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The Role of House of Sustainability in Green Supply Chain Management to Support Eco-Friendly Crystal Salt Packaging Design

Tegar Winoto Bagaskara[1], Farida Pulansari[1]

[1]*The National Development University "Veteran" of East Java, Industrial Engineering, Surabaya, Indonesia*

**Corresponding Author: Tegar Winoto Bagaskara*
Email: 21032010143@student.upnjatim.ac.id

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Abstract

This study aims to develop an environmentally friendly crystal salt packaging design using the House of Sustainability (HoS) approach at PT Baruna Energi Solusindo Teknik. The methods used include observation, questionnaire distribution, and literature study to identify consumer needs through Voice of Customer (VoC), as well as mapping sustainability attributes with Quality Function Deployment (QFD). The analysis showed that the use of HDPE plastic in packaging results in high carbon emissions and energy consumption. Based on VoC, the most prioritized attributes for consumers are environmental health, safety, and product price. The most influential technical responses in packaging design are the type of eco-friendly material, product durability, and pollution control. The proposed alternative packaging uses kraft paper material with a size of 33 cm × 33.5 cm and a transparent window to display the product contents. This design is considered to fulfill the overall technical, aesthetic, and sustainability aspects. In conclusion, the implementation of the House of Sustainability is effective in supporting environmentally friendly packaging design and strengthening green supply chain management in the company.

Introduction

Global environmental issues characterized by an increasing amount of plastic waste, especially from the packaging sector, have triggered concerns from various parties. Based on data from the Ellen MacArthur Foundation (2022), the packaging sector accounts for about 40% of total global plastic consumption, and most of it ends up as waste that pollutes the oceans. In Indonesia, by 2024, the total plastic waste is estimated to reach 3.4 million tons, with around 350,000 tons of it polluting the oceans. This issue drives the importance of adopting environmentally friendly packaging that is biodegradable or recyclable (Upadhyay & Kumar, 2020; Surya et al., 2023).

Green Supply Chain Management (GSCM) is a strategic approach that not only considers supply chain efficiency, but also the integration of environmental and social aspects in the production and distribution process (Fikri & Rini, 2023; Gawusu et al., 2022). Green supply chains are needed to balance between environmental aspects and corporate strategy (Pulansari & Putri, 2020). A strong implementation of GSCM is proven to increase energy efficiency, reduce carbon emissions, and improve corporate image (Roh et al., 2022; Hariyani et al., 2024). One important component in GSCM is sustainable product and packaging design (Pramesti et al., 2020; Gumulya, 2022: Steenis et al., 2017; White et al., 2015; Wandosell te al., 2021).

The House of Sustainability (HoS) is a development of the Quality Function Deployment (QFD) method that integrates environmental, social, and economic aspects into product design (Upadhyay & Kumar, 2020; Horan, 2022; Bereketli & Genevois, 2013; Santoso et al., 2024;

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Puglieri et al., 2020). This concept emphasizes the importance of consumer engagement through Voice of Customer (VoC) to produce relevant and sustainable products (Yunan, 2023; Mashabai et al., 2023). The HoS approach allows companies to systematically evaluate sustainability attributes and design the most prioritized technical solutions (Kartini et al., 2023; Prasetiyo et al., 2022; Adams et al., 2016).

PT Baruna Energi Solusindo Teknik, as a crystal salt producer in Indonesia, faces a major challenge related to the use of HDPE plastic as packaging material. Based on internal data, the use of 120,000 kg of plastic produces 720 tons of CO_2 emissions from the production process and 210 tons of CO_2 from waste incineration, and consumes 216,000 MJ of energy per year. This shows the importance of switching to environmentally friendly alternative packaging materials (Erfiana et al., 2022; Artadi, 2022).

Several studies have shown that the use of biodegradable and recyclable packaging materials has great potential to reduce environmental impacts in both the food and manufacturing industries (Anggalih, 2022; Morashti et al., 2022). For example, research by Wojnarowska et al. (2025) proved that the use of recycled glass bottles in the beverage industry can lower the carbon footprint in the supply chain. Meanwhile, Hariyani et al. (2024) emphasized the importance of collaboration between suppliers and manufacturers in creating environmentally friendly packaging materials. In addition to the sustainability aspect, packaging design also influences consumer views, product selling points, and compliance with standards such as SNI and BPOM (Zainudin et al., 2021; Putra et al., 2020; Pratiwi & Arini, 2021; Ministry of Industry, 2020).

However, research integrating GSCM and HoS approaches in the packaging design of crystal salt products is still very limited, especially in the salt processing industry sector (Shodiqin et al., 2024; Ackerman, 2015; Navabhatra, 2025). Therefore, this research was conducted to fill this gap through the development of environmentally friendly packaging based on the principles of the House of Sustainability and GSCM, utilizing QFD and VoC methods to systematically capture technical needs and consumer preferences.

The main objective of this study is to develop an environmentally friendly crystal salt packaging design that not only reduces environmental impact but also improves supply chain efficiency and company competitiveness. This study is expected to contribute theoretically to the development of an integrated sustainability approach and practically in the form of recommendations for sustainable packaging designs that can be applied in the manufacturing industry. Although many sustainability attributes are adopted from international literature, their relevance to the local Indonesian context, particularly for the salt industry in East Java, is carefully considered through discussions with company stakeholders and by referring to national packaging standards such as SNI and BPOM regulations.

Methods

This study uses a descriptive quantitative approach with design and evaluation methods aimed at developing environmentally friendly crystal salt packaging based on the House of Sustainability (HoS) concept. The research focuses on the packaging process of crystal salt products at PT Baruna Energi Solusindo Teknik, particularly the transition from HDPE plastic packaging to more environmentally friendly alternative packaging. The descriptive quantitative approach was chosen to systematically capture consumer perceptions through measurable data, which can then be integrated into the HoS and Quality Function Deployment (QFD) analytical frameworks. Although qualitative methods such as focused group discussions or participatory workshops have the potential to provide additional insights into emotional factors and user

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experiences, the scope of this research prioritizes structured quantification to align with the technical design optimization process.

Location and Time of Research

The research was conducted at PT Baruna Energi Solusindo Teknik, Surabaya, East Java, during the period January to April 2025. The location was chosen because the company actively produces high volumes of crystal salt and is committed to more sustainable product development.

Identification and Operational Definition of Variables

In this study, the variables used are classified into two main types, namely independent variables and dependent variables. The dependent variable is environmentally friendly crystal salt packaging design. This variable is expressed in the form of packaging design specifications that integrate sustainability aspects in terms of environmental, social, economic, and product quality. Meanwhile, the independent variables are sustainability attributes that influence packaging design and were identified based on literature and field study results. These attributes consist of:

Table 1. Sustainability Indicators and Attributes

No.	Indicator	Sustainability Attributes	Literature
1	Environment	Natural resource management	Upadhyay and Kumar (2020)
		Environmental Health	Upadhyay and Kumar (2020)
		Recyclable	Faradilla et al. (2022)
		Minimizing Waste	Daniella et al. (2024)
2	Economy	Production Cost Efficiency	Firmansyah (2025)
		Competitiveness	Upadhyay and Kumar (2020)
		Product Price	Faradilla et al. (2022)
3	Social	Security	Harahap (2023)
		Supplier Engagement	Ruslaini and Kusnanto (2020)
		Regulatory Compliance	Ruslaini and Kusnanto (2020)
4	Quality	Durability	Horan (2022)
		Flexible	Faradilla et al. (2022)
		Resilience	Faradilla et al. (2022)
		Attractive Design	Faradilla et al. (2022)

Each attribute is measured using a Likert scale (1-5) through a questionnaire instrument to determine the level of importance in the eyes of consumers. The data obtained are then analyzed to determine the priority weight of each attribute to prepare a House of Sustainability (HoS), which is used as a basis in designing environmentally friendly packaging that meets consumer needs and expectations. It should be noted that sustainability attributes often involve practical trade-offs; for example, increasing product attractiveness may conflict with efforts to minimize material use or maximize recycling, while increasing product durability may lead to increased production costs or complexity. This study addresses these trade-offs by applying priority weights through Voice of Customer (VoC) analysis, so that design decisions can balance various conflicting factors according to consumer preferences and sustainability priorities.

Data Collection Technique

Data collection was carried out using three main methods, namely direct observation, interviews, and questionnaire surveys. Observations were conducted in a semi-structured

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manner by mapping the production process flow, types of crystal salt packaging materials, packaging material flow, energy consumption during the drying stage, and waste management practices. In-depth interviews were conducted with production managers and packaging operators to obtain contextual information about the challenges in implementing sustainability principles, as well as to explore insights into opportunities for process improvement. Meanwhile, a questionnaire using a Likert scale (1-5) was distributed purposively to nine respondents consisting of CSR managers, finance managers, quality control managers, production managers, and five environmental experts with expertise in evaluating sustainability aspects. Data from this questionnaire was analyzed using the Voice of Customer (VoC) approach to identify consumer needs and preferences regarding environmentally friendly packaging attributes and determine the priority of the most desired attributes.

Data Processing Technique

After analyzing using the Voice of Customer (VoC) approach, the next step is to conduct a House of Sustainability (HoS) analysis. The stages of the House of Sustainability (HoS), which starts from determining the technical response, determining the relationship between technical responses and sustainability attributes, determining technical correlations and relationships between technical responses, calculating weights, absolute priorities and relative priorities.

Results and Discussion

Data collection in this study was carried out to obtain a comprehensive picture of the actual conditions of the production and packaging process of crystal salt products at PT Baruna Energi Solusindo Teknik, as well as the environmental impacts caused. The data collected consisted of raw material usage data, production process data, and environmental impact data due to the use of plastic as packaging material.

Table 2. Raw Material Usage Data

Raw Materials	Needs per Year	Unit
Sea Water	500000	m^3
Electrical Energy	175000	kWh
HDPE plastic	120000	Kg

Based on documentation from the company, it is known that the crystal salt production process involves the consumption of the main raw materials of seawater, electrical energy, and HDPE plastic for packaging. The volume of seawater used in a year reaches 500,000 m^3, while the consumption of electrical energy is recorded at 175,000 kWh. The use of HDPE plastic as packaging material reaches 120,000 kg per year. This data shows a considerable dependence on natural resources and energy in the production and distribution of products.

Table 3. Data on Energy/Electricity Usage in the Production Process

Production Stages	Duration (Days)	Energy/Electricity (kWh)
Seawater Filtration	10	25000
Solar Evaporation	45	0
Crystallization	15	15000
Drying	7	85000
Sorting and Packaging	10	50000
Distribution to Warehouse	3	-

The company's crystal salt production process consists of several stages: seawater filtration, sunlight-assisted evaporation, crystallization, drying, sorting and packaging. Among all these

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stages, the drying process is the most energy-intensive, with consumption reaching 85,000 kWh per year. The high energy consumption at this stage indicates the need to apply more efficient technologies in the production process.

Table 4. Environmental Impact Data

Environmental Impact Data (120 tons of plastic/year)				
No.	**Impact**	**Consumption (Kg)**	**Emissions (Kg plastic)**	**Total Emissions (tons CO2)**
1	Carbon Emissions from Plastic Production	120000	6	720
2	Carbon Emissions from Plastic Combustion	60000	3.5	210

Table 5. Energy Consumption Data

Plastic Type	**Consumption**	**Energy**	**Total Usage**
HDPE	120000	1.8	216000
Energy Consumption for Plastics Production			216000

In addition to material and energy consumption, the data also shows a significant environmental impact from the use of plastic packaging. The HDPE plastic production process generates carbon emissions of 720 tons of CO_2 per year. On the other hand, around 60,000 kg of unmanaged plastic is incinerated, resulting in additional emissions of 210 tons of CO_2, bringing the total emissions from plastic use to 930 tons of CO_2 per year. In addition to emissions, plastic production also contributes to energy consumption of 216,000 MJ per year. This confirms that plastic use not only impacts air pollution, but also significantly increases energy consumption.

Green Supply Chain Management Analysis

Green Supply Chain Management (GSCM) is a strategic approach that integrates sustainability aspects in all supply chain activities, from raw material procurement to final waste management. In the context of this research, GSCM analysis is used to evaluate the extent to which the supply chain process at PT Baruna Energi Solusindo Teknik has reflected environmentally friendly practices, as well as to identify potential improvements in each operational stage.

At the green procurement stage, it was found that the company still uses HDPE plastic as the main packaging material, which does not meet the criteria for sustainable materials. This packaging is flexible with no supporting structure and is transparent, sealed with a manual seal system with the words “Hasil Cucian” on the surface of the packaging, indicating a lack of design elements and product information, which is not in line with the principles of sustainable design. The absence of supplier selection based on environmental criteria, such as ISO 14001 certification, indicates that sustainability aspects have not yet become a primary consideration in the procurement process. Therefore, the company is advised to establish strategic partnerships with suppliers of environmentally friendly materials, such as recycled kraft paper and bioplastics, as a transition toward a green supply chain.

At the green design stage, the crystal salt packaging produced by PT Baruna Energi Solusindo Teknik still uses HDPE plastic material which is known to be strong, impact resistant, and resistant to moisture. The packaging is in the form of a large transparent bag with a seal at the top to maintain freshness and prevent contamination. The design is simple and functional, with

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a transparent display that makes it easy for consumers to see the contents of the product. However, this packaging did not reflect the principles of eco-design as it did not have any recycling features or sustainability information, which reduced the appeal of the product and had a negative impact on the environment. Therefore, a redesign is needed by considering biodegradable materials, modular design for easy recycling, and visual elements that support an eco-friendly image.

In the green production stage, the crystal salt production process at PT Baruna Energi Solusindo Teknik consists of seawater filtration, evaporation, crystallization, re-washing, drying, and packaging. Based on Table 3, the drying stage is the most energy-intensive, with a consumption of 85,000 kWh per year, thus contributing significantly to carbon emissions. The final product is crystalline salt that is packaged using HDPE plastic. To support green production, the company can conduct regular energy audits, replace old machines with more efficient ones, and implement a washing water reuse system. These steps will increase energy efficiency while supporting a more environmentally friendly production process.

In terms of green distribution, the company still relies on fossil fuel vehicles with fuel consumption reaching 1,800 liters per month, resulting in carbon emissions of 45,600 kg CO_2 per year, a significant environmental impact from product distribution. To address this, distribution optimization can be pursued through the implementation of a GPS-based digital route system, the use of electric vehicles (EVs), and more efficient distribution scheduling, as illustrated in Table 6 which presents the distribution data of crystal salt products. While the transition to EVs offers considerable sustainability benefits, it also faces infrastructure and cost barriers in East Java. As an interim strategy, the company can explore hybrid vehicle options, optimize delivery routes using logistics software, or collaborate with third-party logistics providers specializing in eco-friendly transportation. These measures can yield immediate environmental improvements while gradually paving the way for a full transition to EV-based distribution.

Table 6. Distribution Data of Crystal Salt Products

Parameters	Value	Unit
Number of Distribution Vehicles	4 units	Vehicle Unit
Fuel Consumption per Month	1800	Liter/month
Average Distance Traveled	450	Km/day
CO_2 Emissions per Year	45600	Kg CO_2

Analysis on green packaging shows that the use of HDPE plastic for packaging has a considerable environmental impact, both in terms of emissions and energy consumption. With a total plastic consumption of 120,000 kg per year, the resulting emissions reach 930 tons of CO_2. In addition, the energy used to produce the plastic reaches 216,000 MJ. In this context, replacing packaging materials with more environmentally friendly materials such as biodegradable and recyclable kraft paper is an important step to reduce the environmental footprint of the product. Table 7 below shows the evaluation data of crystal salt product packaging.

Table 7. Crystal Salt Product Packaging Evaluation Data

Parameters	Value	Unit
Packaging Material Type	HDPE	-
Total Plastic Consumption/Year	120	Tons
CO_2 emissions from plastic production	720	Tons of CO_2

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Parameters	Value	Unit
Plastic Packaging Production Energy	216000	MJ

In addition, in terms of green recycling aspect, it was found that the company does not yet have an adequate plastic waste management system. Unused plastic tends to be burned, producing additional emissions without utilizing the economic value of recycling. The absence of an internal recycling system and the lack of cooperation with waste treatment partners are major obstacles to forming a sustainable closed system. Therefore, the company needs to immediately develop a better waste management system through collaboration with recycling industry partners and by leveraging existing opportunities at the local level. Mechanical recycling models are the most feasible initial option given the current infrastructure, while the implementation of Extended Producer Responsibility (EPR) principles can strengthen reliance on recycling practices in packaging waste management. Collaboration with municipal waste management systems and private recycling companies is also key to creating a more closed-loop and sustainable packaging material management cycle.

Overall, the results of the GSCM analysis show that PT Baruna Energi Solusindo Teknik has a great opportunity to improve sustainability performance at all stages of the supply chain. This effort will not only reduce environmental impacts, but also strengthen the company's competitiveness amid increasing consumer awareness of the importance of sustainable products. The integration of GSCM principles is an important foundation in supporting the successful design of environmentally friendly crystal salt packaging based on the House of Sustainability.

Questionnaire

To determine consumer perceptions and expectations regarding environmentally friendly packaging, a questionnaire was distributed using a 1-5 Likert scale approach to nine respondents consisting of CSR managers, finance managers, quality control managers, production managers, and five environmental experts with expertise in evaluating sustainability aspects. The questionnaire summary results served as the basis for understanding the sustainability attributes considered important by consumers and were further used in the development of the Voice of Customer (VoC).

Table 8. Questionnaire Recapitulation

No	Question	R1	R2	R3	R4	R5	R6	R7	R8	R9
1	I feel that the use of environmentally friendly crystal salt packaging supports better management of natural resources.	4	5	3	4	5	5	5	5	5
2	I feel that the use of environmentally friendly packaging can reduce the risk to human health and the environment.	5	5	4	5	5	5	5	5	5
3	I prefer to buy crystal salt whose packaging can be recycled or reused.	3	4	4	4	5	4	5	5	5
4	I support the use of environmentally friendly packaging to help minimize the waste generated.	4	4	4	4	5	5	5	5	5
5	I believe that the use of environmentally friendly packaging can improve production cost	3	4	3	3	4	5	4	3	5

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No	Question	R1	R2	R3	R4	R5	R6	R7	R8	R9
	efficiency in the long run through reduced raw material costs and waste.									
6	The use of environmentally friendly packaging can provide a competitive advantage for companies in the industry.	4	5	4	4	5	5	3	3	4
7	The price of crystal salt with environmentally friendly packaging influences my decision to buy the product.	3	4	3	4	5	5	3	3	4
8	I feel safer using crystal salt with eco-friendly packaging because I know it is safer for my health and the environment.	4	5	4	4	5	5	5	5	5
9	I feel more confident buying salt from brands that care about sustainability and the environment.	3	4	5	3	5	4	4	5	5
10	I feel more comfortable buying salt from producers that comply with regulations related to sustainability and environmental management.	3	4	3	3	5	4	4	5	5
11	I feel that the use of environmentally friendly crystal salt packaging has high durability and is not easily damaged.	4	4	3	4	4	3	3	4	4
12	I think the eco-friendly crystal salt packaging is very functional, easy to open and store.	4	5	4	4	5	3	3	5	4
13	I think that the environmentally friendly packaging of crystal salt can maintain the quality of the salt inside well.	5	5	5	5	5	3	3	5	4
14	I believe that crystal salt with eco-friendly packaging has a more attractive design than plastic packaging.	5	4	4	4	5	3	3	5	5

The questionnaire distributed to consumers shows that sustainability is a major concern. Attributes such as environmental health (4.89), safety (4.67), and product price (4.67) were the most prioritized. This shows the high level of consumer concern for products that are not only quality but also ecologically and economically sustainable.

Analysis of Consumer Importance Level with Voice of Customer (VoC)

Voice of Customer (VoC) is a systematic method to capture consumer needs and preferences for products. In this research, VoC is used to analyze the packaging attributes that consumers prioritize most in the context of sustainability, so that it can be used as a foundation in the alternative packaging design process.

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Table 9. Voice of Customer and Calculation

Attributes		Level of Importance					N	Interest Level	*Rank*	*Goal*	*Improvement Ratio*	*Sales Point*	*Raw Weight*	*Normalized Raw Weight*
		1	2	3	4	5								
Environment	Natural Resource Management	0	0	1	2	6	9	4.56	4	5	1.01	1.5	6.9	0.08
	Environmental Health	0	0	0	1	8	9	4.89	1	5	1.00	1.5	7.35	0.09
	Recyclable	0	0	1	4	4	9	4.33	7	4	0.99	1.5	6.45	0.08
	Minimizing Waste	0	0	0	4	5	9	4.56	4	5	1.01	1.5	6.9	0.08
Economy	Production Cost Efficiency	0	0	4	3	2	9	3.78	13	4	1.01	1.2	4.56	0.06
	Competitiveness	0	0	2	4	3	9	4.11	10	4	1.00	1.2	4.92	0.06
	Product Price	0	0	0	3	6	9	4.67	2	5	1.01	1.5	7.05	0.09
Social	Security	0	0	0	3	6	9	4.67	2	5	1.01	1.5	7.05	0.09
	Supplier Engagement	0	0	2	3	4	9	4.22	8	4	0.99	1.2	5.04	0.06
	Regulatory Compliance	0	0	3	3	3	9	4.00	12	4	1.00	1.2	4.8	0.06
Quality	Durability	0	0	3	6	0	9	3.67	14	4	1.01	1.2	4.44	0.05
	Flexible	0	0	2	4	3	9	4.11	10	4	1.00	1.2	4.92	0.06
	Resilience	0	0	2	1	6	9	4.44	6	4	0.99	1.5	6.6	0.08
	Attractive Design	0	0	2	3	4	9	4.22	8	4	0.99	1.2	5.04	0.06
								60.22					82.02	

The VoC analysis confirmed that consumers are very concerned about sustainability aspects in purchasing decisions. The three main attributes with the highest raw weight values are environmental health (7.35), safety (7.05), and product price (7.05). This indicates that companies need to design packaging that is not only technically environmentally friendly, but also provides a positive perception of the safety and economic value of the product.

House of Sustainability (HoS) Analysis

The House of Sustainability (HoS) is a tool to map the relationship between sustainability attributes desired by consumers and technical characteristics that can be realized in packaging design. In this subsection, a HoS matrix is developed that shows the relationship between elements as well as technical weights based on absolute and relative priority calculations.

The first step in implementing HoS is to identify consumer needs based on the results of the Voice of Customer (VoC) analysis, which resulted in 14 sustainability attributes that consumers consider important. These attributes include environmental health, safety, product price, recyclability, and natural resource management, among others. Furthermore, these attributes are associated with ten technical responses or technical solutions designed to meet consumers' sustainability needs, such as material selection, packaging form, pollution control, production optimization, tools usage, and certification and standardization. The relationship between each attribute and technical response is outlined in a relationship matrix using weighted scoring

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symbols, i.e. 9 for strong relationship, 3 for medium, and 1 for weak. The analysis results show that the technical responses with the highest priority weights are environmentally friendly material types with an absolute priority value of 3.73, durable products with a value of 3.38, and pollution control with a value of 3.15.

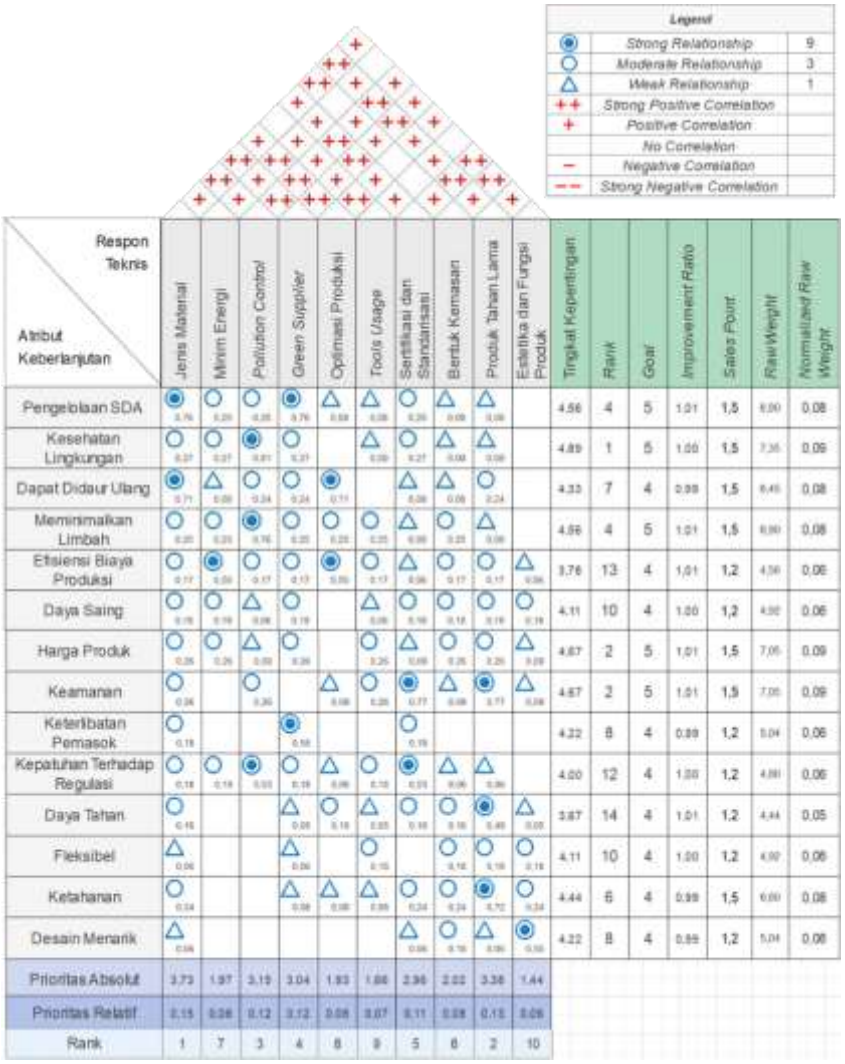

Figure 1. House of Sustainability of Eco-Friendly Crystal Salt Packaging

Material type is a top priority as it has strong relationships with almost all important attributes in the environment and quality dimensions, particularly environmental health, recyclability and waste management. The findings indicate that packaging design should focus on using environmentally friendly materials such as biodegradable and recyclable kraft paper, instead of the HDPE plastic that is currently used. Product durability is also a priority as it relates to protection against moisture and damage during distribution, which is closely related to packaging durability and safety. Meanwhile, pollution control is important in the context of energy efficiency and the company's efforts to reduce emissions in the packaging production process.

In addition to the relationship between attributes and technical responses, technical correlations between technical responses were also analyzed to understand how one technical solution can influence or reinforce other technical solutions. For example, the type of material shows a strong positive correlation with packaging shape and pollution control, which means that the

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choice of material not only has a direct impact on sustainability, but also reinforces other technical elements. Based on the results of technical weight calculations, absolute and relative priority values, and the relationships between elements in the House of Sustainability (HoS) matrix, this approach provides a robust framework for redesigning crystal salt packaging in a sustainable manner, which not only meets consumer preferences and environmental demands but also ensures that each key attribute, such as environmental health or product durability directly influences the technical aspects of packaging development. The structured weighing process helps manage trade-offs and provides transparency in how the final design choices are derived from consumer input and sustainability considerations.

Product Specifications

Based on the results of the Voice of Customer (VoC) and House of Sustainability (HoS) analysis, alternative packaging specifications for crystal salt products were designed that integrate sustainability principles and consumer preferences. The packaging design developed uses kraft paper as the base material, which has biodegradable properties, is easily recyclable, and can reduce carbon emissions and energy consumption when compared to the HDPE plastic previously used.

This packaging has dimensions of 33 cm × 33.5 cm, with a basic shape resembling a paper bag equipped with a transparent circular window in the center of the package. This window feature allows consumers to see the contents of the product directly without opening the package, while increasing visual appeal. To maintain product safety during distribution and storage, the packaging closure system is designed using a top fold with a seal sticker, which provides additional protection against moisture and contamination.

Based on the House of Sustainability that has been determined previously, by measuring the sustainability aspects to increase the sustainability score in the design concept, the design of the sustainability packaging of crystal salt packaging made from kraft paper is obtained. In addition to designing technical specifications, this research also produced a prototype of eco-friendly crystal salt packaging made from kraft paper as a form of implementation of the House of Sustainability analysis. The prototype was designed with dimensions of 33 cm × 33.5 cm and features a simple yet functional design. One of the main elements of the prototype is the transparent circular window in the center of the package, which allows consumers to directly see the contents of the product without the need to open the package. This feature not only enhances visual appeal, but also reinforces the product's image as a high-quality product and transparent in presentation.

The packaging structure is designed to be sturdy and resistant to moisture, given the hygroscopic nature of crystal salt. The addition of a folding closure system with seal stickers provides additional security during the distribution and storage process. In terms of aesthetics, the natural look of kraft paper gives a premium feel and supports the perception of sustainability among consumers. This prototype embodies the highest technical priorities in HoS, such as the selection of eco-friendly materials, packaging durability, and pollution control during the production process. As such, it reflects the synergy between consumer needs, product sustainability and sustainable business strategy.

Conclusion

This study proves that the integration of the House of Sustainability (HoS) approach and Green Supply Chain Management (GSCM) is effective in supporting the development of environmentally friendly crystal salt packaging design at PT Baruna Energi Solusindo Teknik. Based on Voice of Customer (VoC) analysis, the sustainability attributes most prioritized by

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consumers are environmental health, product safety, and price, which were then implemented as key technical responses such as selecting environmentally friendly materials, durable products, and pollution control. The resulting packaging design, a 33 × 33.5 cm kraft paper box with a transparent window, is considered to meet technical, visual, and sustainability aspects while reducing carbon emissions and energy consumption compared to the previous use of HDPE plastic. This approach also strengthens the application of GSCM across various dimensions such as green procurement and green recycling to enhance the company's efficiency and competitiveness. For further development, it is recommended that future studies evaluate packaging performance through real-world distribution and storage tests, and address potential trade-offs between sustainability and functional performance through prototype performance testing under simulated storage and distribution conditions. Additionally, incorporating Life Cycle Assessment (LCA) will facilitate a more comprehensive understanding of the environmental impacts of alternative packaging solutions throughout the product lifecycle, and open opportunities to expand the application of the HoS approach to other industrial sectors to test its flexibility in various contexts.

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