

Service Quality, Perceived Value and Satisfaction in Shaping Customer Loyalty in Rural LPG Consumption: A Structural Mediation Analysis

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Abstract

Clean energy is fundamental for rural development. The Pradhan Mantri Ujjwala Yojana (PMUY) substantially expanded access to Liquefied Petroleum Gas (LPG) among low-income households; however, sustaining its regular use remains a challenge. This study investigates the intricate relationships between Perceived Value and Service Quality on the one hand and Customer Loyalty on the other, with the mediating role of customer satisfaction in these relationships using Partial Least Squares Structural Equation Modelling (PLS-SEM). Hitherto, little empirical research has been done on the rural energy market and the influence of these factors on sustainable LPG use in India, which this study seeks to address. This study uses data from 426 rural households in the States of Uttar Pradesh and Uttarakhand in India, gathered through a questionnaire survey. It brings in novel insights to the discourse of the provision of rural energy by providing in-depth explanation of consumer loyalty in the Bottom of the Pyramid (BOP) sector, highlighting that policy for energy access should place customers' perspectives, needs and satisfaction at the centre of decision-making. The study extends the Value-Based Adoption Model (VAM) and Theory of Planned Behaviour (TPB) by positioning customer satisfaction as a central mediating mechanism through which consumers overall evaluation of perceived benefits and reinforcement of positive attitudes and intentions leading to loyalty.

Keywords: Customer Loyalty, Customer Satisfaction, LPG Consumption, Mediation Model, Perceived Value, Quality of Service.

Introduction

Reliable, sustainable and low-cost energy supply is essential for progress in rural areas of the developing world. The National Energy Policy of India has emphasized the transition from traditional biomass fuels to cleaner alternatives such as liquefied petroleum gas (LPG), recognizing its broader implications on public health, gender development and environmental sustainability. The use of LPG in rural homes has conventionally been a luxury, but following public policy and fuel infrastructure, access to LPG has increased on a mass scale (1). It is more so with the launch of Pradhan Mantri Ujjwala Yojana (PMUY) in 2016. However, providing access alone does not guarantee the adoption (2). The hitherto existing literature on LPG is centred on urban or corporate contexts and little is known about rural energy markets in low-income countries (3, 4). In the context of LPG, the dominant focus has been on economic and infrastructural determinants, such as price and subsidy, affordability, accessibility,

awareness, policy design, gender norms, refill behaviour and the like (1, 2). In these studies, satisfaction with LPG is discussed largely in terms of cost, convenience and access, without being formally framed as determinants linked to loyalty outcomes. These leave a huge research gap. Service Quality, or the SERVQUAL model consists of five dimensions: tangibility, reliability, responsiveness, assurance and empathy. Together, these five dimensions increase customer satisfaction by fostering service excellence and developing a long-term customer-centric attitude. Perceived value, defined as the consumer's overall evaluation of a product or service's utility, results from a trade-off between acquired benefits and expended costs (5). It fits in as a process between product characteristics and behavioral intentions, especially in contexts such as LPG market in rural India, characterized by lesser product-knowledge and greater fluidity (6). Value perceptions transcend pure economic considerations. For example, giving

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mothers more time to devote to other home tasks and their kids' schooling can be cardinal to value perception in rural energy changeover (7). Customer satisfaction signifies the congruence between 'what customers expect and what they actually perceive' with respect to a product or service. It implies a post-purchase evaluation of a product or service (8). In LPG studies, customer satisfaction is typically described as the congruity between users' expectations and their experience of LPG fuel and related services such as booking, delivery, pricing and support (9). Loyalty is construed as a profound commitment to repurchase and endure a relationship despite competitive offers or situational pressures and constitutes a sequential progression through four different phases - cognitive, affective, conative and action loyalty (10). Loyalty combines what customers think, feel and do over time and thus it is an amalgamation of cognitive, emotional and behavioral components (11).

The theoretical foundation of the current study rests on five complementary perspectives. Expectation-Confirmation Theory explains the influence of service quality on customer satisfaction as it expounds satisfaction is formed through the comparison between prior expectations and perceived performance (12). Perceived Value Theory and Value-Based Adoption Model suggest that consumers make overall assessments of benefits relative to sacrifices, such as price, effort and risk and such evaluation in turn determines satisfaction and leads to subsequent behavioral responses (13, 14). Commitment - Trust Theory emphasizes that long-term relationships are built through trust, satisfaction and value exchanges (15). Finally, the Theory of Planned Behaviour (TPB) posits that behavioral intentions are determined by attitudes, subjective norms and perceived behavioral control, which subsequently influence actual behaviour, which in the present study are mirrored through customer loyalty (16).

The novelty of the current study is that it seeks to unravel the interlinkages of perceived value and service quality with customer satisfaction and loyalty for rural LPG users in India, using insights from the broader services literature. This research adds to existing corpuses of knowledge through three main aspects. First, it changes the emphasis from LPG adoption into post-adoption consumer

behavior by focusing on loyalty among rural LPG consumers. Second, it integrates several theoretical perspectives to understand the antecedents of behavioral outcome in the field of clean energy. Third, it offers empirical data from rural India, which is an understudied area in terms of studies of customer loyalty and energy consumption.

Based on the identified research gap, the study pursues the following objectives:

RO1: To examine the relationships among service quality, perceived value, customer satisfaction and customer loyalty in rural LPG consumption.

RO2: Investigate the methods through which these relationships operate.

RO3: To contribute to the understanding of post-adoption consumer behaviour in rural clean-energy markets.

Previous literature suggests that service quality improves customer satisfaction and loyalty and value perception plays a key role in positive consumer evaluations (17, 18). Satisfaction acts as a mediator for transforming evaluations into loyalty results (19). Therefore, the research proposes seven hypotheses based on these premises and the theoretical foundations, as depicted in the conceptual framework in Figure 1.

H1: Service quality (SQ) significantly and positively influences customer loyalty (CL) regarding LPG usage in rural India.

H2: There is a positive impact of service quality (SQ) on customer satisfaction (CS) in LPG Consumption in rural India.

H3: Perceived value (PV) positively influences and is significantly related to customer loyalty (CL) to the consumption of LPG in rural India.

H4: Perceived value (PV) is significantly and positively associated with customer satisfaction (CS) in LPG Consumption in rural India.

H5: Customer Satisfaction (CS) has a significant and positive impact on Customer Loyalty (CL) in LPG Consumption in rural India.

H6: Customer satisfaction (CS) mediates the association between service quality (SQ) and customer loyalty (CL) in LPG Consumption in rural India.

H7: Customer satisfaction (CS) mediates the relationship between perceived value (PV) and customer loyalty (CL) in LPG Consumption based on rural India.

Grounded on the reviewed literature and theoretical underpinnings in the foregoing the

conceptual framework of this study is shown in the Figure 1.

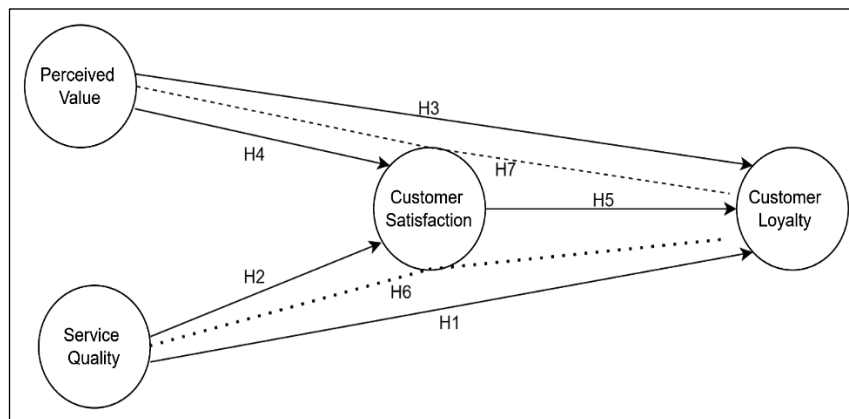


Figure 1: Conceptual Framework

Note: Solid Lines Indicate Direct Relationships. Dotted or Dashed Lines Indicate Indirect Relationships.

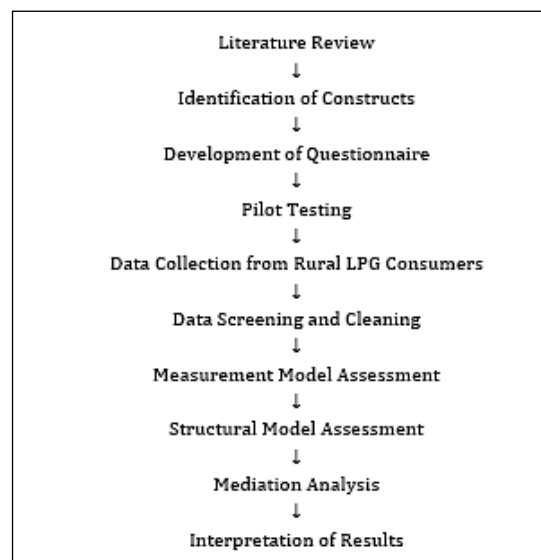


Figure 2: Research Design

Methodology

Research Design

The current research is based on a positivist paradigm and employs empirical data, reliable instruments and statistical procedures to provide clear cut generalizable results. Figure 2 presents the overall research design adopted in this study. The present research employs a straightforward cross-sectional approach to investigate the links among the constructs, which were identified through an extensive review of literature, followed by development of questionnaire and pilot testing on 41 respondents. Subsequently, data was collected from rural LPG consumers through a cross-sectional approach, screened for completeness and consistency. This approach enables analysis of these relationships at it exists at one

point in time and provides empirical evidence to support or disconfirm the theory that is being tested (20–22). The study tests for the hypothesized direct and mediating effects using Partial Least Squares Structural Equation Modelling (PLS-SEM).

PLS-SEM was selected for this inquiry because the objective of the study was to explain and predict customer loyalty through a complex mediation framework and SEM becomes particularly applicable because it estimates multiple paths among observed and latent variables while simultaneously adjusting for measurement error (23). In contrast to covariance-based SEM (CB-SEM), PLS-SEM is more appropriate in predictive research, theory development and models involving multiple latent constructs and mediation relationships (22). Furthermore, PLS-SEM is less

stringent about data distribution assumptions and is more appropriate in complex social science path model estimations (24).

Measures

The five service quality dimensions - tangibles, reliability, responsiveness, assurance and empathy - originated from one study which stated that SERVQUAL is a general-purpose scale tailored to different service contexts. The scale is already used in several studies for energy and utility services such as LPG delivery, particularly in the developing country setting (25, 26). The distributor delivers LPG cylinders on the promised date. The staff gives individual attention when there is a complaint. Two sample items employed in this study are shown as "The distributor delivers LPG cylinders on the promised date" (1) and, "the staff gives individual attention when I raise concerns" (2). On the other side, on Perceived value, five items have been adapted from PERVAL Scale which is a popular, widely used and adapted perceived value measure scale. Scholars have adapted this dimension according to their specific research context (27, 28). Three sample statements that are used in the questionnaire include "LPG helps me save time compared to traditional fuels" (functional value), "My neighbors give respect for those who use LPGs" (social value) and "It saves time, effort as well as money by using LPG while cooking at home than conventional fuels" (Convenience Value). Customer Satisfaction scale uses 7 items adapted from the literature, including example questions like 'I am satisfied with my overall experience with LPG' and 'LPG has made my daily life easier'. For Customer Loyalty - the 7-item Customer Loyalty scale was adapted from the research (29). Some of the sample questions were "I trust and feel satisfied with the service provided by my current LPG provider" and "I would be prepared to pay a bit more for LPG if I could keep receiving it from my same LPG intermediaries."

Sampling and Data Collection

The analysis targeted rural Indian household that took up Liquefied Petroleum Gas (LPG) under the Pradhan Mantri Ujjwala Yojana (PMUY) throughout which persistence was also highlighted. The sampling frame was developed based on areas with high and varied LPG adoption

behavior patterns. For the purposes of our study, a multistage stratified random sampling method to ensure representation in some categories that cut across different geographic and social strata' was used, as suggested for research of heterogeneous rural populations.

The states of Uttar Pradesh and Uttarakhand, which have maximum percentage of beneficiaries under the PMUY scheme in India were selected for sampling. The information was obtained for these two states. Districts were selected to reflect geographical disparities in PMUY coverage as well as Rurality Index. Random sampling of villages and LPG household within the village was then conducted. The main respondent of household was either a female LPG user or decision maker of the households for using LPG. Women in rural India cook mostly and all beneficiaries under the Pradhan Mantri Ujjwala Yojana (PMUY) are women only. In non-PMUY households, if a male family member purchases the gas connection, it is typically a lady in the family who uses it. Therefore, in this study, the female family member is assumed to be the customer.

The questionnaire was composed of closed-end Likert-scale type questions and translated into vernaculars for better understanding. The sample size is 426, which is also acceptable for structural equation modelling (21). Field workers were trained and gathered the responses following very stringent protocols to protect the quality of the information.

Data Analysis Technique

The analysis method was partial least-squares structural equation modeling (PLS-SEM), which is known for its applicability to complex mediation and latent-variable association models (21). The analysis followed a two-step procedure. In the first stage, measurement model evaluation involved the assessment of indicators' reliability, reliability of internal consistency (Cronbach's Alpha and Composite Reliability), convergent validity (average variance extracted) and discriminant validity using Fornell-Larcker Criterion & HTMT Ratio. In the second stage, the structural model evaluation was conducted using path coefficients, coefficient of determinations (R^2), effect sizes (f^2), predictive relevance (Q^2) and bootstrapping with 10,000 subsamples to test the significance of direct and indirect effects.

Results

Demographic Profile

Table 1 presents the demographic structure of the sample and reports the variables measuring consumer perceptions of rural LPG consumption and consumer loyalty towards these fuels.

Measurement Model Assessment

The first step in evaluating data under PLS-SEM is to examine the measurement model, presented in Table 2 and Figure 3.

Table 1: Demographic Information

	Frequency	Percentage (%)		Frequency	Percentage (%)
Gender			Education		
Male	170	40.0	Illiterate	161	37.8
Female	256	60.0	Matriculate	131	30.8
Total	426	100.0	Graduate	81	19.0
			Postgraduate	53	12.4
			Total	426	100.0
Age			Geographical Location		
18-27 Years	91	21.4	Urban	157	36.8
28-37 Years	130	30.4	Rural	269	63.2
38-47 Years	148	34.8	Total	426	100.0
Above 48 Years	57	13.4			
Total	426	100.0			

Table 2: Measurement Model

Variables	Outer Loadings	VIF	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	AVE
CL			0.860	0.862	0.893	0.545
	CL1	0.683				
	CL2	0.691				
	CL3	0.787				
	CL4	0.785				
	CL5	0.747				
	CL6	0.780				
	CL7	0.684				
CS			0.856	0.857	0.890	0.536
	CS1	0.705				
	CS2	0.721				
	CS3	0.782				
	CS4	0.731				
	CS5	0.748				
	CS6	0.721				
	CS7	0.715				
PV			0.776	0.783	0.848	0.528
	PV1	0.698				
	PV2	0.772				
	PV3	0.656				
	PV4	0.759				
	PV5	0.743				
SQ			0.777	0.781	0.848	0.528
	SQ1	0.737				
	SQ2	0.741				
	SQ3	0.721				
	SQ4	0.698				
	SQ5	0.734				

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality, VIF = Variance Inflation Factor, AVE = Average Variance Extracted.

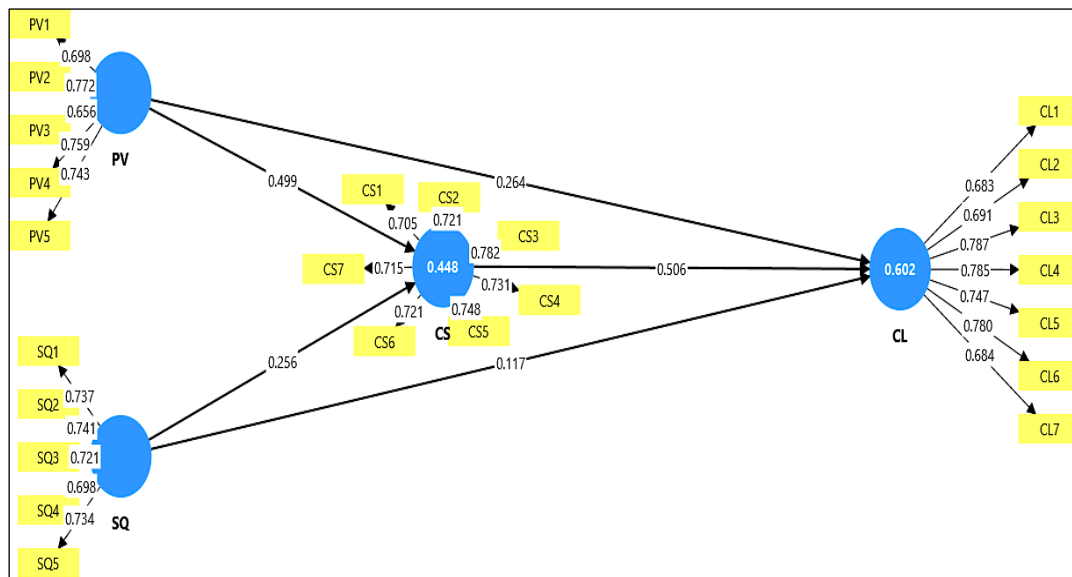


Figure 3: Measurement Model

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality.

As shown in Table 2, all components had Variance Inflation Factor (VIF) loadings above the standard criterion of 0.7, except for CL1, CL2, CL7, PV1, PV3 and SQ4. However, these indicators have been retained because factor loadings between 0.40 and 0.70 should be eliminated only if their removal increases internal consistency reliability or convergent validity to a level exceeding the recommended threshold and because these retained items contribute to the theoretical comprehensiveness of the constructs (22).

Internal consistency reliability was examined using Cronbach's alpha and Composite Reliability ((rho_a) and (rho_c)) and Convergent validity was evaluated through Average Variance Extracted (AVE), while discriminant validity was assessed using the Fornell-Larcker criterion. Cronbach's alphas for the four constructs vary from 0.77 to 0.86 and the Composite Reliability varies from 0.848 to 0.893, which is quite acceptable. All the AVE values exceed 0.50, the lowest permissible criterion required, showing convergent validity. Further, the Variance Inflation Factor (VIF) values across all items are well below the accepted level of 3.3, with observed VIF values ranging from 1.346 to 1.955 (20, 30). The ensuing statistical evidence addresses concerns about predictor redundancy and supports the orthogonality of the

constructs, thereby preserving the interpretive sanctity of the resultant SEM analyses. The heterotrait-monotrait (HTMT) ratio and the Fornell-Larcker criterion, as depicted in Table 3, were used to measure the discriminant validity. The HTMT ratios were never above the conservative level of 0.90 and the highest inter-construct value was 0.853 between customer satisfaction (CS) and customer loyalty (CL) (31). In this way, the discriminant validity is adequately established, indicating that the constructs are empirically distinct. Using Fornell Larcker test, the square roots of average variance extracted (AVE) of each construct were higher than the construct-construct correlations. As an illustration, the square root of AVE of CL [0.738] is greater than its relationships with CS [0.733], PV [0.645] and SQ [0.515]. Other constructs have comparable patterns which also support sufficient discriminant validity. The psychometric properties of the measurement model exhibit strong internal consistency and construct validity. These results substantiate the scales' reliability and affirm the appropriateness of the measurement model for further investigation of the mediating relationships among Service Quality, Perceived Value, Customer Satisfaction and Customer Loyalty in the context of LPG consumption in rural India.

Table 3: Discriminant Validity

	CL	CS	PV	SQ
HTMT				
CL				
CS	0.853			
PV	0.788	0.765		
SQ	0.625	0.621	0.666	
Fornell-Larcker Criterion				
CL	0.738			
CS	0.733	0.732		
PV	0.645	0.632	0.726	
SQ	0.515	0.515	0.52	0.726

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality.

Structural Model Estimation and Path Analysis

Subsequently, the structural model was estimated to examine the hypothesized direct and indirect relationships among constructs. To test the mediating effect of customer satisfaction,

bootstrapping procedures with 426 samples were employed. Statistical significance was determined based on the 95% bias-corrected confidence intervals, ensuring robustness of the mediation paths. The authors have used several factors to assess the model's quality, as shown in Table 4.

Table 4: f-Square, R-Square and Q-Square

Effect Size (f^2)					
	CL	CS	PV	SQ	
CL					R ²
CS	0.356				0.602
PV	0.096	0.329			0.448
SQ	0.023	0.087			0.436
Model Fit			SRMR		NFI
			0.076		0.688

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality, f^2 = Effect size, Standardized Root Mean Square Residual, NFI = Normed Fit Index, R² = Coefficient of Determination, Q² = Predictive Relevance.

Effect size (f^2) tells how much a predictor construct contributes to the outcome value of a target construct. According to studies, if f^2 is greater than 0.2 but less than 0.15, it has a weak effect; if greater than 0.15 but less than 0.35, it has a moderate effect; and, lastly, if greater than 0.35, it has a strong effect as per research (32). Customer Satisfaction (CS) has the largest impact on Customer Loyalty (CL) ($f^2 = 0.356$). Perceived Value (PV) also influences both CL [0.096] and CS [0.329], especially the latter. R² indicates the amount of variance explained in the endogenous (dependent) constructs. Suggested R² values for endogenous latent variables are 0.67 (significant), 0.33 (moderate) and 0.19 (weak) as per research (33). 60.2% of the variance of Customer Loyalty (CL) is explained by its predictors (such as CS, PV and SQ). Similarly, 43.6% of the variance in Customer Satisfaction (CS) is explained by its predictors (PV and SQ). These are moderate to

substantial R² values, indicating a decent model in terms of explanatory power. Q² assesses the model's predictive relevance (via blindfolding). Values > 0 indicate predictive relevance. Q² values for CL [0.448] and CS [0.436] are well above 0, indicating that the model has strong predictive relevance for both CL and CS (34). Standardized Root Mean Square Residual (SRMR), which measures model fit is considered acceptable if it is below 0.08. SRMR value of 0.076 indicates a good fit.

Hypotheses Testing

Table 5 and Figure 4 provide an in-depth analysis of the mediating role of CS in the development of CL, with PV and SQ as antecedent variables. The structural model includes bootstrapped path coefficients that indicate the direct and indirect effects, thereby explaining the dynamics of mediation at work in rural LPG consumption behaviour in India.

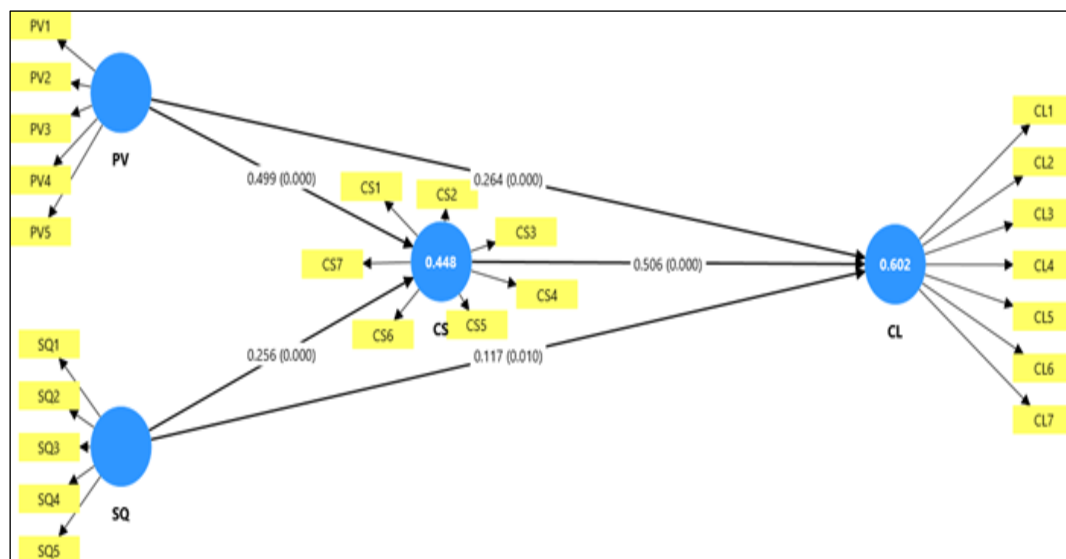
Table 5: Path Testing

Hypothesized paths	β	SD	T-statistics	p-value	BC 95% CI	Results
Direct Effects						
H1: SQ -> CL	0.117	0.045	2.578	0.010	(0.029, 0.208)	Supported
H2: SQ -> CS	0.256	0.052	4.941	0.000	(0.156, 0.36)	Supported
H3: PV -> CL	0.264	0.053	4.980	0.000	(0.161, 0.368)	Supported
H4: PV -> CS	0.499	0.052	9.515	0.000	(0.395, 0.602)	Supported
H5: CS -> CL	0.506	0.052	9.790	0.000	(0.404, 0.607)	Supported
Mediation Effects						
H6: SQ -> CS -> CL	0.130	0.030	4.257	0.000	(0.074, 0.192)	Supported
H7: PV -> CS -> CL	0.253	0.037	6.916	0.000	(0.183, 0.327)	Supported

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality, SD = Standard Deviation, β = standardized path coefficient (beta coefficient).

Service Quality (SQ) has a significant positive impact on CL ($b/t/p/0.117/2.578/0.010$), thus confirming Hypothesis 1 that service quality has a positive, significant effect on customer loyalty in

rural LPG consumption. At the same time, SQ has a significant impact on CS ($b = 0.256$, $t = 4.941$, $p = 0.010$), supporting Hypothesis 2.

**Figure 4:** Structural Model

Note: CL = Customer Loyalty, CS = Customer Satisfaction, PV = Perceived Value, SQ = Service Quality.

The effect of PV on CL is also relatively high ($b = 0.264$, $t = 4.980$, $p = 0.001$), which supports Hypothesis 3 and posits that perceived value positively and significantly influences customer loyalty in LPG consumption in rural settings. Further, PV significantly influences CS ($b = 0.499$, $t = 9.515$, $p < 0.001$), which is why Hypothesis 4 is accepted. Rural consumers who think they obtain more value from LPG are more likely to report elevated levels of satisfaction. The direct path from Customer Satisfaction to Customer Loyalty (CS -> CL) is statistically robust ($\beta = 0.506$, $t = 9.790$, $p < 0.001$), affirming Hypothesis 5 that Customer Satisfaction has a positive and significant effect on customer loyalty in LPG Consumption in Rural India. The indirect pathways substantiate the

partial mediation hypotheses. Service Quality exerts an indirect influence on Loyalty via Satisfaction (SQ -> CS -> CL) ($\beta = 0.130$, $t = 4.257$, $p < 0.001$), thereby validating the Hypothesis 6. Also, the mediated effect of Perceived Value on Loyalty through Satisfaction (PV -> CS -> CL) is both statistically significant ($\beta = 0.253$, $t = 6.916$, $p < 0.001$), thereby supporting the Hypothesis 7. Thus, both the mediation hypotheses, H6 and H7, have shown consistency and alignment, confirming that Customer satisfaction mediates the relationships between service quality and customer loyalty, as well as between perceived value and customer loyalty, in LPG Consumption in Rural India.

A comparative assessment of the two mediating paths indicates that the indirect effect of perceived

value on customer loyalty through customer satisfaction (H7) is substantially stronger than that of service quality (H6). Specifically, the indirect coefficient for H7 ($\beta = 0.253$, $t = 6.916$, 95% CI [0.183, 0.327]) is nearly twice the magnitude of the indirect effect observed for H6 ($\beta = 0.13$, $t = 4.257$, 95% CI [0.074, 0.192]). The higher beta coefficient and t-value for H7 indicate a more powerful and statistically robust mediating mechanism. Additionally, the confidence interval for the perceived value mediation effect lies above that of service quality, with only minimal overlap, suggesting a consistently stronger and more robust indirect influence on customer loyalty.

Figure 4 illustrates the overall structural relationships among the constructs and demonstrates how customer loyalty is influenced through both direct and indirect instrumentalities. The model highlights customer satisfaction as a central connecting construct linking consumers' evaluations of service quality and perceived value with their loyalty outcomes. The pattern of relationships suggests that loyalty among rural LPG consumers is not solely a consequence of service delivery or value perceptions, but also depends on consumers' overall satisfaction with their consumption experience.

Discussion

The results confirm the significance of H1. This result is consistent with the research on service quality that directly influences behavioral intentions (3). Empirical evidence from service industry such as LPG also indicates that higher levels of perceived service quality leads to stronger customer loyalty (34). In a study among rural consumers of Bharatgas in Raigarh and Solapur District, Maharashtra, India, a positive relationship between service quality dimensions and customer loyalty among rural LPG customers was found (35). However, the study focusses on a single brand and region and on gaps in perception, rather than on long-term loyalty behaviour. Research on LPG in rural India has had been rather limited on the nexus between service-quality and customer loyalty, which this study has sought to bridge.

It is also supported in the findings that customer satisfaction is significantly affected in a positive manner by service quality (H2). This is also in synch with earlier research findings that confirms high-quality services influence customer

satisfaction positively (36). This is also in alignment with another research findings according to which customer satisfaction in essential sectors like Islamic banking in Oman was substantially influenced by excellence in service delivery (37). Such relationships have also been found broadly in the service industry, as was found in research in the City of Makassar, Indonesia (38). There has had been limited adaptation of SERVQUAL or similar scales to rural LPG context which this study sought to bridge (39).

The current study also finds that perceived value has a significant impact on customer loyalty (H3). This is particularly in line with an earlier study which highlights that when customers feel that they are receiving value for money in terms of quality, efficiency and financial cost, they have a propensity to remain loyal (40). The current findings are in synch with an earlier research work which proved the same through a PLS-SEM study within the food delivery industry (41). For LPG service providers, this would apply to customers feeling assured of cylinder delivery, convenience of booking, subsidy processes being transparent and feeling safe. According to a study, perceived value enhances customer recommendation of the provider of the service, which is true for energy markets, including for compressed biogas as an LPG-like fuel and thus it augments propensity to purchase and re-purchase. In a study from Rajasthan, it was found that health messaging increases the reported willingness to pay for LPG; but study did not examine loyalty or brand stickiness; this study extends earlier research by examining the relationship between value perception and loyalty especially in the context of LPG consumption in rural India.

The findings also support the fact that perceived value has a significant association with customer satisfaction (H4). Earlier, in a study carried out at Hans Café, Indonesia, empirical evidence showed that both product quality and service quality significantly and positively influence customer satisfaction and that customer satisfaction is shaped not only by the functional performance and reliability of the product, but also by the quality-of-service delivery, including responsiveness, assurance and reliability (42). Research on experiential services suggest that perceived value has been found to have a direct and positive effect on overall customer experience (43). Moreover, a

recent study conducted through structural equation modelling found that perceived value is an important factor influencing satisfaction, even more so than perceived quality; however, this study was based on empirical data from industrial buyers in the Indonesian chemical market, rather than a consumer or household population (44). Research on the role of Compressed Biogas (CBG) in determining perceived value and its impact on customer satisfaction and loyalty indicates that functional, social and convenience aspects of perception significantly affect customer satisfaction. But this study addressed Compressed Biogas only. In fact, there has had been little research on LPG in rural India showing links between perceived value and customer satisfaction, which this study sought to bridge.

The findings demonstrate the direct significant impact of customer satisfaction on customer loyalty (H5). Consistent with earlier research, customer satisfaction signifies an important precursor of favorable post-consumption behavioral outcomes, including customers' continued patronage and loyalty (45).

Contextualizing it to LPG, low levels of satisfaction due to lack of knowledge on advantages of clean cooking fuel and inefficient after-sales service often result in households with just basic access to LPG by taking the new connection, but reverting to using traditional biomass thereafter, which is just the contrary of loyalty (46). A thorough, rural-focused study that directly tests whether or how customer satisfaction translates into customer loyalty for LPG consumption remained a clear research gap in Indian context, which this research sought to fulfill.

The current study also provides strong empirical support for the mediating role of customer satisfaction in the relationship between service quality and customer loyalty (H6) in the context of LPG consumption in rural India. The vindication of H6 aligns with the service marketing theory, which postulates that customer satisfaction is a central psychological mechanism that links service performance with long-term behavioral outcomes (47).

Earlier, in a survey undertaken among customers of a Chinese Securities firm way back in 2007, it had been established that customer satisfaction does play a mediating role upon the relationship between service quality and customer loyalty (48).

In research conducted at Pangkalan Rizky Inayah, a distribution base for 3 kg LPG in Indonesia, it emerged that service quality significantly and positively affects customer satisfaction, which in turn enhances customers' intention to purchase LPG (49). In a study on tourism villages (*desa wisata*) in Badung Regency, Bali, Indonesia, the results indicate an insignificant direct effect of service quality on customer loyalty and a significant direct influence of service quality with customer satisfaction and customer satisfaction with customer loyalty, indicating a complete mediation by customer satisfaction (50). Thus, albeit there were studies, these were tangentially different from LPG consumption in rural households in India, which this study sought to bridge.

This study also supports mediating role of customer satisfaction in the relationship between perceived value and customer loyalty (H7). The stronger indirect effect of perceived value on loyalty through satisfaction (H7) suggests that satisfaction is a key mechanism through which value perceptions translate into loyalty. There has been some support towards this in earlier research. In a study in East Java, Indonesia on "Kilau Emas" customers, it was found that perceived value increases repurchase intention primarily indirectly - through emotional and social value that strengthen customer satisfaction - rather than through a strong direct effect (51). In a study on PT JINOM Ponorogo (also understood as PT Jinom Network Indonesia), a telecommunications and internet service provider (ISP) that delivers reliable internet access, it was found that customer satisfaction has a positive and significant effect on mediating perceived value on customer loyalty (52). In a study in traditional banks and fintech, it was found that satisfaction mediates the relationships between the dimensions of perceived value and customer loyalty (53). In a study in four distinct service sectors of Pakistan, viz. hospitals, educations, banks and hotels, service quality, corporate image and perceived value were found to be the key drivers in enhancing brand loyalty and customer satisfaction mediated in their relationship (54).

Thus, even as there has had been strong general evidence that customer satisfaction can mediate between service quality or perceived value and loyalty, this had not been rigorously tested for LPG

consumption in rural India, especially with both paths in a single model. No LPG study jointly modelled service quality -> satisfaction -> loyalty and perceived value -> satisfaction -> loyalty in one structural model for rural consumers and herein lied a clear research gap, which this study sought to bridge. The learnings from the study can inform improved services, new definitions of value and smarter ways to engage rural LPG customers and to that extent the current study is a novelty.

Conclusion

The findings of this research challenge distribution-centered strategies by identifying user-centered quality indicators as critical drivers for promoting long-term LPG adoption. Notably, the value perceived, including functional utilities, emotional assurance and cost-effectiveness, comes out as the most important factor that affects loyalty. Moreover, customer satisfaction is also an important psychological factor that enhances the impact of value and service quality on loyalty. Thus, the fuel transitions would require not only infrastructural changes but also improvements in the relational and experiential aspects. These results are quite important. These findings offer critical insights that translate into both theoretical advancements and practical strategies for industry professionals

Theoretical Implications

The results support long-established service marketing principles, including SERVQUAL, where customer satisfaction is achieved through the fulfillment or exceeding of expectations, eventually leading to customer loyalty. These also reinforce the Expectancy-Disconfirmation Theory, according to which satisfaction is a function of the difference between the user's expectations and the actual performance of the product or the service being utilized. The results challenge the assumption that customers in rural environments with limited alternatives are indifferent to service quality. Even for basic services such as LPG, attributes like timely delivery, courtesy and attentiveness are shown to be essential for customer retention. Furthermore, the article integrates the concept of perceived value, typically associated with competitive markets, into rural consumption patterns. This integration strengthens the Value-Based Adoption Model (VAM) and Theory of Planned Behavior (TPB) models. The presentment

of customer satisfaction as a mediator between service deliverables as well as perceived value on the one hand and loyalty, on the other, has a strong connection with the Theory of Planned Behavior (TPB), particularly in relation to satisfaction influencing future intentions to preserve behaviors like loyalty.

Practical Implications

As the study claims, LPG providers should primarily invest in service quality to ensure sustainable rural customer satisfaction and loyalty. This involves simplifying the booking process, making timely deliveries, ensuring clear communication, quick response to complaints, systematic feedback mechanisms, such as surveys into distributor evaluations and compensation structures and complaint management systems. Some strategies that will improve satisfaction and loyalty include improvement in the last mile of delivery infrastructure, full employee training and responsiveness to customer needs. Instead of mere efficiency, building trust through empathy and reliability must be the priority.

It further emerges from the findings of this study that perceived value has a large impact on satisfaction and loyalty. This features the importance of clearly communicating the financial, functional and health advantages of LPG, such as savings in terms of cost and time and improved health outcomes. Government agencies and LPG distributors should emphasize these advantages. Appropriate use of technology, such as through mobile phone applications for booking, payments, delivery tracking, delivery authentication, customer feedback and other value-added services, aptly made available in local languages, will facilitate augmentation of service quality as well as perceptions of value and help in adopting LPG in rural areas. Incentives such as discount coupons, bonus refills and referral rewards may further encourage loyalty and frequent use.

In the wake of government initiatives such as the Pradhan Mantri Ujjwala Yojana (PMUY) for enhancing the connectivity of LPG in remote areas, it is of utmost importance to understand factors of satisfaction and loyalty in such areas, both for the government and private entities. From the study, it can be construed that even when the accessibility in terms of infrastructure is high, issues related to service and value are of equal concern for the sustainability of LPG.

The integration of PMUY with the National Health Mission of the Government of India could improve the quality of air indoors and help prevent respiratory and cardiovascular diseases. Frontline workers of the National Health Mission could help promote the regular usage of LPG for household purposes. These programs have the potential to promote energy access, health, women's empowerment and transparency, thus aligning with India's clean and healthy energy goals.

Limitations

For this research, data was collected from 426 LPG consumers. Cross-sectional analysis which was conducted to determine the results would inherently limit investigation's ability for establishing causal relations amongst variables. The survey did not include households that use LPG in carrying out non-domestic obligations. Additionally, it did not include commercial consumers. Also, the sample was restricted to consumers living in two Indian states of Uttar Pradesh and Uttarakhand. While significant, the study may not fully reflect the diversity of India's vast rural countryside. Socio-cultural, economic, fuel preferences and infrastructural differences across states and regions may lead to dissimilarities in customer expectations and experiences with LPG services. Therefore, the findings should be generalized with caution.

The field staff who conducted the survey were advised to consider women as respondents only, as they are mostly the users of cooking fuel in the kitchen. Since it was a door-to-door survey, capturing the decision-maker's response from the family, who might have been a male member, cannot be ruled out. The Oil marketing companies have now engaged Village Level Entrepreneurs (VLEs) and Self-Help Groups (SHGs) to provide last-mile LPG service delivery in rural and remote areas. In future studies, surveys may also be conducted by including these VLEs and SHGs to have a wider response on the quality of service.

The scope for further research based on the results of the study is high. The suggested research design would involve a longitudinal study to analyze the dynamic interrelation between customer satisfaction and loyalty as the service quality or policy is modified. In the study to build an expanded model of customer loyalty and satisfaction, the following factors could be taken into consideration: trust level with the service

provider, attitude towards price changes, availability of subsidies, level of education among customers and technology interventions including digital initiatives. Future research may replicate the study across diverse Indian states and regions to assess the stability and applicability of the proposed model. The research could also be extended to other states and markets where new government policies are being implemented to enhance the use of LPG services through an extension of the eligibility for the benefits. The research could also focus on loyalty rather than satisfaction and further extend to other aspects like advocacy, compliance, or the efficiency of the use of LPG services. Such analyses would facilitate the assessment of long-term behavioral changes related to service quality and perceived value.

Abbreviations

CBG: Compressed Bio Gas, LPG: Liquefied Petroleum Gas, PERVAL: Perceived Value, PLS-SEM: Partial Least Squares Structural Equation Modelling, PMUY: The Pradhan Mantri Ujjwala Yojana, SHG: Self-Help Group, SERVQUAL: Service Quality, TPB: Theory of Planned Behaviour, VAM: Value-Based Adoption Model, VLE: Village Level Entrepreneur.

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Author Contributions

Kamalakanta Mishra: Conceptualization, Literature Review, Methodology and Research Design, Data Collection, Data Analysis, Manuscript Writing (Original Draft), References, Paritosh Mishra: Problem Formulation, Literature Review, Discussions and Implications, Review and Editing of the Draft, Supervision, Jonardan Koner: Problem Formulation, Literature Review, Discussion and Conclusion. All authors approved the final manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest with respect to the research, authorship and/or publication of this article.

Data Availability

Data can be provided by the corresponding author upon reasonable request.

Declaration of Artificial Intelligence (AI) Assistance

The authors declare that no generative AI or AI assisted tools were used in the preparation of this manuscript. The authors take full responsibility for the content's originality, interpretation and accuracy.

Ethics Approval

This study adhered to established ethical standards for research involving human participants in India. Participation was voluntary and informed consent was sought from each individual prior to the administration of data collection instruments. The survey was confidential. Also privacy and self-determination was ensured. As the study did not involve any risk and survey data was anonymous, formal ethical approval was not required as per prevailing institutional and national research guidelines.

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