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Sustainable Consumers' Attitude & Perception towards Circular Economy of Bangladesh regarding Ship Breaking and Recycling Products: Evidence from SEM Approach

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Abstract

The study investigates those determinants which impact on consumers' attitude and perception towards circular economy regarding ship breaking and recycling products in Bangladesh. The purpose of the research was to investigate consumers' attitude and perception towards ship breaking and recycling products in the content of Bangladeshi consumers. A standardized questionnaire was used to collect 215 data from Bangladeshi consumers of different areas, residents in a few geographical locations like Chattogram, Cumilla, Dhaka and Mymensingh using purposive sampling method. A partial least square structured equation modelling (PLS- SEM) approach was used to evaluate the data and test the hypotheses. The Descriptive research design has been used for this study. There is total 215 respondents. Total 16 items have been considered and given to the respondent to respond according to independent and dependent variables. SPSS version 25 and Smart PLS had used to conduct statistical analysis. The findings indicate that the recycling attitude and perception towards ship breaking and recycling products significantly influenced by Perceived Behavioural Control and Subjective Norms. The maximum respondents in this investigation are students. In this study the sample have considered maximum from the urban area. Side by side there are only 215 sample size. Diversify the sample population, increase sample size, adopt a mixed methods approach, consider cultural and contextual factors. The study provides support to the authorities conduct their ship breaking and recycling business by considering the consumers' attitude and perception determinants and help them to make proper consumer market. This study also could provide new insights about how competitive advantages could be improved by examining the affective determinants development impacts at the perspective of Bangladeshi consumers.

Keywords: Perceived Behavioural Control, Recycling Behaviour, Recycling products, Subjective Norms, Ship breaking products

Introduction

The term circular economy refers an economic system designed to minimize waste and make the best use of natural resources by keeping products and materials in use for as long as possible. Consumers' perceptions denotes that how a consumer feels about a company. This includes their thoughts, emotions and opinions related to a brand and its products or services. Consumers try to use the product that should contain the minimum standard of some benefits comprising environmental benefits for human 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.

However, ship - breaking also known as ship recycling, Ship demolition, ship dismantling or ship cracking is a type of ship disposal involving the breaking up of ships either as a source of parts which can be sold for re-use, or for the extraction of raw materials, chiefly scrap. In Bangladesh there are a lot of ship breaking and recycling products.

Life jackets, swimming ring, ship 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.

. Ship breaking products can be considered a "green product". Every year our government collects revenue from the ship breaking products through import duty, yards tau and other taxes. 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 (Hutub, 2017).

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 factors 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.

Literature Review

Relevant Literature Review & Hypothesis Development

To find out the research gap, it is essential to review the related research works. The review of literature can help a researcher for building up the conceptual frame work about certain topics. So, to assume the research problem and find out the specific research gap, literature reviews are considered as essential assignment. In order the above purpose, some selected reviews have been presented below:

According to Kalthia (2007), the ship recycling product industry promises high returns and is beneficial for the growth of developing economies. The ship breaking product industry generate mass employment opportunities, large revenues, and sustainable resource management, all contributing to the development of our economy. Then Nation (2009), the ship breaking product industry provides employment irrespective of seasons, unlike farming. It is easy to get a job in the industry as people do not need and prior skills or knowledge. One of the workers provided the following insight about his job in the ship breaking industry. Findings were that the people from the Northern part of the country, who to a great extent, depend on this industry for their livelihood. Besides Hossain M.M., (2010), the ship breaking product industry is the main source of the bulk of raw materials used by some 500 private sector re-rolling mills and nearly 50 steel mills for producing mild steel rods, bars and angles at affordable prices. Findings were that a significant proportion of new building constructions in Bangladeshi cities and towns uses metal cut from the ships that sailed the oceans of the world. Furthermore, this ship breaking products industry provides many scrap items which one being used by local households and businesses as well being exported to earn foreign currency. After that A. Helal & S. Mohammad (2017), ship breaking product industry provides jobs to many skilled and semi-skilled workers coming from across the country. findings were that in 2015, the industry provided between 25,000 and 40,000 full-time equivalent jobs, ranging from management and administration roles to technical and supporting jobs, ranging from management and administration roles to technical and supporting jobs. The technical & supporting jobs include experts and their Helpers. Thus, we hypothesize the following,

H_1: ***Economic benefits positively affect consumers' perception towards ship breaking products.***

The ship breaking products industry of Bangladesh is criticized on a number of grounds, including the dangerous working conditions and the number of deaths arising from these, environmental pollution, and the impacts of working with as bestos and other materials that are hazardous to human health (Cairns, 2007). Then Sharma. S.A., (2012) reported that there were about 1,300 workers killed and about 4,000 workers severely injured during the last decade in the ship breaking products industry of Bangladesh. After that Hossain. M.S., (2008) noted that the accidents are not always reported or recorded and employers often conceal the information, even from the families of victims, and typically avoid paying any compensation. Rights activists in Bangladesh claim that the health cost for employees working in the ship-breaking years in too high because of environmental issues, for example, about 90% of the workers suffer some form of accidental injury while working in the ship yards. Most of the injuries occur as the workers work bare handed and bare footed and in very muddy conditions. Next, the environmentalists fear that the unregulated and haphazard growth of the ship breaking industry and its subsidiary industries, such as the re-rolling industry which is a by-product of the ship-breaking industry might lead to serious environmental degradation. There are allegations from different NGOs and environmental groups that the ship-breaking often violate environmental law by dumping hazardous chemicals and other materials on the beach without care (Hasan, 2012). Then A. Tanjila (2023), argued that starting by accident as a result of a cyclone, this industry has become one of the most important industries from a global marine business perspective. A cheap and resilient labor force, coupled with flat beaches for intentional stranding, ushered in the start of a new industry for Bangladeshi; dismantling the great hulks of the sea and selling their steel for scrap. Almost all the parts of the scrap ships are being reused in some way or other and even some items in better condition are exported. Thus, we hypothesize the following,

H_2*: Environmental Hazard has a significant effect on consumers' perception towards ship Breaking products in Bangladesh.*

According to Hasan (2012) reviewed the literature on product features of ship breaking products and suggested that the quality of ship breaking product are very high for high profile ship. Consumers also can relate the price with the quality. That means the price of the ship breaking products also reasonable. The development process technology of ship breaking product also very historical and strong to build the product. Then, ship breaking, products allow the materials from the ship, especially steel, to be recycled and made into new products. This lowers the demand for mined iron ore and reduces energy use in the steelmaking process. Fixtures and other equipment on board the vessels can also be reused (Wikipedia). Next, Hasa et. al., (2013) reveled that various disposable materials and refuse are discharged and spilled from scrapped ships, and these often get mixed with beach sediment and seawater, which in turn has a negative impact on the coastal environment and biodiversity. After that, Hossain et. al., (2016) concluded that the ship breaking product industry tend to be the most environmentally efficient method of dismantling a vessel to recycle its materials. Steel and other recyclable items are

utilized for shipbuilding, furniture making, construction, machinery and electrical industries. Then According to before the dismantling process being, the brokers acting on behalf of the ship owner inform the ship recycling authorities about the vessel's position. The inspection team ensures that the owner has completed all certificates such as import/ export shipment, taxes and duties. Once the vessel has been granted permission to enter the yard, it will either be towed or driven upwards by the vessel's propulsion into the intertidal zone towards the beach's highest land point during high tide. Once the tide falls, the dismantling activities begin, which involve removing. Machinery and "gutting" Thus, we hypothesize the following,

H_3: ***Product features have a significant influence on consumers' perception towards ship breaking products in Bangladesh***.

In order to fully comply with the obligations placed on Bangladesh by the international legal framework and given many negative impacts of ship breaking industry on environment, existing environmental laws should be amended. Alternatively, separate legislation regulating the shipbreaking industry should be adopted to address all the environmental, labour and social aspects of the industry. A. Shawkat & F. Abdullah (2014), "Legal regulation of the shipbreaking industry in Bangladesh: The international regulatory framework and domestic implementation challenges". Then, (UNCTAD, 2019) showed that Bangladesh is an emerging country in the ship scrapping business in the international Market. Bangladesh topped in shipbreaking with 47.2% of the Global tonnage in 2018. Low labor costs, flat uniform intertidal zone, moderate enforcement of laws, steel, and iron demand in the local market offered advantages to the ship breaking product industry in Bangladesh. However, rules and regulation are seldom enforced or followed in Bangladesh (Barua et al., 2018). As a result, a shady image is reflected in the ship breaking product industry in Bangladesh. (Barua S. et. al., 2018), "Environment Hazards Associated with Open-Beach Breaking of End-of-Life Ships: A Review, Environmental Science and Pollution Research".

After that According to U.M. Mohammad (2021) ship breaking product industry maintained the continually improving an effective management system for the safe and environmentally sound recycling of ships in accordance with the requirements of this international standard and determined the fulfilment of the requirements. It included a commitment to comply with applicable legal requirements and with other requirements to which the facility subscribes. Thus, we hypothesize the following,

H_4: ***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 for 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)

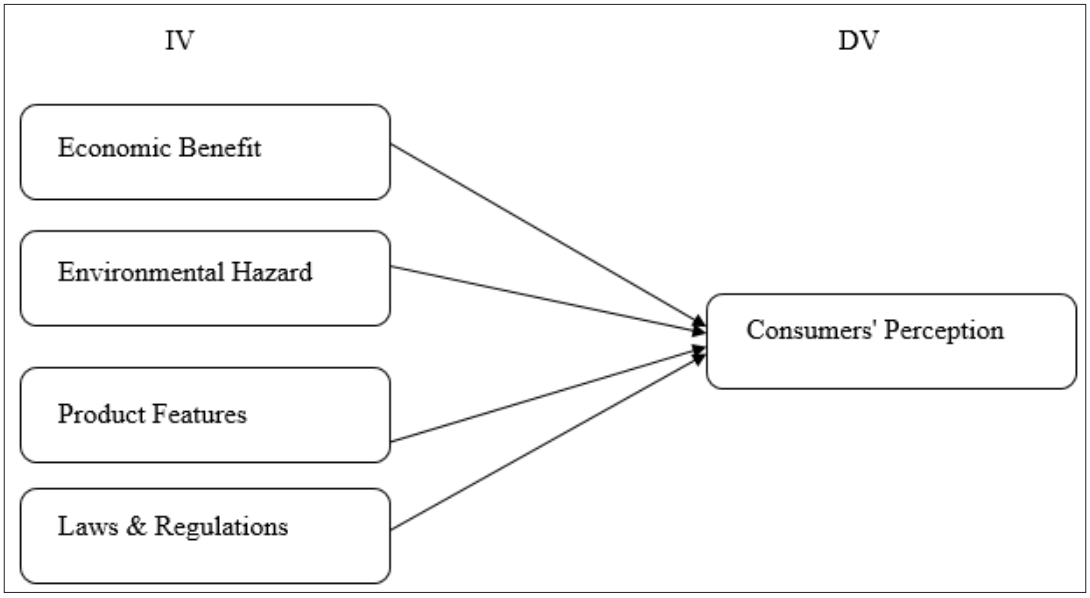


Figure 1: Conceptual Framework

Research Problem and Research Objective

The utility attached to the product or service is derived from quality dimensions. When faces with a choice decision, consumers use information on the product dimensions of the alternatives to determine utilities for the alternatives. In Bangladesh there are a lot of shipbreaking and recycling products. Many big and small businessmen earn their livelihood from these products. 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, even though studies on consumers' perception towards ship breaking products have seen conducted from various perspectives, the dynamic complex natures of the determinants which effect on consumers' perception and competitive strategies have not been clearly addressed in Bangladesh. In a broader context, some factors may influence the results of this current study. Hence, the findings of the study cannot be generalized for other countries. So, the study has empirically tested its relevant components which influence on consumers' perception towards ship breaking products from the perspectives of Bangladeshi consumers. Therefore, the information from this study can help policy -makers and planners to take right decisions about ship breaking products industry of Bangladesh. This paper aims at determining the consumers' perception which has been affected by different determinants in the context of Bangladesh.

Materials and Methods

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, 2010). 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. The population of this study comprises of this study comprises of general consumers, residents in a few geographical areas of Bangladesh like Chattagram, Cumilla, Dhaka and Mymensingh were regarded as the population for this study. A structured questionnaire was employed to collect data from 215 respondents living those selected areas of Bangladesh. Primary data was collected from the respondents using structured questionnaire. Respondents for this study were chosen using purposive sampling technique as non-probability sampling methods. Non -probability sampling has been used because it is less-time consuming and less costly to prepare a sample frame. As illustrated Table 1, the study used four constructs to examine consumers' perception towards ship breaking products. Economic benefit factor includes a positive economic environment, contribution to our national economy and budget friendly.

Table 1: Origin of constructs and measured variables

Constructs	Items measured variables	Adapted form
Economic Benefit	EB_1 A positive economic environment EB_2 Contribution to our national economic EB_3 Budget friendly	A. Helal & S. Mohammad, et. al; (2017)
Environmental Hazard	EH^1 Process of production is not environmentally friendly EH_2 Lack of wastage disposal & treatment facilities EH_3 Environmentally unsafe management	A. Tanjila, et. al; (2023)
Product Features	PF_1 Effective technology of production PF_2 Acceptable standard of quality PF_3 Adaptable pricing	Hossain, et al; (2016)
Laws & Regulations	LR_1 is not strong enough LR_2 Strick laws & regulations will more encourage for purchasing	U.M. Mohammad, et. al; (2021)
	CP_1 Environment friendly production process impacts positively towards perception 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	P.H.S. Mohammad &, et. al; (2021)

Source: Authors' Contribution

The descriptive statistic and inferential statistic were applied to achieve study objectives. 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, 2017). **SPSS 25** version used to analysis demographic characteristics of the respondents. The **smart PLS** software **version 3.0** was applied to examine the data collected via questionnaire.

Results & Interpretations

Analysis of Demographic Characteristics

Among 215 respondents participating in the study 170 (79.06%) were male and 45 (45.71%) 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 30,000 Tk.to 40,000 Tk; 34 (15.81%) above 40,000 Tk.

Table 2: Demographic characteristics of the respondents

Variables	Respondents (N=215)	Percentage (%)
Gender		
Male	170	79.06
Female	45	20.94
Age (in Year)		
16-20	20	9.30
21-30	146	67.91
31-40	47	21.86
40+	2	0.93
Monthly Income (in BDT)		
20,000	116	53.95
30,000-40,000	65	30.24
40,000+	34	15.81

Source: Field Investigation

Results of Constructs Reliability and Validity

To ensure the validity of latent variables, we assessed both convergent and discriminant validities (Trochim & Donnelly, 2001). Convergent validity was assessed by examining both the average variance extracted (AVE) scores and the factor loading of the indicators related to each construct. A Confirmatory factor analysis was adopted to compute the factor loadings.

Unidimensionality

In the present constructs, the Unidimensionality component designates that every measurement item has a satisfactory equal factor loading according to the corresponding latent construct. Hair et al., (2019) claim that each factor has a measurement variable with a least factor loading of **0.70**. According to **Table 3**, only (CP1) has factor loading of 0.682. However, CP1 factor loading value is close to 0.70. So, the researchers can be recommended that the Unidimensionality measurement model has been recognized.

Table 3: Construct Reliability and Validity

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	0.810			
Product Features	PF1	0.716	0.696	0.705	0.624
	PF2	0.825			
	PF3	0.823			
Laws and regulations	L&R1	0.817	0.787	0.837	0.701
	L&R2	0.914			
	L&R3	0.776			
Consumers' Perception	CP1	0.682	0.811	0.882	0.728
	CP2	0.941			
	CP3	0.913			

Source: Output from Smart PLS (PLS Algorithm)

Construct reliability tests

The researchers used Cronbach's alpha and Composite reliability (CR) to test the internal consistency. The recommended values of composite reliability (CR) and Cronbach's alpha are equal to or greater than 0.70, which is considered satisfactory to good for research (Hair et. al., 2019). As illustrated in **Table 3**, all of the CR values have a satisfactory level and the Cronbach's alpha values have also satisfactory level; but except the product features construct. However, the Cronbach's alpha value of (PF) construct is close to 0.70. So, the researchers recommended that the constructs be reliable for further research.

Convergent validity tests

The average variance extracted (AVE) is 0.50 or greater than 0.50, assuring the convergent validity of the latent constructs (Hair et al.; 2019). As illustrates in **Table 3**, all the average variance extracted (AVE) values are greater than 0.50 in this study because of the appropriateness of the constructs for further research.

Hypothesis Testing Result Based on Measurement Model

The researchers make an assessment which one accepts and rejects via significant and insignificant relationships that can be identified by structural model analysis. (M.R. Miah, N. Meher, et al., 2022). The testing results of structural model include the paths, path coefficients, t values, and p values. A two- tailed t-test with a level of significance of 5% was used to test the hypotheses that had been developed. The coefficients are statistically significant if the measured t-value is greater than the critical value of 1.96.

Table 4: Testing of Structural Modelling

Path	Coefficient	T statistics	P values
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 factors out of four had a significant and positive impact on consumer' perception towards ship breaking products from the perspective of Bangladeshi consumers. Besides, the rest of the factors have no significant positive relationship with the consumers' perceptions towards ship breaking products in the country. The economic factor (β_1=0.821, t= 16.957) and laws & regulations factor (β_4=0.116, t=2.200) are significantly and positively related to the perception of Bangladeshi consumers towards ship breaking products at P<0.05.

From the above findings, the study found that those two independent variables, like economic benefit and laws & regulations, have a significant positive relationship with the dependent variable, consumers' perception. Based on the analysis, the researchers found that the independent variables environmental factors and product features have no significant positive relationship with the dependent variable consumers' perception. 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 higher than the p value of 0.05.

The study recommended that environmental hazards and product features have no significant positive relationship with consumers' perception towards ship breaking products. Based on the research, economic benefit's significant value was notated at 0.000, which is lower than the P-value of 0.05. This indicates that economic benefit has a significant positive relationship with consumers' perception towards ship breaking products in Bangladesh. A. Helal, S. Mohammad, et. al., (2017); A Tanjila, et. al., (2023) also supported that economic benefit has a positive impact on consumers' perception towards ship breaking products in Bangladesh. Based on the analysis, the researchers found that laws & regulations has a positive connection with consumers' perception towards ship breaking products. Here, significant value of 0.028 is lower than the p-value of 0.05. This suggests that laws & regulations has a significant positive relationship with consumers' perception towards ship breaking products in Bangladesh.

According to U.M. Mohammad, et. al., (2021); A. Tanjila, et. at., (2023), also supported that laws & regulations has a strong relationship with consumers' perception towards ship breaking products.

Structural Model Analysis

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: Structural Model Results

Construct	VIF	R-square	R-square adjusted	f-square	Q^2predict	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

According to Table 5, the f- Square of two latent constructs, including environmental hazard, and product features had no effect on consumers' perception at f- square is lower than .02 and another construct, including economic benefit had large effect on consumers' perception towards ship breaking products. Here, the researchers mention that f-square (1.489) is higher than .35.

Another construct, including laws & regulations had small effect at f-square is ranges within .02 to .15. From the above findings, the study found that Q2 predict assess the predictive performance of the model. The Table 5 reveals that Q2 predict (0.922) is larger than zero for the model to have predictive relevance.

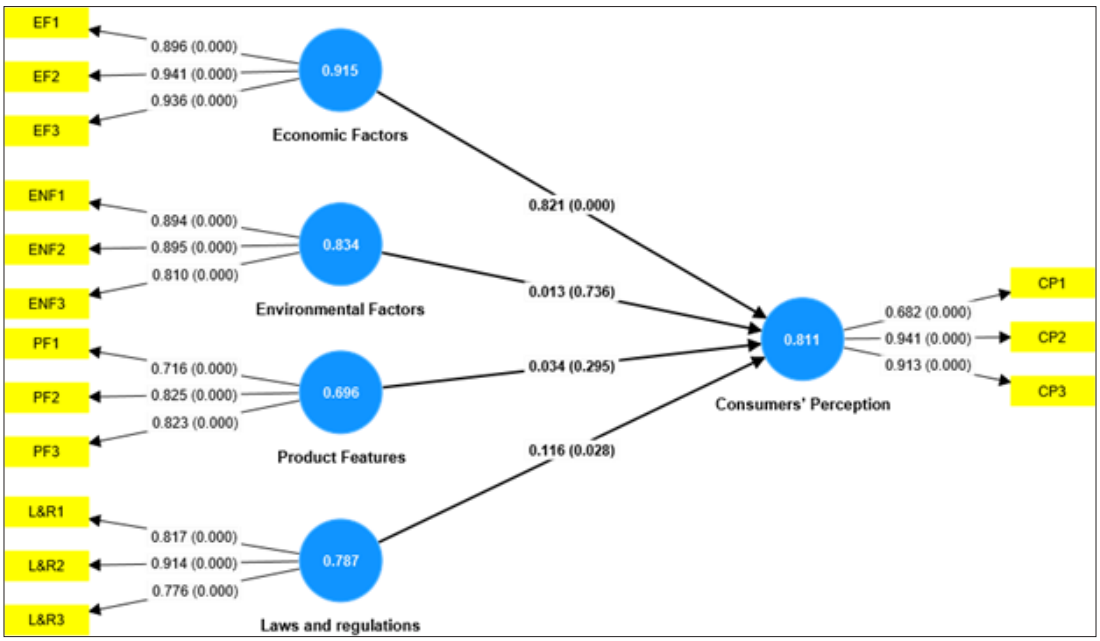


Figure 2: Structural Equation Model

Discussions

The study has been found that most researchers found the historical background and present situation of ship breaking industry in Bangladesh. There were less focus and thus fewer studies into the consumers' perception towards ship breaking products in the context of Bangladeshi consumers. According to the findings of the above analysis, two independent variables have positive impact on consumers' perception from the perspective of Bangladeshi consumers. The economic factor (β_1= 0.821, t= 16.957) and laws & regulations (β_4= 0.116, t= 2.200) are significantly and positively related to consumers' perception about ship breaking products in Bangladesh. Based on the analysis, the researchers found that the independent variables environmental hazard, and product features have no significant positive relationship with the dependent variable consumers' perception. Here environmental hazard, product features were not supported at a significant value of 0.736 and 0.295 respectively, which are higher than the P value of 0.05.

Conclusion and Implications

The findings indicate that the ship-breaking and recycling industry in Bangladesh has significant potential to contribute to the development of a circular economy through the recovery, reuse and recycling of materials from end-of-life ships. The study has been conducted with the objective of exploring the consumers' perception towards ship breaking products from the perspective of Bangladeshi consumers. Different determinants are important tools to inference consumers' perception towards ship breaking products in Bangladesh. This research studies the influence of economic benefit, environmental hazard, product feature, laws & regulations on consumers' perception towards ship breaking products in the content of Bangladesh. The results of the research have revealed that two of the considerable factors had a positive significant impact on consumers' perception towards ship breaking products in the perspectives of 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 of competitiveness strategies. Finally, this systematic examination of relationships among the constructs could facilitate a clear understanding of the nature of consumers' perfection towards ship breaking products in Bangladesh. Thus, there are two aspects of this research

Limitations and Further Research

Despites the potential contribution of ship recycling to the circular economy of Bangladesh, several limitations should be acknowledged when interpreting the findings of the study. First, all data were drawn from 215 respondents. The results of the study may be improved if more respondents are drawn. So, future research should improve the generalizability of the sampling by expanding the sample size. Second, the researchers of this study only with four determinants which 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 is based on quantitative techniques; however, a qualitative perspective could also be conducted through approaching managerial views, but because of a short time frame, mixed-method techniques were not used. Finally, further study should reexamine all the hypotheses in other age groups, income levels for better findings.

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