Journal of Marketing & Social Research
ISSN (Online): 3008-0711
Volume: 02 | Issue 02 | Mar-Apr. | 2025
Journal homepage: https://jmsr-online.com/

Research Article

Analysing Sustainable Development related to Market Perspective in Seafood Industry using Analytical Hierarchy Process

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Submission: 10/01/2024; Received: 02/02/2025; Revision: 11/03/2025; Published: 26/03/2025

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Abstract: The seafood industry has been one of the world's fastest-growing sectors for many years. Advancement in any sector becomes inevitable, especially in a sector that supplies the world's protein needs. However, it has a lasting impact on day-to-day living and increases competition in sustainable management. The researchers in the study have evolved the application of the Analytical Hierarchy Process (AHP) to identify and prioritize the key factors that influence the sustainable seafood market. These factors have been evaluated by experiencing a sustainable seafood market. During the evaluation procedure, the AHP was applied to determine the relative weightage of the evaluation criteria. The study results indicate that Quality, Market Branding, User Renunciation, Positioning Strategies and then Freezing Technology which is the most important criteria for a sustainable seafood market to have a significant impact. The out of indicates the highest ranking in User Renunciation among other criteria. The preference for future strategy decision-making procedures helps the stakeholders make effective decisions.

Keywords: Sustainable Seafood Market, Multi-Criteria Decision Making (MCDM)Relationship. Analytical Hierarchy Process (AHP). Sustainable Development Goals.

INTRODUCTION

Seafood is an important contributor towards developing a sustainable market since it fulfils the rising demand worldwide while protecting the environment. Long-term market expansion and ecological balance can be achieved by the seafood business by encouraging ethical behaviour and sustainable production. The seafood sector is essential to feeding millions of people worldwide, providing a crucial source of protein, and making a substantial contribution to economies and food security worldwide. Nonetheless, there are many obstacles the industry must overcome to successfully promote its goods. Strict regulatory restrictions, shifting consumer preferences for sustainability and transparency, and price volatility [1], brought on by erratic events like weather and supply chain interruptions make it challenging for seafood businesses to achieve steady growth and profitability. Notwithstanding these obstacles, there are plenty of chances for innovation and adaptation in the sector. Seafood's growing appeal as a sustainable and healthful protein source, along with e-commerce's explosive expansion, presents opportunities to expand your customer base and forge closer bonds with existing customers. Fish companies need to use sustainable and effective marketing strategies to take advantage of these prospects and overcome current obstacles [2]. Using the Analytic Hierarchy Process (AHP), a systematic decision-making methodology is one such strategy. AHP gives seafood companies a methodical framework for assessing and ranking many aspects that affect marketing tactics, allowing them to successfully handle challenging situations. AHP assists stakeholders in determining the best course of action that satisfies regulatory, consumer-driven, and economic objectives by decomposing issues into hierarchical components and conducting pairwise comparisons. This study explores how the AHP technique can be used to create sustainable marketing plans for the seafood sector. Seafood companies can make well-informed decisions by using the AHP framework, which analyses important issues like price volatility, regulatory compliance, and changing consumer tastes, as well as opportunities like digital transformation and sustainability messages. The development of robust and customer-focused marketing strategies that boost sustainability, increase profitability, and guarantee long-term success in a cutthroat global marketplace is eventually supported by this strategy.

LITERATURE REVIEW

The following studies examine the tactics and functions involved in the growth of the seafood market.

2.1 Sustainable Market development & Seafood Industry challenges:

TTN Lan (2023) looked into the market development plans of renewable energy companies in Vietnam, pointing out flaws and suggesting fixes to improve operational effectiveness. Additionally, it makes recommendations for macro-level regulations to promote industry expansion and

match business plans with real-world requirements. L. Sujanska et al (2023) analysed how sustainability affects consumer attitudes, builds brand recognition, and fosters consumer loyalty and trust. It offers sustainable marketing ideas and tactics that help businesses stand out from the competition, become more competitive, and succeed over the long haul. GK Amoako et.al (2022) investigated how Ghanaian consumers react to sustainable marketing tactics and their effect on attaining the Sustainable Development Goals (SDGs). The favourable effect of green marketing on consumer behaviour is mediated by price, according to structural equation modelling based on 622 valid replies. Marketers and legislators can use the data to improve public acceptability and alter consumer sentiments, particularly among young people Kittinger et al (2021) proposed utilizing jurisdictional methods to align incentives for sustainability among governments, producers, and supply chains by merging market-based approaches with ecosystem-based governance. It finds weaknesses in the current certification frameworks and investigates how these methods can lead to conservation accomplishments at the ecosystem scale. J Penca et al(2021) examined the Mediterranean market, pointing out problems like the undervaluation of SSF products and their lack of traceability. It also suggests innovations including product diversification, value chain shortening, and community empowerment. By enhancing their organization and market power, these programs can assist SSF in becoming more socially, economically, and environmentally sustainable. DF Willer et al (2021) addressed how modern processing technology can boost edible meat yield, improve food safety, and raise production efficiency. They also look at consumer obstacles and show how convenient, enticing bivalve products could provide sustainable seafood options.

2.2 Analytical Hierarchy Process in Fisheries:

TT Hue et al (2023) utilized the Delphi technique and AHP to study the green brand equity (GBE) for sustainable development in underdeveloped nations. It highlights five important GBE elements and offers guidance to help with sustainable development initiatives. In their multi-criteria evaluation. HB Akdeniz et al (2023) evaluated the Analytic Hierarchy Process (AHP) as crucial for choosing appropriate locations for shrimp farming in Turkey. The findings show that just 0.88% of the land is suitable for aquaculture, either strongly or moderately. N. Mangun et al (2021) created a framework for evaluating the economic, social, and environmental aspects of Indonesia's fishery supply chain's sustainable performance using the AHP technique. Future policy decisions are informed by this finding, which ranks environmental variables as the most important for sustainability. Awang et al (2020) ranked the elements influencing sustainable fishing management using the Analytic Hierarchy Process (AHP). Protecting species interactions, profit, employment, and overfishing for long-term sustainability are top issues.HR Francisco et al (2019) used the Analytic Hierarchy Process (AHP) and found that 18.71% of the land was suitable for fish farming. Resource allocation and regional planning for aquaculture growth can benefit from this strategy. SK Mangla et al (2017) ranked 30 barriers using fuzzy AHP and gave regulators and industry management advice on how to use SCP more effectively. HB Akdeniz et al., the Analytic Hierarchy Process (AHP) is crucial for choosing appropriate locations for shrimp farming in Turkey. The findings show that just 0.88% of the land is suitable for aquaculture, either strongly or moderately.

2.3 Multi-Criteria Decision-Making in seafood sustainability:

G. Ferla et al (2024) reviewed the application of multi-criteria decision analysis (MCDA) to evaluate food supply chain sustainability, emphasizing sustainability indicators, stakeholder participation, and methodology. D Yadav et al (2023) investigated how strict food safety regulations (FSMs) affect international trade and the difficulties faced by Indian seafood exporters. This study ranks markets, identifies important FSMs, and determines that the EU, USA, and Japan have the most stringent requirements using Delphi, fuzzy AHP, and TOPSIS.M Pradeep et al (2023)used the Fuzzy DEMATEL approach to assess the key obstacles in the seafood packaging sector, including economic crises and knowledge leakage. The results of the study provide valuable perspectives for improving industry competitiveness, sustainability, and efficiency. ML Tseng et al (2022) investigated zero-waste practices and the circular business strategy in the seafood processing sector under uncertainty. It finds important characteristics, relationships, and crucial behaviours like recycling and reuse using sophisticated techniques like the fuzzy Delphi method, fuzzy DEMATEL, and Choquet integral, offering practical insights for long-term success. R Voola et al (2022) researched the salient features of the literature on B2B marketing's fragmented engagement with the Sustainable Development Goals (SDGs) of the UN. It examines the prospects for proactive research, putting out strategies and inquiries to connect B2B marketing with societal issues relevant to the SDGs. CN Wang et.al (2021) proposed a Multi-Criteria Decision Making (MCDM) model that employs the Weighted Aggregated Sum Product Assessment (WASPAS) and the Fuzzy Analytical Network Process (FANP) to assess and choose the best raw shrimp providers for the fisheries sector. When faced with a fuzzy decision-making environment, the model determines that Supplier 3 is the best option. M. Luna et al (2019) conducted research and suggested a multi-criteria decision-making approach for designing feeding plans for gilthead seabream production.

AHP and fuzzy AHP are two of the many research tools available in the seafood business sector, and they are used to address issues including price volatility, sustainability, and regulations. Although AHP has been employed in industries such as fisheries and seafood packaging, it has not been widely used to design marketing strategies for the seafood manufacturing sector, especially when it comes to consumer trends and sustainability. Furthermore, barely any study has been done to ascertain how AHP can evaluate the interdependencies among the elements pertaining to user preferences, regulatory compliance, and pricing fluctuations. This study closes this gap using AHP by developing a framework for sustainable marketing that incorporates these factors to enhance decision-making.

code	Criteria	References
A1	Quality	5
A2	Market Branding	12
A3	Time Delivery	19
A4	Freezing Technologys	8
A5	User Renunciation	3
A6	Positioning Strategic	16

Primary Objective;

- To identify the main criteria in the seafood industry among overall barriers related to the sustainable development market.
- To highlight which barriers, contribute towards increased User Renunciation in the outcome.
- To identify specific criteria that impacts the final outcome.
- To contribute towards the economic development and sustainable development to the nation as the ultimate goal.

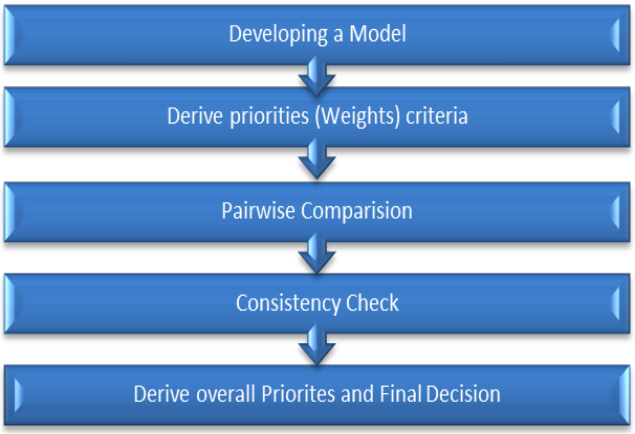
Criteria	Impact highlight
Quality	Quality is a multifaceted concept that has been the subject of extensive research and debate across various disciplines. At its core, quality refers to the degree to which a product or service meets the needs and expectations of the consumer or user. (Box, 1983) (Ada et al., 2017)
Market Branding	Brand marketing is a strategic approach to promoting and positioning a company's products or services in the market. At its core, brand marketing involves creating a distinctive identity for a brand that resonates with consumers and differentiates it from competitors. (Chaves, 2017) (Brodie, 2009)
Time Delivery	In consumer behaviour, brand preference describes the tendency of consumers to Favor and select products from a specific brand over competing alternatives, often due to perceived superiority, positive associations, or brand loyalty (Clarence & Keni, 2022).
Freezing Technology	Based on the sources provided, brand preference can be defined as a consumer's tendency to choose a specific brand over others when making a purchase decision (Rajagopal, 2010).
User Renunciation	At its core, positioning refers to the way in which a product, service, or brand is perceived by consumers relative to competitors in the market (Moore & Helstein, 2009)
Positioning Strategic	details dimension definition Particularly, the paper could explore the multidimensional nature of preference, including its cognitive, affective, and conative components (Clarence & Keni, 2022).

RESEARCH METHODOLOGY

Analytic Hierarchy Process (AHP) approach in 1996 [132–137]. This approach breaks down a decision-making problem into multiple levels, and the total of these levels creates a hierarchy.
Quality management, strategic planning, and policymaking are just a few of the numerous business applications that have AHP.
The following characteristics, the ANP can consider all kinds of dependencies and resolve issues with dependency and feedback between attributes and alternatives in the real world: Attribute independence is not required; it is seen as a compensating technique.

Score	Linguistic terms
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate values

.
Step 1: explain the issue.
Step2: the goal of the issue by taking into account all factors, including actors, goals, and results
Step 3: Determine the criteria and their sub-criteria.
Step 4: Hierarchically organizes the issue, considering the objective, a set of substitutes, and criteria.
Step 5: create a collection of matrices for pairwise comparisons.



The matrix can be defined by

$$A=\begin{bmatrix} Aa_{11} & Aa_{12} & \dots & A\,a_{1n} \\ Aa_{21} & Aa_{22} & \dots & Aa_{2n} \\ \vdots & \vdots & & \vdots \\ Aa_{n1} & Aa_{n2} & \dots & Aa_{nm} \end{bmatrix} \quad [1]$$

a- Build the normalized pairwise comparison matrix A

$$A1=\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nm} \end{bmatrix} \quad [2]$$

And $a_{ij'}=\frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$ for i, j = 1, 2…., n [3]

b- calculate the eigenvalue and eigenvector.

$$w=\begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_2 \end{bmatrix}, \text{and} \quad w_1=\frac{\sum_{i=1}^{n} a_{ij}'}{n} \text{ for i=1,2,3,….n,}$$

[4]

$$w'=Aw=\begin{bmatrix} w_{1,}' \\ w_2' \\ \vdots \\ w_{n'} \end{bmatrix}$$

$$\text{And } \lambda_{max}=\frac{1}{n}\left(\frac{w_1'}{w_1}+\frac{w_2'}{w_2}+\cdots+\frac{w_n'}{w_n}\right) \quad [6]$$

Where ω is the eigenvector, w_1 is the eigenvalue of criterion I, and λ_{max} is the largest eigenvalue of the pairwise comparison matrix.

Step6:

N	2	3	4	5	6	7	8	9	10
RI	0	0.52	0.89	1.11	1.25	1.35	1.46	1.45	1.49

Where CI= $(\lambda_{max}-n)$(n-1)and CR=CI/RI [7]

consistency ratio	0.0821

Step 7: A matrix larger than 4x4 with a CR score >0.10 indicates an inconsistent assessment. Decision-makers ought to update the pairwise comparison matrix's original values. Using the normalized numbers, determine whether the CR value of less than 0.10 is satisfactory.

The study used a group decision-making technique, which

consistency index	0.102594885

considers combining the viewpoints of several people. The arithmetic mean method was used to aggregate individual judgments.

RESULT

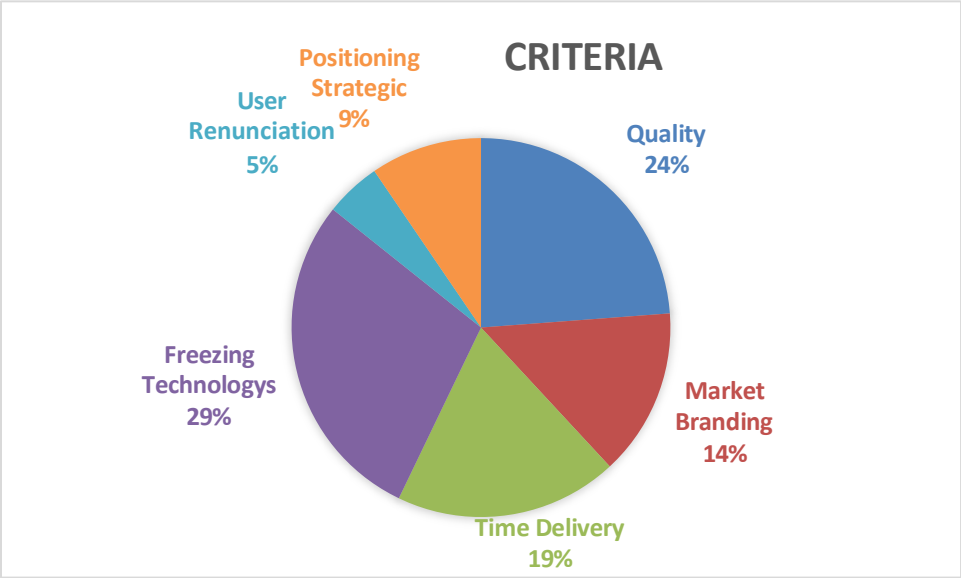
Data Analysis

This case study uses the six main criteria that have been summarised. All assessment team members' pairwise comparison judgments are gathered using a questionnaire that covers all strategic aspects and the level of the AHP model. This method has proven to be highly effective in gathering data. Given the properties of the next criteria level, pairwise comparison judgments are produced about the attributes of one level of hierarchy. Six competent seafood sustainable market dealer executive officers with at least ten years of experience participated in the survey.

	A1	A2	A3	A4	A5	A6
A1	1.0000	0.5000	0.2500	2.0000	0.5000	1.0000
A2	0.2500	1.0000	0.5000	3.0000	2.0000	1.0000
A3	1.0000	0.2500	1.0000	1.0000	3.0000	0.5000
A4	0.3333	0.3333	1.0000	1.0000	1.0000	3.0000
A5	0.2000	0.2000	0.3333	2.0000	1.0000	3.0000
A6	0.5000	0.5000	0.2500	2.0000	0.2000	1.0000

In our scenario, we offer wide value gaps across circumstances to emphasize the significance of differences and design safety scales that do not use all the values that can be used for ranking. As a result, each Saaty scale is highly unique and fits the particular situation and reality of each criterion. The criteria will be developed after the AHP framework is fully constructed. The Matrix displays the comparison matrix that compares the term's level aspects to how well they contribute to the main goal. A paired comparison matrix is created following the comparison of each element; Quality, Market Branding, Time Delivery, Freezing Technologies, User Renunciation, and Positioning strategic have normalized weights of 0.155773, 0.29098, 0.18870, 0.18343, 0.14460, and 0.11912, respectively. The CR is less than 0.10, at 0.0821. With a weight of 0.14460, user renunciation is a significant criterion among the six criteria, which are ranked in order of importance: User Renunciation, Positioning strategies, Market Branding, Time Delivery, Quality and Freezing Technologies. A5 with a User Renunciation weight of, 0.14460 Seafood that is safe, fresh, and of high quality is essential to keep. customers. Consistently, products must meet or

exceed client expectations. A6 With a weight of 0.11912 positioning strategies sustainable methods for seafood an increase in sales of seafood goods with eco-labels after putting the positioning strategies into practice. A2 with a weight of of0.29098 Market Branding, to develop a strong brand identity that reflects to sustainability including logos packaging and visual elements. A3 with a weight of 0.18870 Time Delivery To ensure freshness and quality, we will deliver sustainable seafood products within 24 to 48 hours after your order. The on-time delivery rate surpasses client expectations and fosters loyalty. A1 with a weight of 0.155773 Quality is the nutritional value, freshness, and Flavors of seafood, and food standards are all considered aspects of product quality.to reduce pollutants and chemical residues as much as possible. A4 with a weight of 0.18343 the freshness and quality of seafood Use an environmentally friendly and energy-efficient freezing system to reduce your carbon footprint.



Getting senior and middle management's support and commitment to evaluation terms would also encourage the continued use of the suggested model. The evaluators were initially trained on AHP principles and assessment techniques to address the challenge of evaluating pairwise comparison judgment. Consequently, we can say that the suggested AHP model can greatly aid in decision-making and strategic issue comprehension.

The seafood industry's examination of the seafood sustainability development market using the AHP method produced a useful consistency ratio. A popular approach in domains like seafood sustainability development, this organized decision-making methodology aids people in organizing, assessing, and prioritizing appropriate complex criteria or alternatives.

MANAGERIAL IMPLICATION

- This study offers a methodology that helps practitioners, salespeople, and marketers identify the most significant risk, especially in the seafood industry, and create a sustainable market emphasizing the Indian context.
- It contributes to both food safety and quality as well as economic viability, while previous research solely focused on issues of the seafood industry's environmental impact.
- But this study work incorporates the development of food safety and economic viability into the sustainable process that advances socioeconomic development.
- Furthermore, by analysing sustainable hazards in an Indian setting, this research project helps other scholars investigate sustainable development.

Incorporating sustainable development goals (SDGs) is essential for the long-term success of the seafood sustainable develop market sector.

- **SDG 8** (Decent Work and Economic Growth) A1 promoting sustainable development improve the quality life and ensure the economic growth is inclusive and equitable. A2 develop branding strategies that encourage responsible consumption patterns. The study has relevance to SDG:8 aligning with the quality of seafood industry under A1 indicator.
- **SDG 9** (Industry innovation and infrastructure) A3 to levering technology and innovation for efficient time delivery. A6 develop and upgrade infrastructure to support economic development. The study has relevance to SDG: 9 aligning with the time delivery of the seafood industry under A3 indicators.
- **SDG 12**(Responsible consumption and production) A5 encouraging sustainable consumption patterns through user retention strategies. A4 promoting sustainable food systems through freezing technology. The study has relevance to SDG: 12 aligning with the freezing technology of the seafood industry under A5 indicators.

CONCLUSION

The study concludes by offering a thorough grasp of the requirements for the seafood industry's sustainable growth as well as the relative significance of underlying requirement. The findings of this study can be utilized to create a sustainable market that will enhance the seafood industry's productivity and technology. Future research could concentrate on creating tools and methods to meet the specified requirements and assess them through case studies or experiments. Future studies can focus and also concentrate on taking into account additional aspects of the fish sector - like harvesting and produce, processing and marketing, retail and food service aspects. Such studies especially for future researchers can assist the seafood industry increase its productivity and efficiency in terms of technology and offer a more comprehensive grasp of the sustainable market.

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