use low-carbon cement. However, as the prices of low-carbon cement and Portland cement are now comparable, some stakeholders are willing to give it a try.
   Low-carbon cement is suitable for various masonry applications such as cement finish, monolithic finish, bricklaying, and pebble washing. However, its usage intent is low due to the small quantities used in smaller construction projects or private builds, where it does not reach an economical scale. Therefore, promoting it in these contexts may lose its significance.

5. Conclusion

5.1 Conclusion

Based on the organized data provided by Asia Cement and valuable information obtained during discussions, low-carbon cement is an energy-saving and carbon-reducing product. In the cement production process, it reduces the proportion of high-carbon clinker, employs high-performance formulations, and enhances workability. This significantly improves traditional cement drawbacks, such as the need for additives, reduces pollution in the production process, and ensures good mortar water retention and cohesion. The mortar is adaptable to different sources of coarse and fine aggregates, minimizing issues like swelling, cracking, and chicken feet patterns. Using low-carbon cement for cement base and finishing can reduce time and provide flexibility in scheduling.

From this study, a practical and theoretical gap is evident. While we recognize low-carbon cement as an excellent product and believe that all customers should use it in the context of energy conservation, the actual usage rate is not high due to consumer habits and brand loyalty. This indicates a significant opportunity for improvement. The current marketing strategy is somewhat correct, but only a small segment of the population is conscious of the benefits. Therefore, Asia Cement can leverage various activities within the Far East Group to promote the importance of ESG and, in turn, encourage builders, construction companies, and masonry artisan teams to adopt low-carbon cement. This approach aims to achieve an "outside-in" marketing effect, closely intertwining with sustainable development, connecting manufacturing, quality control, and human protection, and contributing to the global village without compromising environmental protection.

5.2 Research suggestion

In terms of the current marketing and distribution strategies of Asia Cement, there are areas for improvement and learning opportunities. The following recommendations are proposed:

1. The unit price of low-carbon cement is higher. To encourage businesses to use it, the pricing strategy of aligning it with Portland cement can be maintained.
2. Two marketing approaches are suggested. The first involves targeting actual users or demanders, promoting product trials, technical exchanges with masons, and building product reputation.
3. The second marketing approach targets the general public who may not be direct users but can influence decisions. Enhancing awareness through media marketing, especially leveraging the Far East Group's extensive network and participation in events, is crucial, especially in the context of the current popularity of ESG issues.
4. Considering the limited shelf life of cement and transportation costs, expanding the number of delivery points beyond the current 5-7, even if the distribution channels are narrow, can contribute to economies of scale.
5. Establishing a promotion team for low-carbon cement is recommended, with a current membership of 3-5. As the business grows, increasing manpower, either internally or through collaborations with masonry artisan teams, will help boost sales.
6. Masonry artisan teams may be resistant to changing their habits and practices. Conducting 1-2 day

workshops in various regions to showcase the convenience and advantages of the product can gradually increase their willingness to try low-carbon cement.

7. Organize the reengineering and promotion of this new product to set up a dedicated department. In order to promote low-carbon cement, a temporary promotion team was set up. Due to the excellent quality of the product and the hard work of the team, the revenue has been increasing. Since this method of promotion is useful, the organization should be strengthened. Once a dedicated organization grows, some internal forces begin to change the production and marketing processes. As the organization grows, company executives are faced with the problem of managing the organization, and then they discover that the management process is closely related to the process of process innovation. The establishment of a dedicated new product promotion organization, senior managers to support and help promote. Managers focus on how to make the best use of the organization's resources in order to effectively achieve their goals, and they must face the problem of making the manufacturing process more efficient by increasing the number of people in the organization, and by strengthening the marketing of new products and the distribution of channels.

5.3 Future research directions

This case study adopts qualitative research through in-depth interviews with customers to obtain research findings on product innovation and marketing strategies. It is suggested that future research could employ quantitative methods by designing a questionnaire to explore differences in consumer habits, brand perception, and purchase intentions between low-carbon cement and Portland cement in ESG contexts. Through this analysis, cement manufacturers can understand consumer purchasing behavior and preferences, thereby proposing new marketing strategies to enhance customer loyalty.

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