

Research Article

Evaluating Consumers' Perception Towards Ship Breaking Products in Bangladesh: A PLS-SEM Approach

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Abstract

Ship breaking product has distinct impact on socio-economic development for the country. This study investigates the impact of some cues which effect on consumers' perception towards ship breaking products in Bangladesh. The main objective of the study was to find out consumers' perception towards ship breaking products in the content of Bangladeshi consumers. Descriptive research design has been used and quantitative type research was applied. A structured questionnaire was used to collect the data from 215 respondents who were Bangladeshi consumers of different residents' areas, like Chattagram, Cumilla, Dhaka and Mymensingh by using purposive sampling technique. A partial least square structured equation modeling (PLS- SEM) was used to analyze the data and to test the hypotheses to get actual findings of the study. The findings of the study demonstrated that economic benefit, laws & regulations had a significant (p -value < 0.05) positive impact on consumes' perception. Another rest of the constructs including environmental hazard, and product features had no significant positive effect on consumes' perception towards ship breaking products in Bangladesh. The study has been provided some guidelines based on findings for ship breaking industry how to create the positive perception of Bangladeshi consumers. This study could provide new insights about how the ship breaking industry in Bangladesh gain competitive advantages improved by examining some constructs (economic benefit, laws & regulations, environmental hazard and product features) development impacts at the perspective of Bangladeshi consumers. Finally, some policy implications followed by findings based on empirical phenomenon can be supportive guidelines for the ship breaking industries at the context of Bangladeshi market.

Keywords

Ship Breaking Product, Consumers' Perception, Laws & Regulations, PLS-SEM

1. Introduction

The term consumers' perceptions describe the overall impression of a business/company, including their ideas, feelings, and views about a brand and its goods or services. Consumers tend to prefer products that meet basic criteria, including offering environmental benefits that positively impact people and society. As the number of end-of-life ships is increasing worldwide, the demand for the shipbreaking industry is also

increasing. There is an increasing need for safe and efficient dismantling of ships. There has also been an increased focus on sustainable and environment-friendly ship recycling activities.

Ship-breaking (also called ship recycling, ship dismantling, ship demolition, or ship cracking) is a process used to dispose of ships by breaking them down. This can be done to salvage

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parts for resale or to extract raw materials, primarily scrap metal. Bangladesh produces a lot of products from ship-breaking and recycling. Life jackets, swimming ring, emergency rescue boats, ship binoculars, lights, torch, sofa, rocking chair, decorating items, pipes, railings, all kitchen items, cables, etc. are the ship breaking products and many businessmen earn their livelihood from those products. Perception about those types of products depend on its benefits and economic impact. The ship-breaking industry in Bangladesh is primarily located in Sitakund (from Bhatary to Kumira), just north of Chittagong city along the Bay of Bengal. Ship-breaking products can be seen as "green products" because almost every part of the ship is recycled, reused, or resold. This process provides raw materials to steel mills and steel plate re-manufacturing, while also supplying asbestos for re-manufacturing, as well as paint, furniture, lubricants, electrical equipment, and oil to a variety of businesses that have emerged as a direct result of this industry. The government generates revenue from ship-breaking products through import duties, yard taxes, and other levies.

Some negative barriers such as environmental hazard and labor unsafety can affect badly consumers perception towards ship breaking and recycling products. For improving consumers' perception towards ship breaking and recycling products need development of an environmentally safe as well as should ensure occupational health safety [19], Hutr.

Recently many research prospects have been conducted on consumers' perception towards ship breaking products in developing countries. But there is a noticeable absence of research in Bangladesh. There the research question of this study was postulated as "which constructs are more influential that effect on consumers' perception towards ship breaking products in the context of Bangladesh?" Thus, the aim of this study was to fill up the research gap by identifying some determinants to effect on consumers' perception towards ship breaking products in Bangladesh.

1.1. Statement of the Problem

In Bangladesh there are a lot of ship breaking and recycling products. Many big and small businessmen earn their livelihood from these products. Positive perception about this type of product depends on its benefits and economic impact. Also, some negative barriers such as environmental hazard and labor unsafety can affect badly consumer perception towards ship breaking and recycling products. For improving consumers' perception towards ship breaking products need development of an environmentally safe ship breaking and recycling industry, as well as should ensure occupational health safety. Bangladesh has become a signatory of the Basel Convention which pleas to prevent transport of hazardous substances. Besides, there are an Environment Convention. The study has been tried to show that ship-breaking activity contributes a highly waste and pollution for current location where the process done. Moreover, some other research ar-

gued that ship-breaking process by any standard is dangerous occupation due to intoxication from dangerous substances and also accident that could be happened on the plots due to worker who wears no protection equipment. By addressing these issues, the study aims to provide actionable insights for business and policy development maintaining ethical practices. There are a lot of shipbreaking and recycling products in Bangladesh. Many big and small businessmen earn their livelihood from these products. International shipping companies own and use ships for their trade and finally sale them predominantly to Bangladesh, India, and Pakistan for breaking up, Ali, [1]. Perception about this type of product depend on its benefits and economic impact. For some negative barriers like as environmental hazard and labor unsafety can affect badly consumers' perception towards ship breaking & recycling products. However, with these objectives the author attempted to study of consumers perception towards ship breaking products in Bangladesh. To achieve the findings this study covers some specific objectives; *firstly*, to identify some relative constructs which influence on consumers' perception towards ship breaking products. The *second* is to develop some hypothesis which are needed to be tested. *Finally*, to highlight the potential contributions of the study from both theoretical and practical stand points which have been applied by the decision makers of the ship breaking industry to create positive perception of consumers towards ship breaking products in Bangladesh.

1.2. Research Questions

On the basis of problem statement, following research questions have been developed.

RQ1: What are the determinants that influence consumers' perception towards ship breaking products?

RQ2: What are the economic benefits of using ship breaking products?

RQ3: What are the major helpful recommendations for the policy maker?

2. Literature Review

2.1. Theoretical Background

2.1.1. Consumers' Perception

Consumers' perception encompasses the beliefs, opinions, and feelings that customers hold about a brand. This concept is vital for fostering consumer loyalty and retention, as well as establishing brand reputation and awareness. Maria *et al.*, [22] suggest that perception is the mechanism through which individuals choose, organize, and interpret stimuli to create a coherent and meaningful understanding. Consumers' perception is influenced by various factors, including both direct and indirect interactions with products or services. Perception, as defined by Kotler [20], is the process through which an indi-

vidual collects, evaluates, and retains both internal and environmental stimuli. According to Gregory *et al.*, [12], perception involves the set of processes that allow an individual to become aware of and interpret information from their surroundings.

2.1.2. Ship Breaking Products

Ship breaking enables the recycling and production of new goods from the ship's materials, particularly steel. This process reduces the demand for mined iron ore and decreases energy consumption in steel manufacturing. Additionally, fixtures and other equipment on board these vessels can also be reused. Bangladesh is becoming an emerging country in the global ship-breaking products industry. The country benefits from low labor costs, a flat and uniform intertidal zone, relatively moderate law enforcement, and strong domestic demand for steel and iron, creating advantageous conditions for the ship-breaking sector. Ship-breaking items involve the removal of reusable parts from a used ship, such as steel scraps, furniture, and electronic components. Hong, [20]. Shipping companies use ships for recycling to produce ship breaking products for their trade and finally sell to the end-users. Ali, [8]. Ship disposal is taking ships apart for parts that can be reused or removing raw materials like steel that can be remade into something else. Ship breaking provides a way to reuse materials and recycle steel that would otherwise be sunk in the ocean or wasted, One Step. Power, [27].

2.1.3. Economic Benefits

Economic benefits are tangible gains that can be quantified in terms of revenue earned or money saved through the implementation of specific policies. Explore the definition and concept of economic benefits, surplus and how net income is useful in determining new business policies, Wilson, [37]. The ship-breaking products industry plays a significant role in Bangladesh's economy. The sector contributes over Taka 5 billion (about US \$68 million) annually through customs duties, income taxes, and value-added taxes (A. Helal & S. Mohammad, [4]. The ship-breaking products industry significantly contributes to employment in Bangladesh, offering jobs to a large number of skilled and semi-skilled workers from all over the country. In 2015 approximately 20,500 metric tons of furniture, fittings, and other non-ferrous materials were recovered from ship-breaking operations, valued at about Taka 1.2 billion, equivalent to roughly US \$17 million, based on 2009-10 constant prices (Sujauddin *et al.*, [30]. Beyond the direct economic benefits that the Bangladesh ship-breaking industry contributes to its supply chain, numerous upstream activities service the industry and generate additional output and employment. Key upstream sectors include transport and construction services, oxygen plants, electricity and other utilities, machinery and equipment maintenance and repair services, as well as insurance, banking, and regulatory services, [32] Moreover, the expenditure made by ship recycling workers also stimulates various economic

activities and services, such as personal services, retail and real estate. These impacts are not confined solely to the local economy but extend across the entire country.

2.1.4. Environmental Hazard

Extreme conditions or substances in the earth's ecosystem that could have an adverse impact on people and the things they value are known as environmental hazards. A material or circumstance that has an opportunity to harm the environment is also considered an environmental hazard. It can be biological, chemical, or physical agents resulting from human activity. Pesticides, heavy metals, and toxic waste are a few of these, A. Tanjila, [2]. Workers in the ship-breaking industry face harsh and hazardous conditions with limited facilities. In Bangladesh, the ship-breaking products industry is widely regarded as one of the most dangerous and risky workplaces. According to a study conducted in the ship-breaking yard of Sitakunda, approximately three out of every five workers described their working environment as "not good," while two out of every five considered it "very bad" K. R. Juel; F. Nishat, *et. al.*, [20]. Ship breaking is a challenging process due to the structural complexity of ships, which leads to numerous environmental, safety, and health hazards, [23]. Workers often face a lack of personal protective equipment and receive minimal, if any, training. The absence of sufficient safety controls, poorly monitored work operations, and the high risk of explosions combine to create extremely hazardous work environments in ship-breaking yards, U. Kamal, [36]. Workers face significant challenges accessing healthcare services, and their living conditions are worsened by inadequate housing, welfare support, and sanitary facilities (ILO, 1996-2024). By utilizing technological and organizational innovations that are socially, environmentally and economically beneficial, business can better achieve their social and environmental goals, F. Tola, [10].

2.1.5. Product Features

A product feature refers to a particular function or attribute of a product that offers value to customers. It encompasses capabilities, performance improvements, or design elements. Product managers must define and prioritize features to build. On the other hand, product feature is a discrete area of functionality within the product. While important, it is only one small piece of what customers are actually buying. Dismantling or breaking down ships revitalizes the worldwide shipping sector by replacing aging ships and reusing or recycling up to 95% of their resources. In recent years, Bangladesh has established itself as a leading participant in the worldwide shipbreaking products industry. The goal of this research is to provide insights into the structure and functioning of the ship-breaking products industry in Bangladesh, with an emphasis on the origin, types, and lifetime of disassembled ships to enhances our understanding of Bangladesh's ship-breaking products industry, S. Mohammad, K. Ryu, *et. al.*, [31]. Ship-breaking products involve the process of breaking up

ships to either salvage parts for resale or to extract raw materials, primarily scrap. This allows materials from the ship, particularly steel, to be recycled and repurposed into new products. International Maritime Organization, [35]. The decommissioning process differs significantly between developed and third-world countries. In both circumstances, shipbreakers compete for the ship, with the highest bidder winning the contract. The ship-breaker then procures the ship from international brokers who trade in old ships. The price paid typically ranges around \$400 per tonne, with poorer environmental legislation resulting in higher prices, Hulsen, Isabell, *et al.*, [18].

2.1.6. Laws and Regulations

In 2011, the Government of Bangladesh introduced new national laws and policies aimed at improving workplace safety and health standards as well as environmental standards in shipbreaking yards. However, despite these efforts, significant challenges remain. Governance and enforcement of laws and policies are often lacking, [33]. These rules were also given by the High Court in 2005 and 2007. According to these regulations, importers must obtain an Environmentally Clean Certificate from the Department of Environment (DoE) for the importation of any ship intended for breaking purposes. In the ship-breaking products industry, one of the most crucial legal frameworks is the Basel Convention also known as the “Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal”. It is an international agreement that was created to lessen the flow of hazardous waste across national borders, with a focus on preventing the transfer of hazardous waste from developed to developing nations. In Bangladesh, there is no legal regulatory framework specifically designed for monitoring this current environmental damage caused by ship breaking. Although international regulations govern the global operations of the ship breaking product industry, Bangladesh has not adopted any of these regulations or established comprehensive domestic laws to address related issues, Quazi, [9]. The Government of Bangladesh has made efforts to develop regulatory guidelines for the ship breaking industry. However, these initiatives are often criticized for being biased or insufficient to effectively address the industrial needs and environmental conservation priorities in the country, A. Shawkat, & F. Abdullah, [14].

2.2. Literature Review and Hypothesis Development

To identify research gaps, it's crucial to review the existing literatures. Literature reviews aid researchers in developing conceptual frameworks and pinpointing areas for further study. Here, we present selected reviews to facilitate this process.

Kalthia, [20] asserts that the ship recycling product industry holds significant potential for delivering high returns and fostering the advancement of developing economies. The ship

breaking product industry contributes to the growth of our economy by generating substantial revenues, facilitating efficient use of resources, and providing large employment opportunities. While developed countries are not major players in the ship breaking industry, they do benefit indirectly through the sale of old ships and the demand for recycled materials. The industry itself is largely concentrated in developing nations like Bangladesh, India, and Pakistan, where it provides a significant economic boost.

Apart from Hossain M. M. [15], the ship breaking product industry serves as the primary supplier of raw materials for approximately 500 private sector re-rolling mills and nearly 50 steel mills. These mills utilize the materials to manufacture mild steel rods, angles, and bars at affordable prices. Research indicates that a considerable portion of new building constructions in Bangladeshi urban and rural areas incorporates metal salvaged from ships that have traversed the world's oceans. Additionally, the shipbreaking products industry supplies various scrap items that are utilized by local households and businesses, and some are exported to earn foreign currency. According to A. Helal & S. Mohammad, [4], it was found that the shipbreaking products industry offers employment to a significant number of skilled and semi-skilled workers from various regions of the country. The research findings indicated that during the year 2015, the ship breaking products industry generated approximately 25,000 to 40,000 full-time equivalent employment opportunities. These jobs encompassed a wide range of roles, including management, administration, technical, and support positions. Then, F. Tola, E. M. Mosconi, Gian Vincenzi, [11], circular economy for ship recycling represents significant potential as most of the materials extracted from ships can be the source for creating green markets, which encourage the development of market opportunities for the supply of entities raw materials to improve upstream design and downstream recovery for new industrial processes. After that Abdullah *et al.*, [5], the contribution of shipbreaking product industry to the national economy is substantial. Ship scrapping is Bangladesh's primary steel supplier, resulting in significant savings in foreign exchange by minimizing the requirement for importing steel materials. Bangladesh requires 500,000 tons of metal/ steel, but the country lacks domestic iron ore sources or mines. As a result, ship scrapping has become an indispensable and significant source of raw materials for Bangladesh. Besides, over the last few years, the industry has consistently generated a substantial output valued at approximately BDT 53.3 billion (equivalent to USD 770 million). Based on this information, we hypothesize the following:

H₁: Economic benefits positively influence on consumers' perception towards ship breaking products.

The ship breaking products industry in Bangladesh has faced criticism on several reasons, notably due to hazardous working conditions leading to fatalities, environmental pollution, and the health risks associated with handling asbestos and other hazardous materials, Cairns, [7]. Sharma, S. A. [24]

reported that approximately 1,300 workers lost their lives, and around 4,000 suffered severe injuries in the ship breaking products industry of Bangladesh over the last decade. Additionally, Hossain, M. S. [16] observed that accidents are frequently underreported or not recorded at all. Employers often conceal such information, even from the families of victims, and commonly avoid compensation payments. According to rights activists in Bangladesh, the health cost on employees working in ship-breaking yards is excessively high due to environmental concerns. For instance, approximately 90% of workers experience some form of accidental injury while working in the shipyards. Many of these injuries occur because workers operate without proper protective materials, such as gloves and shoes, in extremely muddy conditions. Environmentalists' express concerns over the haphazard and unregulated growth of the shipbreaking industry and its associated sectors, such as the re-rolling industry, which could result in serious environmental degradation, S. A. Sharma, [29]. Then, U, Kamal, M., N. Nor, M. I. Moinul, ANM., [25], lack of coordination among different agencies, lack of adequate training and awareness among the workers and workers poor economic condition, which contribute to the degradation of marine and local environments and trigger health hazards among the workers. Therefore, degrading the environment and undermining occupational health and safety regulations have become regular; thus, accidental death and injury to the workers are common in this sector. Environmental hazards and health rights of workers in shipbreaking in Bangladesh. According to A. Tanjila [2], the ship breaking industry in Bangladesh initially began as a result of a cyclone, but it has since evolved into one of the most significant sectors in the global marine business. The industry benefits from an inexpensive and adaptable workforce and flat beaches that facilitate the intentional stranding of ships. This has led to the emergence of a new industry in Bangladesh focused on dismantling ships and selling their steel for scrap. Nearly all components of these scrapped ships find reuse in various ways, with some items in good condition even being exported. Thus, we hypothesize the following,

H₂: Environmental Hazard has a significant effect on consumers' perception towards ship Breaking products in Bangladesh.

Hasan, [13] conducted a literature review on the features of ship-breaking products and concluded that the quality of these products is generally high, especially for high-profile ships. Furthermore, consumers can connect quality and price, indicating that the pricing of ship breaking products is also reasonable. The technological development process in ship breaking products has a rich historical background and is strong in building these products. Ship breaking allows materials from ships, particularly steel, to be recycled and repurposed into new products. This practice reduces the need for mined iron ore and diminishes energy consumption in steel production. Additionally, fixtures and other equipment found aboard vessels can be reused, further contributing to sus-

tainability (Wikipedia). Then Hasa *et al.*, [13] discovered that a variety of disposable materials and waste are released and spilled from dismantled ships, frequently mingling with beach sediment and seawater. This contamination adversely affects the coastal environment and biodiversity. Following this, Hossain *et al.*, [17] concluded that the ship breaking product industry represents one of the most environmentally efficient approaches to dismantling vessels for material recycling. The steel and other recyclable materials recovered from ships are utilized across various sectors including shipbuilding, furniture manufacturing, machinery, construction, and electrical industries. Prior to the dismantling process, brokers representing the ship owner notify the ship recycling authorities regarding the vessel's location. An inspection team verifies that all necessary certificates, including import/export documentation, taxes, and duties, have been obtained by the owner. Upon receiving permission to enter the yard, the vessel is either towed or propelled into the intertidal zone, reaching the highest point of the beach during high tide. Dismantling operations commence as the tide recedes, involving the removal of machinery and gutting processes. After that M. Emil., [26], ship recycling market imperfections and the relevance of a consortium of ship recycling nations in the India sub-continent, ships are sizeable engineering products that are difficult to throw away. Initially, ships that have reached the end of life (EOL) after serving in the oceans, have been either abandoned, sunk, or broken up to dispose of in small chunks to be recycled. Shipbreaking, the first step of the recycling process, as opposed to sinking or abandoning aged ships, seems to be most eco-friendly and financially sensible choice; because it enables better handling of hazardous substances and the utilization of valuable resources like iron, steel, aluminium, and polymers. However, a very small proportion of shipbreaking activities are conducted safely and efficiently. Based on these procedures, we hypothesize the following:

H₃: Product features have a significant influence on consumers' perception towards ship breaking products in Bangladesh.

The ship breaking industry in Bangladesh is governed by a combination of laws and regulations, including the ship breaking and ship recycling rules, 2011 and the Bangladesh ship recycling Act, 2018. These regulations aim to ensure safe and environmentally sound ship recycling practices, addressing both worker safety and environmental protection. Alternatively, the adoption of separate legislation specifically tailored to regulate the shipbreaking industry could effectively address social, environmental, and labor concerns associated with the industry. A. Shawkat & F. Abdullah [3] conducted a study titled "Legal regulation of the ship breaking industry in Bangladesh: The international regulatory framework and domestic implementation challenges". Additionally, UNCTAD, [35] reported that Bangladesh has emerged as a prominent country in the ship scrapping business within the international market. In 2018, Bangladesh emerged as the top position in shipbreaking, accounting for 47.2% of the global

tonnage. The ship breaking product industry in Bangladesh benefits from factors such as low labor costs, a flat and uniform intertidal zone, and moderate enforcement of laws, alongside strong local demand for steel and iron. However, as highlighted by Barua et al., [6], rules and regulations are rarely enforced or adhered to in Bangladesh. Consequently, the ship breaking product industry in Bangladesh projects a shady image due to environmental hazards associated with open-beach breaking of end-of-life ships Barua et al., [6]. Subsequently, U. M. Mohammad [26], highlighted that the ship-breaking product industry has consistently improved its management system to ensure the safe and environment-friendly recycling of ships, aligning with international standards and meeting their requirements. It involved a commitment to adhere to relevant legal requirements and other subscribed regulations. Then R. Dev, B., M. Rahman, H., et. al., [28], the government of Bangladesh has introduced laws for monitoring the shipbreaking industries to wake it a potential sector of Bangladesh. In journal 2011, the Ministry of Environment and Forests issued a shipbreaking guideline to achieve Environmentally sound management. On February 13, the Bangladesh government recognized shipbreaking as a formal industry. The Ministry of industries issued “the Ship breaking and Recycling rules, 2011”. Based on these premises,

we hypothesize the following:

H₄: Laws & regulations have a significant influence on consumers' perception towards ship breaking products industry in Bangladesh.

Many researchers have done lots of works on ship breaking product industry characteristics, historical background, country's laws & regulations and environmental accountability issues of different countries. Here the researchers tried to show the chronological development and consumers' perception towards shipbreaking products industry of Bangladesh. From the relevant literatures we find out that those studies mainly concentrated on the foreign context, but this research has been tried to measure the consumers' perception towards ship breaking products regarding Bangladesh perspective which remained as an unexplored field. Moreover, in Bangladesh, there is no depth research conducted yet so far in this regard. So, the study has been tried to fill up this gap by using some determinants (economic benefits, environmental hazard, product features, laws & regulations) for measuring consumers' perception towards ship breaking product in Bangladesh. In this study, four independent variables and one dependent variable (consumers' perception) have been recognized. Based on the previous literature and discussions, the conceptual framework (Figure 1).

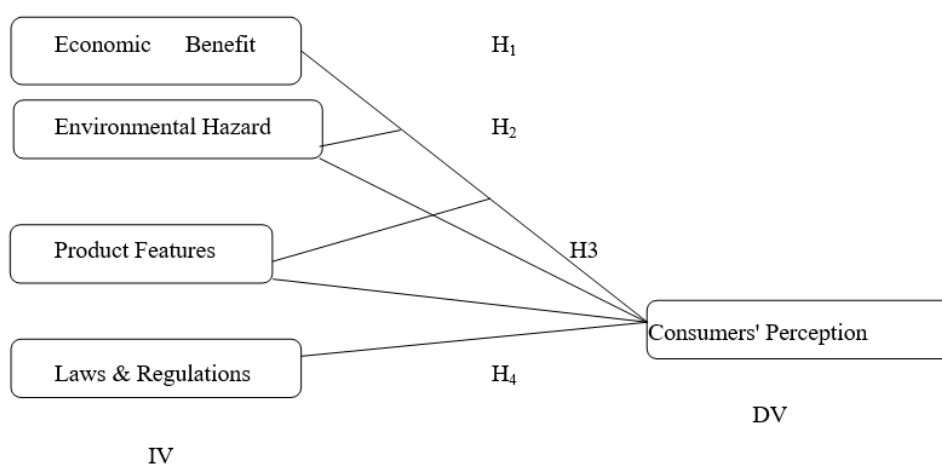


Figure 1. Conceptual Framework.

3. Materials and Methods

3.1. Research Design

A structured framework for conducting the research effort is provided by a research design M_c Daniel Jr & Gates, [24]. The study has been used exploratory research design. The goal of exploratory research is to get more clarity and knowledge of an idea or to help define a situation more fully Gates, [11]. Exploratory research aims to focus a study area and refine vague research issues into ones that are clean and

aid in achieving specific research goals Wong, [38]. Exploratory research design can either be in quantitative or qualitative. The study has been used quantitative research design to investigate how consumer react about ship breaking products. Quantitative surveys are highly valuable for investigating social phenomena through, computational, mathematical and statistical techniques, Leahey, [21].

3.2. Participants

The population of this study comprises of general consumers, residents in a few geographical areas of Bangladesh like Chattagram, Cumilla, Dhaka and Mymensingh. A struc-

tured questionnaire was used to collect data from 215 respondents living those selected areas of Bangladesh. Among 215 respondents participating in the study 170 (79.07%) were male and 45 (20.93%) were female. Only the responses were collected from those respondents most of them between 21-30

age and the percentage was 67.91%. The monthly income ranges of 215 participants were; 116 (53.95%) less than 20,000 Tk, 65 (30.24%) from 20,000 Tk. to 40,000 Tk; 34 (15.81%) above 40,000 Tk.

Table 1. Demographic profile of the respondents (Source: Field Investigation).

Gender	Respondents (N=215)	Percentage (%)
Male	170	79.07
Female	45	20.93
Age (in year)		
16-20	20	9.3
21-30	146	67.91
31-40	47	21.86
40 ⁺	2	0.93
Monthly Income (in BDT)		
≤ 20000	116	53.95
20,000-40,000	65	30.24
40,000+	34	15.81

3.3. Sampling Technique and Sources of Data

Purposive sampling, a non-probability sampling technique, was employed to select participants for this study. Non-probability sampling was chosen for its efficiency and cost-effectiveness in sample frame preparation. 215 respondents have been selected from different areas (Chattagram, Cumilla, Dhaka and Mymensingh) in Bangladesh. Primary data was collected from the respondents using structured questionnaire. The questions were divided into several sections that include demographic profile and all variable in this study. Open-ended questions were included to gather socio-demographic data from the respondents. Five-point Likert scale (1= Strongly disagree to 5= Strongly agree) was incorporated to collect data about constructs which effect on consumers' perception towards ship breaking products in Bangladesh.

3.4. Description of the Variables

As illustrated Table 2, the study used four constructs to examine consumers' perception towards ship breaking products. Economic benefit includes a positive economic environment, contribution to our national economy, and budget friendly. The environmental hazard includes process of production is not environment friendly, lack of waste disposal & treatment facilities, environmentally unsafe management and disposal of hazardous wastes and materials. Product features include effective technology of production, acceptable standard of quality, adaptable pricing. The laws & regulations includes yet not strong enough, strick laws & regulations encourage for purchasing.

Table 2. Description of variables and their details.

Variable Name	Details	Adapted form
Economic Benefit	EB ₁ A positive economic environment EB ₂ Contribution to our national economic EB ₃ Budget friendly	Abdullah et al., [5]

Variable Name	Details	Adapted form
Environmental Hazard	EH_1 Process of production is not environmentally friendly	A. Tanjila, <i>et. al.</i> , [2]
	EH_2 Lack of wastage disposal & treatment facilities	
	EH_3 Environmentally unsafe management	
Product Features	PF_1 Effective technology of production	M. Emil., [26]
	PF_2 Acceptable standard of quality	
	PF_3 Adaptable pricing	
Laws & Regulations	LR_1 is not strong enough	R. Dev, B., M. Rahman, H., <i>et. al.</i> , [28]
	LR_2 Strick laws & regulations will more encourage for purchasing	
Consumers' Perception	CP_1 Environment friendly production process impacts positively towards perception.	A. Tanjila, <i>et. al.</i> ; [2]
	CP_2 Worker safety and strong laws also impact on positive perception.	
	CP_3 Adaptable pricing and standard product quality have impact on positive perception	

(Source: Authors' Contribution)

3.5. Statistical Methods

The descriptive statistic and inferential statistic were applied to achieve the objectives of the study. Descriptive statistics are used to summarize and describe the characteristics of a dataset. Cronbach's Alpha has been used to determine the reliability and validity of the measurement items, Chen, [8]. SPSS 25 version used to analysis demographic characteristics of the respondents. Collected data (through the questionnaire) was analyzed using the Smart PLS software version 3.0. Structural equation modeling (SEM) was utilized to verify the conceptual model of the study. Sample distribution relied primarily on percentile measures and frequency distribution. Furthermore, the reliability of the data and scale items was assessed using Cronbach's alpha coefficients, average vari-

ance extracted (AVE), and composite reliability (CR).

4. Results & Interpretations

4.1. Results of Constructs Reliability and Validity

To confirm the validity of the latent variables, both convergent and discriminant validities were evaluated, Trochim & Donnelly, [34]. Convergent validity was determined by analyzing the average variance extracted (AVE) scores and the factor loadings of the indicators associated with each construct. The factor loadings were computed using a confirmatory factor analysis.

Table 3. Reliability and Validity Test of Constructs.

Constructs	Items	Outer loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Economic benefit	EF1	0.896	0.915	0.924	0.854
	EF2	0.941			
	EF3	0.936			
Environmental hazard	ENF1	0.894	0.834	0.836	0.752
	ENF2	0.895			
	ENF3	0.81			
Product features	PF1	0.716	0.696	0.705	0.624
	PF2	0.825			

Constructs	Items	Outer loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Laws and regulations	PF3	0.823	0.787	0.837	0.701
	L&R1	0.817			
	L&R2	0.914			
	L&R3	0.776			
	CP1	0.682			
Consumers' perception	CP2	0.941	0.811	0.882	0.728
	CP3	0.913			

Source: Output from Smart PLS (PLS Algorithm)

4.1.1. Unidimensionality

In the context of our constructs, Unidimensionality indicates that each measurement item possesses a satisfactory and uniform factor loading relative to its corresponding latent construct. Hair et al., [19] suggest that each factor should have a measurement variable with a minimum factor loading of 0.70. As shown in Table 3, only (CP1) exhibits a factor loading of 0.682. However, the factor loading for CP1 is in close proximity to 0.70. Therefore, it can be suggested to the researchers that the Unidimensionality measurement model has been established.

4.1.2. Construct Reliability Tests

Internal consistency was assessed by the Composite reliability (CR) and Cronbach's alpha. The recommended threshold values for composite reliability (CR) and Cronbach's alpha are 0.70 or higher, indicating satisfactory to good reliability for research Hair et al., [19]. As shown in Table 3, all CR values fulfill this satisfactory criterion, and the Cronbach's alpha values also demonstrate satisfactory levels, except for the product features (PF) construct. However, the Cronbach's alpha value for the PF construct is close to 0.70. Hence, it is recommended by the researchers that the constructs exhibit reliability for further research.

4.1.3. Convergent Validity Tests

The average variance extracted (AVE) exceeds or equals 0.50, confirming the convergent validity of the latent constructs, Hair et al., [19]). As shown in Table 3, all AVE values are higher than 0.50, indicates the suitability of the constructs for further research.

4.2. Hypothesis Testing Result Based on Measurement Model

The evaluation of hypotheses, accepting and rejecting them based on significant and insignificant relationships, is conducted through structural model analysis, M. R. Miah, N.

Meher, et al., [25]. The results of this analysis encompass paths, path coefficients, t-values, and p-values. A two-tailed t-test, with 5% level of significance was employed to assess the hypotheses. Coefficients are considered statistically significant if the p-values are lower than the significant level of 5% (0.005).

Table 4. Testing of Structural Modeling.

Path	Coefficient	t-statistic	p-value
EF ->CP	0.821	16.957	0.000
ENF ->CP	0.013	0.337	0.736
PF ->CP	0.034	1.047	0.295
L&R ->CP	0.116	2.200	0.028

(Source: Output from Smart PLS)

According to Table 4 of the above analysis, two constructs out of four had a significant and positive impact on consumer' perception towards ship breaking products from the perspective of Bangladeshi consumers. The economic benefit ($\beta_1=0.821$, $t=16.957$, $p\text{-value}=0.000$) and laws & regulations ($\beta_4=0.116$, $t=2.200$, $p\text{-value}=0.028$) are significantly and positive impact on consumers' perception towards ship breaking products at $p\text{-value} < 0.05$. Abdullah et al., [5]; also supported that economic benefit has a positive impact on consumers' perception towards ship breaking products in Bangladesh. According to R. Dev, B., M. Rahman, H., et. al., [28]; A. Tanjila, et. at., (2023), also supported that laws & regulations has a strong relationship with consumers' perception towards ship breaking products. On the other hand, another two independent variables such as, environmental hazards and product features have no positive influence on consumers' perception towards ship breaking products in Bangladesh. Here, the environmental hazard was not supported at a

significant value of 0.736, which is higher than the p -value of 0.05. Then another independent variable product features were not supported at a significant value of 0.295, which is also higher than the critical p -value of 0.05.

Finally, the study has been remarked that four different hypotheses (H_1 , H_2 , H_3 and H_4) were tested to assess the relationship between dependent and independent variables. The results for H_1 indicate that there is a significant positive influence on consumers' perception towards ship breaking products. This suggests that economic benefit has a statistically meaningful impact on perception. H_2 reveals that there is no positive influence on consumers' perception towards ship breaking products in Bangladesh. This implies that environmental hazard may not lead to significant influence on consumers' perception towards ship breaking products. The above analysis of H_3 shows that there is no significant positive in-

fluence on consumers' perception towards ship breaking products. This suggests that product features do not have a statistically meaningful impact on perception towards ship breaking products in Bangladesh. Lastly, H_4 indicate that there is significant positive influence on consumers' perception towards ship breaking products. This suggests that laws and regulations have a statistically meaningful impact on perception towards ship breaking products.

4.3. Analysis of Structural Equation Model

The structural model analysis includes explained variance (R^2) of the of the dependent and mediating variables, (f^2) is an effect size measure indicating the partial significance of the model.

Table 5. Results of Structural Equation Model.

Construct	VIF	R^2	Adjusted- R^2	f^2	Q^2 predict	RMSE	MAE
EF ->CP	6.144			1.489			
ENF ->CP	3.037			0.001			
PF ->CP	2.564			0.006			
L&R ->CP	6.564			0.028			
CP		0.926	0.925		0.922	0.281	0.227

(Source: Output from Smart PLS)

The result of analysis of structural equation model from [Table 5](#) implies that the f^2 of two latent constructs, including environmental hazard, and product features had no effect on consumers' perception at f^2 is lower than 0.02. Another construct, including economic benefit had large effect on consumers' perception towards ship breaking products. Here, the researchers mention that f^2 (1.489) is higher than 0.35. Rest of the construct, including laws & regulations had small effect at f^2 ranges within 0.02 to 0.15. From the above findings, the study found that Q^2 predict assess the predictive performance of the model. The [Table 5](#) reveals that Q^2 predict (0.922) is larger than zero for the model to have predictive relevance.

5. Discussions

The research aimed to explore consumers' perceptions of shipbreaking products in Bangladesh. It was found that while many researchers have examined the historical background and current state of the shipbreaking industry in Bangladesh, there has been comparatively less focus and fewer studies on consumers' perceptions towards shipbreaking products in the context of Bangladeshi consumers. According to the findings, two independent variables, economic benefit and laws &

regulations, exhibit a significantly (p -value<0.05) positive impact on consumers' perceptions towards shipbreaking products in Bangladesh. However, the analysis revealed that independent variables such as environmental hazards and product features have no positive impact on consumers' perceptions. Specifically, environmental hazards and product features were not supported at significant values of 0.736 and 0.295, respectively, which are higher than the critical p -value of 0.05. Human made hazards while not immediately health-threatening may turn out detrimental to a human's well-being eventually, because deterioration in the environment can produce secondary, unwanted negative effects on the human ecosphere (Wikipedia). Shipbreaking activities contaminate the coastal soil and sea water environment mainly through the discharge of ammonia, burned oil spillage, floatable grease balls, metal rust and other disposable refuse materials together with high turbidity of sea water. So, environmental hazard has a negative effect on consumers' perceptions towards shipbreaking products. On the other hand, product features of shipbreaking product have negative impact on consumers' perception due to perceived complexity, lack of perceived value, or incompatibility with existing needs and preferences, Consumers may view complex features as

difficult to understand or use, leading to frustration and a negative experience. If a feature doesn't align with their needs or expectations, it might be perceived as unnecessary or even

deter mental, decreasing its perceived value. So, product features is not considered as more influential determinant for shipbreaking products.

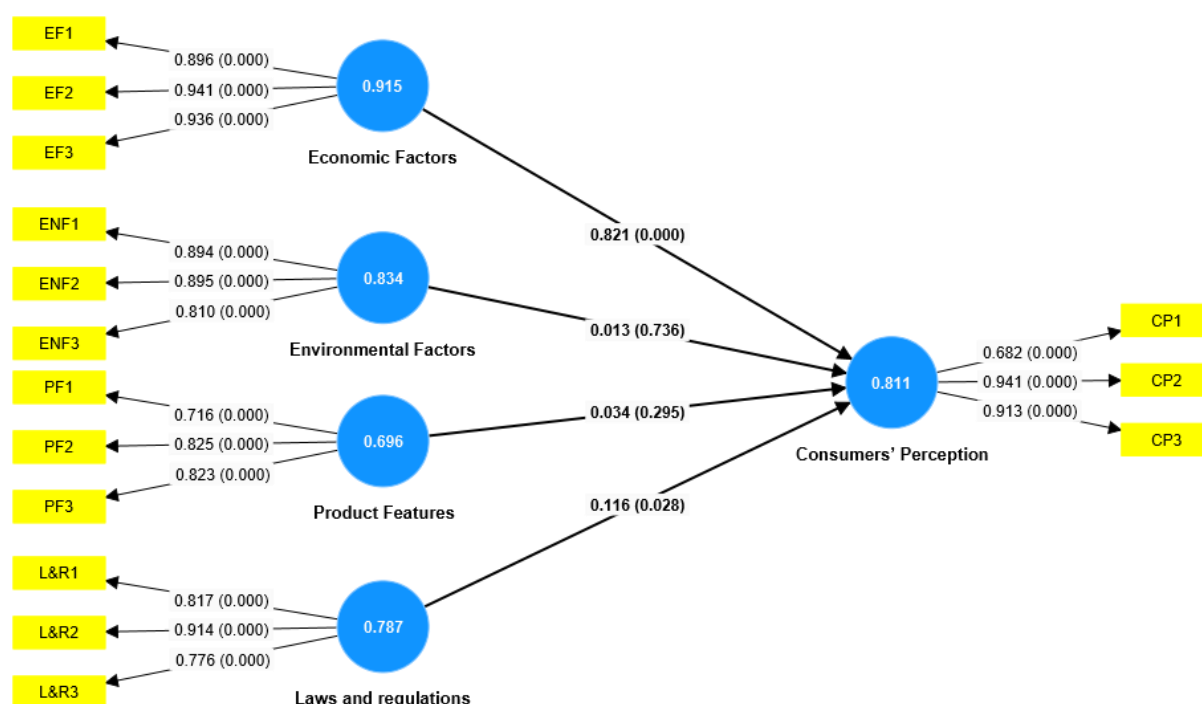


Figure 2. Structural Equation Model.

6. Conclusion and Implications

Shipbreaking products are widely regarded as one of the most sustainable ways for disposing of end-of-life ships, as nearly all parts and machinery from the ships can be recycled or repurposed. Particularly in Bangladesh, the shipbreaking product industry plays a crucial role in generating numerous direct and indirect employment opportunities for unemployed individuals. The study has been conducted with the objective of exploring the consumers' perception towards ship breaking products from the perspective of Bangladeshi consumers. Various determinants serve as important indicators of consumers' perceptions of shipbreaking products in Bangladesh. The research examines the impact of economic benefits, environmental hazards, product features, and laws & regulations on consumers' perceptions towards shipbreaking products in Bangladesh. The findings of the study indicate that two significant constructs have a positive impact on consumers' perceptions of shipbreaking products in the context of Bangladesh. The research paper makes an effort to find out the constructs that have a notable effect on consumers' perception and their purchasing decision. The potential contributions of the study can be discussed from both theoretical and practical stand points. Basically, the study contributed to theoretical enhancement of the current level of knowledge in the existing

literature on consumers' perception towards the ship breaking products. This has been achieved by empirically testing the relationships among some influential constructs to look for consumers' perceptions towards ship breaking products in Bangladesh. This study could provide information about consumers' perception towards ship breaking products based on different determinants. In terms of its practical contribution, the findings of the study could aid in the planning a development the competitiveness strategies of the ship breaking industry in Bangladesh. Finally, this systematic examination of relationships among the constructs could facilitate a clear understanding of the nature of consumers' perception towards ship breaking products. Thus, there are two aspects of this research. *The first* is to establish whether there is a quantitative relationship between consumers' perception with different constructs (economic benefit, environmental hazard, product features and laws & regulations) at the context of Bangladesh. *The second* is to see which, if any, of the determinants have positive influence or no strongly associated on consumers' perception towards ship breaking products in Bangladesh.

7. Limitations and Further Research

This study acknowledges several limitations, highlighting the necessity for ongoing research to further examine and

refine the relationships explored in this study, as well as variables that moderate them. The researchers recognize the following limitations. *Firstly*, data were collected from a sample of 215 respondents. The study's outcomes could potentially be enhanced by increasing the number of respondents (large sample size). Therefore, future research should aim to enhance the generalizability of the findings by increasing the sample size. *Second*, the researchers of this study have been considered only four determinants which have positive/negative effect on consumers' perception towards ship breaking products. Future studies may utilize other determinants such as product quality, effective promotion system etc. *Third*, this research primarily relies on quantitative techniques; nevertheless, a qualitative perspective could provide valuable insights by capturing managerial viewpoints. However, due to a short time frame, mixed-method techniques were not employed. *Finally*, further studies should reassess all hypotheses across different age groups and income levels for better findings.

Abbreviations

SEM	Structural Equation Model
AVE	Average Variance Extracted
CR	Composite Reliability

Author Contributions

Meher Neger is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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