Role of Compressed Biogas to Assess the Effects of Perceived Value on Customer Satisfaction and Customer Loyalty

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Abstract

India's growing economy demands more energy and to sustain this demand, there is an urge to diversify into alternative sources of energy. Compressed biogas (CBG) is a versatile energy source that can replace dependency on fossil fuels. CBG is used in industries or commercial sectors for cooking, heating, power generation, and as a transportation fuel. To effectively market CBG, it is desirable to know customers' perception of CBG. This study examined the effect of perceived value (functional, social, and convenience) on customer satisfaction. Primary data was gathered from 97 respondents. The list of respondents comprised Business to business (B2B) customers, industrial customers, and commercial customers. The results of the study were analyzed using SPSS and AMOS 24 statistical tools. The findings of this study revealed that each dimension of perceived value affects satisfaction differently and customer satisfaction influenced customer loyalty.

Keywords: compressed biogas, perceived value, customer satisfaction, customer loyalty

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Introduction

The Indian economy is developing unequivocally and having a splendid spot in the global scenario (UN Report, 2019). According to the Energy Information Administration Report, India has been positioned as the third-biggest energy customer in the world (EIA, 2016). Behera (2015) investigated that there is a bidirectional causal relationship between energy consumption and economic development i.e. both economic growth and energy consumption causes each other. For fulfilling the requirement of energy in every aspect of development, be it in health, safety, education, environment, industry or agriculture, India mainly depends on the import of fossil fuels. To sustain energy growth requirements, there is a need to diversify into an alternative source of energy. When fuels are burnt, they emit toxins and are responsible for further affecting the level of global warming. By using renewable energy, greenhouse gas emission can be drastically reduced. Renewable energy provides energy efficiency and can contribute to higher levels of energy security while generating significant employment. According to the WWF-India 2015 report, almost 92% of the Indians feel that renewable will become dominant by replacing the use of conventional energy source soon.

One of the renewable energy sources that are catching the attention of the whole world is biogas. It is a versatile energy source having the capability of producing heat, steam, electricity, and vehicle fuel (Wellinger, 2011). By using different upgraded technologies, raw biogas is purified to Biomethane (93-99% methane) and compressed at different pressures for feeding into the natural gas pipeline, vehicle fuel or filling into cylinders. This high calorific value gas is termed as compressed biogas (CBG). With similar calorific values and other properties, CBG is viewed as a complete substitute of liquefied petroleum gas (LPG) and compressed natural gas (CNG). The global biogas market was worth US\$ 20,852.20 Mn in 2018 and is projected to reach US\$ 29,984.92 Mn by 2026 (Fortune Business Insights,2019). In India, the Ministry of New and Renewable Energy (MNRE) took an initiative for technology demonstration on biogas bottling projects in 2008 and sanctioned 11 plants in different states (under R&D policy) with central financial assistance (MNRE report, 2008).

According to the Renewable Watch Research (2018), more than 27 CBG plants are working actively, aggregating a capacity of 46,178 kg per day. Maharashtra and Gujarat together account for 63% of the country's total installed CBG capacity. According to a study conducted by Green Brick Eco Solutions (2014), the potential of CBG in India is 1,281 MW, equivalent to 7 lac kgs of CNG/LPG per day or can full tank 7 lac cars daily. India is realizing that the use of CBG will benefit the Indian economy and provide energy conservation. Dharmendra Pradhan (Petroleum Minister) said, the Government of India is planning to set up over 5,000 CBG plants by 2023 (Business Standard, 2019).

Today, CBG is mainly used in industrial or commercial sectors for cooking, heating or power generation. B2B customers using CBG as fuel are mainly restaurants, commercial kitchens, metal cutting and coating industries, and automobile industries. According to Patel (2018), by creating

value in the product, one can attract and hold customers. Irrespective of the type of business, you are in, customers buying decision depends on the perceived value of the product or service (Zenhom, 2014). In the competitive market, companies can have sustainable development by delivering value-added product higher than their competitors (Li, 2009).

Customer perceived value is the thought/feel in the customer's mind that the success of a product or service depends on customer's belief that product or service can satisfy their wants and needs (Kokemuller, 2019). Therefore, what customer knows, perceive, and talk about CBG is viewed significant as it decides acceptability and satisfaction with CBG in the market.

Based on the above-mentioned description, customer perceived value is the key to success in the business world. To the best of our knowledge, to date, no research has, however, been conducted to study the influence of perceived value on customer satisfaction in the context of CBG. This allows us an opportunity to undertake the present study to assess the effect of perceived value on customer satisfaction and loyalty.

Research Objectives

The research objectives of this study are as follows:
- To study the effect of perceived value dimensions on customer satisfaction.
- To determine the impact of customer satisfaction on customer loyalty.

Review of Literature and Hypotheses Development

While purchasing a product or service a customer search for the "bundle of benefits" it carries to him/her. The benefits include the quality of the product, service, image and brand plus intangible benefits, such as the pleasure and status one gets in using the product. These benefits are value for the customer. The value helps in knowing what customer want and by providing the same company can attract, satisfy and engage customer for lon term.

Perceived Value

In today's competitive business world, companies are creating more values for customers for long-term survival (Wagner, 2014). The increasing demand of the customers for more value creation affects the image and financial performance of the firm (Landroguez, et al, 2013). Perceived value is a holistic concept and it includes the entire product or service. Therefore, assessing value from a customer's perspective is very important for a company (Battaglia et al, 2015).

According to Zeithmal (1988), perceived value can be defined as an overall assessment of a product

or service based on its utility. It is the perception developed by the customer based on what is claimed and what is received. As per Asgarpour et al (2015), perceived value is nothing but the ratio of the benefit received over the price paid. Here, the price includes both the monetary and non-monetary price (other than money to purchase a product).

A broader conceptualization of perceived value was given by Sheth, et al (1991a, 1991b). In their study, they identified five dimensions, namely, social, emotional, functional, epistemic, and conditional value which influenced perceived value. Sweeney & Souter (2001) designed a 19-item measurement scale of perceived value (PERVAL), used to assess customers' value perception about the product. Their analyses resulted in four distinct perceived value dimensions. These are emotional, social, quality/performance, and price/value for money. Majority of the studies have been conducted, using the scale of Grace & O'Cass, 2005; Turel, et al (2007) to measure the consumer perceived value. They all have agreed that at least three dimensions are required to measure consumer perceived value.

But all these studies have discussed or developed a scale of perceived value for consumer markets. For industrial markets, very few studies are available on the dimensionality of perceived value (Ulaga & Eggert, 2006; Callarisa Fiol, et al 2011). Therefore, the concept of customer perceived value become a primary concern for many researchers in the B2B context (Mencarelli & Rivière, 2014).

Anderson & Narus (1998) define value in the B2B context as "the worth in monetary terms of the technical, economic, service, and social benefits a customer company receives in exchange for the price it pays for a market offering."

Sangroya & Nayak (2017) developed a multidimensional green perceived value scale comprising functional value, social value, conditional value, and emotional value dimensions to assess consumers "perception towards green energy."

According to Sheth et al. (1991a), it probably won't be practical for research to use all types of value. Therefore, in the present research, perceived value dimensions such as functional, social, and convenience values have been used.

Dimensions of Perceived Value

Functional value includes factors like reliability, durability, usefulness, resale value, etc. It is related to the perceived efficiency and effectiveness and covers attributes such as price, cost, and quality (Meng, 2014; Mustonen et al, 2015). Functional value is equivalent to quality/price ratio including non-monetary sacrifices (Callarisa Fiol et al, 2011). Functional value is a strong motivator in the B2B

market as purchasing decisions is based on tangible features (Leek & Christodoulides, 2012). Maharum et al (2017) found in their study that consumer considers a product's price, quality, and stability while purchasing green products. Customers tend to base their purchasing decision on price because they consider biogas as a commodity (Herbes, et al, 2016).

Social value infers individual perception about his/her recognition by society on the basis of purchases he/she made (Sangroya & Nayak, 2017). It is the utility derived from the belongingness to one or more specific group. A customer may value certain product based on how others value that product (Aulia et al, 2016). Nelissen & Meijers (2011) stated that consumer uses a particular product for seeking social status, prestige, and a common sense of belongingness. As explained by Maslow (1943) being accepted in the society is part of basic need and product that fulfill this need will favorably affect customer satisfaction and loyalty (Gallarza & Gil, 2006). The adoption of green products also depends on positive symbolic attributes associated with the product. These attributes enable a person to strengthen their identity, status, and prestige in society by purchasing this kind of products (Noppers et al, 2014). Kumar & Ghodeswar (2015) mentioned that consumers would be motivated if their environmental contributions are admired by others. Porras & Gebresenbet (2003) believed that CBG is future energy because of its economic, environmental, and social benefits.

Convenience value refers to as easy procurement and application of a product (Mahendar, 2017). It helps in reducing customer's non-monetary costs (time, energy, and effort) during the purchase or consumption of goods and services (Chang & Polonsky, 2012). Alam & Rashid (2012) in their research study clarified that usability, benefits-cost trade-off, and consciousness emphatically impact the buyers of renewable energy. As CBG is a versatile energy source it can be used for heating, cooking, lighting, electricity, and as vehicle fuel. Carbonlites (CBG manufacturer and supplier in Bangalore) said that their customers are satisfied with CBG because it is cost-effective, easily available, cooks faster, and reduces consumption of LPG. CBG is safe and secure energy source because it is lighter and gets dispersed in the air preventing any dangerous situation other than LPG which is heavier than air.

Perceived Value and Customer Satisfaction and Customer Loyalty

Customer satisfaction is a positive, emotional customer reaction to the "fulfillment-process" (Kotler, 1991; Agnihotri et al, 2016). Satisfied customers can turn out to be he best sales representatives for business. They help in lessening activity cost since procuring new customers is five to twenty-five times more costly than holding current customers (Gallo, 2014). In B2B framework, the customer satisfaction research has mainly emphasized on "disconfirmation of expectations" mode, in which customers compare a product performance with a standard they have developed (Oliver, 1980). When a customer perceives that benefit received is relatively more than the cost incurred, it maximizes consumer satisfaction. Perceived value is an important antecedent of satisfaction and

both are positively related (Haket, 2016; Patterson & Spreng, 1997). The central part of every exchange is the product, so its features (price, quality, and performance) significantly influence purchasing decision and customer satisfaction. If the price or quality of a product is not appropriate then customers might switch to another organization or product (Wu et al., 2014). As Helgesen (2007) stated that in the B2B context, customer satisfaction is mainly influenced by price, quality, feelings, and service support. Therefore, this study proposes that:

H1: Perceived functional value has a significant positive influence on customer satisfaction.

In industrial markets, where product attributes are fundamentals of marketing, the image and reputation of the firm are a key element of decision-making (Fiol et al., 2011). Satisfaction in an industrial context is directly or indirectly linked to the establishment of alliances between the firms for mutual gain. Since, social value include relational benefits, personal interaction, developing trust or commitment, and responsiveness and self-image it will help in strengthening customer satisfaction (Dovaliene, et al, 2015).

It has been verified that perceived social values influence customers' purchasing intentions and has a direct impact on customer satisfaction (Hur et al, 2013). Therefore, the second hypothesis of the study is posited as follows:

H2: Perceived social value has a significant positive influence on customer satisfaction.

As perceived value is an overall assessment of product benefits with sacrifices (monetary cost and non-monetary costs). Customers are actively seeking for convenience to save their non-monetary costs, i.e. time and effort (Kaura, 2013). This means that companies not only focus on the physical attributes of the product but also make it convenient for customers. Product availability, ease of procurement, an ability to be bottled in CNG cylinder and transporting to the utility/site location enhances convenience value. More is the convenience value, better is the satisfaction rate. If the product needs frequent maintenance and support, this may irritate customers and lead to dissatisfaction. Thus, the following is proposed:

H3: Perceived convenience value has a significant positive influence on customer satisfaction.

According to Oliver (1999), customer loyalty is defined as a profoundly held promise to rebuy a favored product or service unfailingly in the future. The customer ends up buying the same brand in spite of situational impacts. In B2B 80/20 rule applies, i.e. 80% revenue is earned from 20% of the customers, maintaining and nurturing those existing customers is important for a company's long-term sustainability and profitability (Aksoy, 2013). Satisfied customers avoid switching, rebound and buy more, and they recommend the product/service to others (Khadka & Maharjan, 2017).

Customer satisfaction is a significant antecedent of customer loyalty (Singh & Vij, 2017). Thus, the following hypothesis is proposed:

H4: Customer satisfaction has a significant positive influence on customer loyalty.
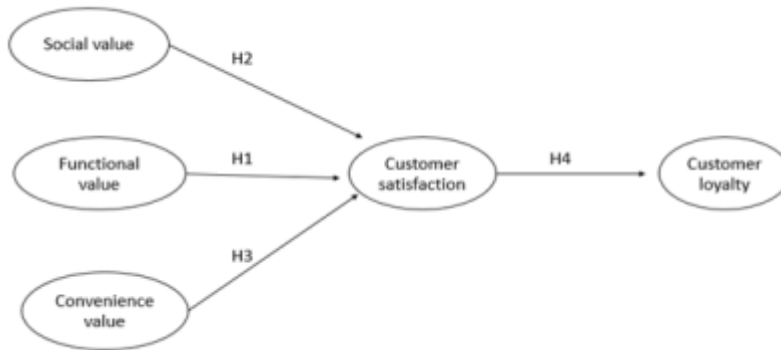
Methodology

Figure 1: Conceptual model for the study

The population for this study is picked from the commercial and industrial areas; those who are using CBG in cooking, power generation, and transportation fuel. After reviewing the extant literature, the survey items were finalized. These items were subjected to validity measure concerning CBG. All the item statements were responded to on a 5-point Likert scale, in which 5 means strongly agree and 1 means strongly disagree. CBG customers (120) from different states (Maharashtra, Gujarat, and Punjab) were requested to participate in the study; however, 97 usable questionnaires were collected (Table 1). According to Tabachnick & Fidell (2013), the minimum sample size desirable for SEM analysis is between the range of 100 and 150 but there is no consensus on the rule of thumb for determining minimum sample size. Velicer & Fava (1998) showed that for given sample size, a convergence to proper solutions and goodness of fit were favorably influenced by: (1) a greater number of indicators per latent variable; and (2) a greater saturation (higher factor loadings).

In the present research, snowball and convenience sampling techniques were employed to arrive at

Table 1: State wise profile of respondents

State	No. of Customers	Customers
Maharashtra	22	Industrial
	5	Commercial
	10	Automobile
Gujarat	15	Industrial
	5	Commercial
	11	Automobile
Punjab	10	Industrial
	10	Commercial
	9	Automobile
Total	97	

the respondents. Out of 97 respondents, 47 are industrial customers, 30 are from the automobile industry, and the remaining 20 are commercial customers (restaurants and mid-day meals). SPSS and AMOS are used to conduct factor analysis and path analysis. The research was conducted between January and May 2019.

Analysis

Table 2 shows the constructs and their sources for instrument development. There are five constructs in the research with three to four items.
Assessment of the Scales

Table 2: Measurement scale items

S. No.	Constructs	No. of Items	Citations
1.	Social value	3	Sangroya & Nayak (2017)
2	Functional value	4	Sangroya & Nayak (2017)
3	Convenience value	3	Azhar Ahmad et al, (2014)
4	Customer satisfaction	3	Oliver (1999)
5	Customer loyalty	3	Johnson & Gustafsson (2000).

Exploratory factor analysis is performed to identify different factors for the study. The KMO test of sample adequacy has a value of 0.756 which is greater than cut off value of 0.7, signifying that the data set fits for factor analysis. The following factors were identified: functional value, social value, convenience value, customer satisfaction, and customer loyalty (Table 3).

Confirmatory factor analysis (CFA) is performed before the estimation of the structural model

Table 3: Factor analysis

S. No.	Factor	Scale Items	Factor Loadings
1.	Social value	Purchasing C BG would help me to feel accepted by others.	0.846
		Purchase of C BG would make a good impression on others.	0.790
		Purchase of CBG would give me social approval.	0.799
2.	Functional value	CBG is well made for reducing environment distortion.	0.879
		CBG has an acceptable level of standard of quality.	0.756
		CBG is a good energy source for the price.	0.862
		CBG has high calorific value with full utilization.	0.834
3.	Convenience value	Procurement of biogas is easy.	0.790
		It helps in reducing non-monetary cost while purchasing and is economically viable.	0.905
		It can be bottled and transported to the utility site.	0.891
4.	Customer satisfaction	I am very satisfied with CBG as fuel use.	0.862
		I am happy with the services provided by CBG suppliers.	0.772
		My choice to use CBG as a sustainable solution is a very wise one.	0.881
5	Customer loyalty	I intend to purchase CBG in the future.	0.838
		I say positive things about CBG to other people.	0.751
		I will recommend CBG to my friends.	0.807

(Figure 2) (Anderson & Gerbing's, 1988). The CFA results show that model fit indices are acceptable (RMSEA = 0.03). It can be concluded that the CFA model fits the sample data very well.

The instrument reliability was tested by conducting composite reliability test, convergent validity test, and discriminant validity test. All test scores met the recommended threshold values as indicated in the tables. No validity concern was found (Table 4).

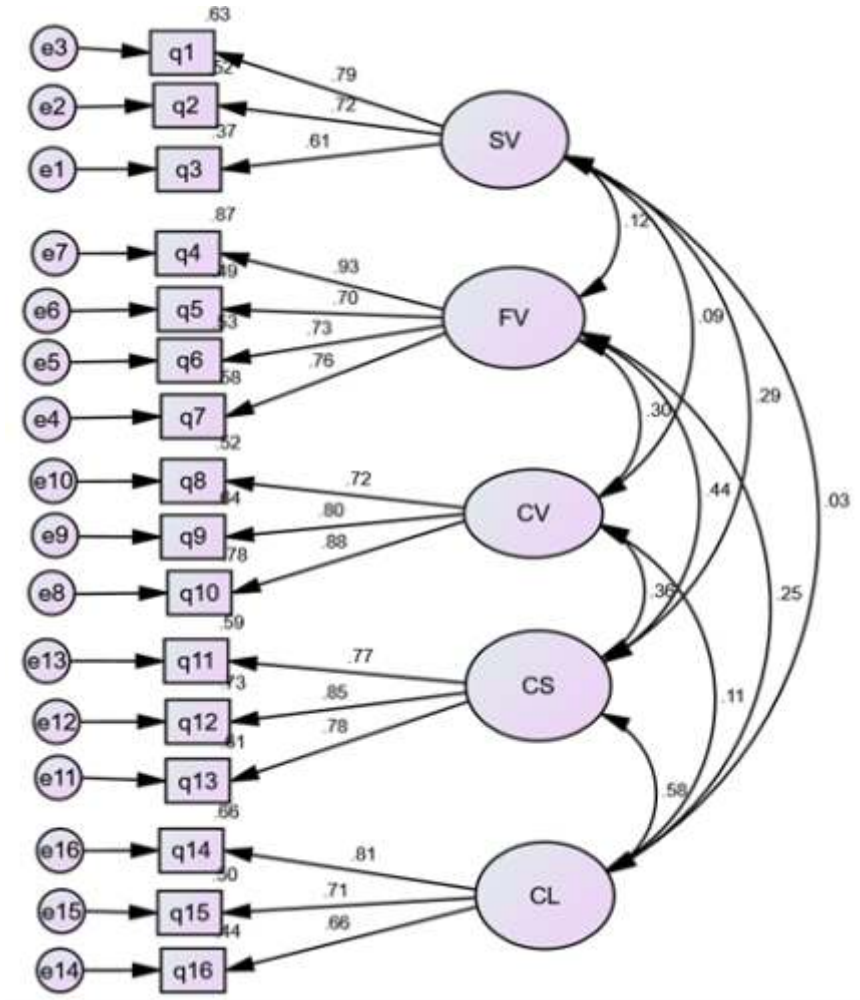**Assessments of the Proposed Structural Model**

Figure 2: CFA model for measurement scale items

Note: SV - social value, FV - functional value, CV - convenience value, CS - customer satisfaction, CL - customer loyalty

Table 4: Fit statistics in the CFA

S. No.	Goodness-of-fit Model Index	Recommended Value*	Observed Value
1.	Chi-square/degree of freedom**	< = 2.00	1.088
2.	Goodness-of-index (GFI)	> = 0.80	0.888
3.	Adjusted goodness-of-index (AGFI)	> = 0.80	0.837
4.	Tucker-Lewis index (TLI)	> = 0.90	0.983
5.	Comparative fit index (CFI)	> = 0.90	0.986
6.	Normalized fit index (NFI)	> = 0.80	0.860
7.	Root mean square of approximation (RMSEA)	< = 0.08	0.030

These criteria are according to Arbuckle & Wothke (1995) and Hair et al (1998).
**Segars & Grower (1993) recommended chi-square/degree of freedom of < = 3.00.

Table 5: Composite reliability, convergent validity, and discriminant validity

	CR	AVE	MSV	MaxR(H)	SV	FV	CV	CS	CL
SV	0.751	0.504	0.083	0.769	**0.710**				
FV	0.864	0.617	0.192	0.909	0.117	**0.785**			
CV	0.845	0.647	0.131	0.865	0.087	0.300*	**0.804**		
CS	0.843	0.642	0.332	0.850	0.288*	0.438**	0.362**	**0.802**	
CL	0.773	0.533	0.332	0.788	0.034	0.249†	0.109	0.576***	**0.730**

Note: CR > 0.7 (composite reliability is met), AVE > 0.5 (convergent validity is met), MSV < AVE (discriminant validity is met)
*Significance of Correlations: † p < 0.100 , * p < 0.050, ** p < 0.010 and *** p < 0.001*

Source: Gaskin & Lim (2016), Master validity tool, AMOS Plugin. Retrieved from Gaskination'sStatWiki

Structural Model Fit and Hypothesis Testing

The structure model (refer Figure 3) consists of latent constructs: Social Value, Functional Value, Convenience Value, Customer satisfaction and Customer loyalty.

Social Value, Functional Value and Convenience Value are exogenous variables and Customer satisfaction and Customer loyalty are endogenous variables in the model. By using the multi-item scales, the latent constructs are measured in the proposed SEM. For each item, there is an error term which is associated.

Analysis of a moment structures (AMOS) is used to verify the model (Figure 1) and test the hypotheses. From Figure 3 it can be seen that all the path coefficients are significant. It was confirmed from Figure 3 that a direct and significant relationship exists between social, functional, and convenience value and satisfaction. Functional value is the principle component of satisfaction (path coefficient 0.37, $P < 0.05$).

In this study, functional value and convenience value (0.25, $P < 0.05$) had a greater influence on customer satisfaction. The coefficients of determination (R^2) of customer satisfaction and customer loyalty are 0.25 and 0.31, respectively.

All the R^2 values of each endogenous variable exceeded the minimum recommended value of 10% (Falk & Miller, 1992) (Table 6). The structural equation modeling showed an acceptable overall model fit (Table 7).
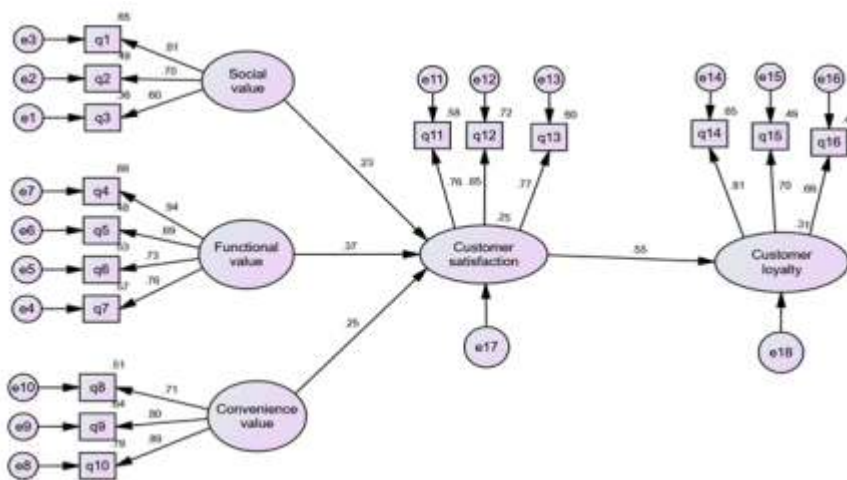
Discussion and Implications

Figure 3: Structural model

Table 6. Path coefficients and determination coefficients of the structural model

Outcome Variables		Causal Variables	SE	CR	P	Path Coefficient	Determination Coefficient (R^2)	Hypotheses
Customer Satisfaction	<---	Functional value	0.084	3.218	0.001	0.367		H1 supported
Customer Satisfaction	<---	Social value	0.131	1.961	0.050	0.230	0.25	H2 supported
Customer Satisfaction	<---	Convenience value	0.069	2.234	0.025	0.248		H3 supported
Customer Loyalty	<---	Customer satisfaction	0.142	4.301	*	0.554	0.31	H4 supported

Note: P refers to the differential probability of two factors. When P ≤ .05, it means two factors have a significant difference.

The value of the probability is 0.000.

Table 7: Fit statistics in the structural model

S. No.	Goodness-of-fit Model Index	Recommended Value	Observed Value
1.	Chi-square/degree of freedom	< = 2.00	1.126
2.	Goodness-of-index (GFI)	> = 0.80	0.878
3.	Adjusted goodness-of-index (AGFI)	> = 0.80	0.834
4.	Tucker-Lewis index (TLI)	> = 0.90	0.975
5.	Comparative fit index (CFI)	> = 0.90	0.979
6.	Normalized fit index (NFI)	> = 0.80	0.846
7.	Root mean square of approximation (RMSEA)	< = 0.08	0.036

Based on the above analysis, it is clear that the different dimensions of perceived value, namely, functional, social, and convenience have a significant effect on customer satisfaction, which is consistent with existing research (Omar et al., 2011; Demirgüneş 2015). The study found that each dimension had a differential effect on satisfaction.

Functional value plays an important role and has the strongest effect on satisfaction. This indicates customers' requirement for the CBG's quality, functions, and competitive price. This finding is supported by the study of Razak, et al (2016). According to them, product quality improvement and the competitive price could increase customer satisfaction. Therefore, companies can offer more functional qualities of CBG such as utilitarian, usefulness of product as an eco-friendly product, and a sustainable energy resource for a quality life.

The second dimension having a strong influence on satisfaction was found to be convenience value. This indicates that customers are accepting CBG due to its versatile nature. CBG can be easily stored and transported to any remote area. With high calorific value, it can burn fast and replace LPG and CNG in commercial or industrial sectors. Thus, companies can convince their potential customers that CBG is a great addition to their lives for a greener economy.

Social value was also found to be effective on satisfaction but has a weak effect, when compared with other dimensions. From this finding, it can be inferred that perception benefits concerning social status are not as important as convenience and performance of the product. These values are less compelling in framing customer satisfaction, though nonappearance of this variable may cause dissatisfaction. Hence, companies should not ignore this factor to strengthen overall satisfaction.

The fact that relative importance of each dimension on customer satisfaction differs, suggesting that managers should pay differential attention to various aspect of perceived value and develop suitable strategies for CBG market.

In line with studies of Guo & Wang (2015) and Haket (2016), the present study found that by enhancing customer satisfaction, it significantly impacts customer loyalty. Notwithstanding, Oliver (1999) clarified that customer satisfaction and customer loyalty are connected inseparably and this connection is asymmetric. A minor change in satisfaction can lead to a substantial change in the loyalty index. Bowen & Chen (2001) mentioned that having satisfied customers is not good enough for a company, but the desire for extremely satisfied customers. Loyal customers recommend a product to their family and friends and this referral helps in attracting more potential customers. According to Heinz Marketing Survey (2016) report, 84% of B2B decision-makers start their buying process with a referral. Therefore, CBG marketer ought not to concentrate just on customer

satisfaction, but should preferably focus on the advantages of long-term customer loyalty.

The results of this study can be used by new entrepreneurs who want to start their business in the biogas market. They can frame strategies based on the findings of this research.

Limitations and Future Directions

This research is subject to several limitations. The first limitation is, among the dimensions of perceived value only three dimensions were used in this study. Thus, further studies may be conducted by adopting multiple dimensional measures for validating the results.

This research measures the effect of perceived value on customer satisfaction, but how perceived value is influencing customer loyalty is not covered under this article.

According to the testing result of this research, only 25% of the customer satisfaction can be explained by the independent variables and customer satisfaction explain 31% variance of customer loyalty. There are many other factors that could influence customer satisfaction and loyalty as well. Therefore, future studies can explore other variables that can influence customer satisfaction and loyalty.

Conclusions

Enhanced energy security and climate change mitigation are the primary drivers for the transformation of the energy system from fossil to renewable sources. India is ranked third in the world, in terms of the renewable energy attractiveness index (EY RECAI report, 2018). One of the sustainable energy sources that are grabbing the eye of the entire world is biogas. At the point when this biogas is upgraded to CBG, it tends to be put into an assortment of uses in the markets such as transportation fuels and electricity/heat.

As CBG is in the nascent stage, the present research is the first of its kind to assess customer's views about CBG and what they perceive while purchasing the same. This research examined the impact of perceived value on the satisfaction of CBG customers. The results represent that each dimension affects customer satisfaction at different levels. Hence, it is an important step forward in framing marketing strategies according to customer requirements.

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