

A FUZZY BASED ANALYSIS OF CONSUMER SATISFACTION AMONG THE ELECTRICITY CONSUMERS FOR IMPROVING CONSUMER RELATIONSHIP MANAGEMENT

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Abstract: *The objective of this study is to measure and analyze consumers' satisfaction of electricity users (domestic) in Kolkata and its surrounding area depending upon various factors, such as the quality of services, supply restoration time, behavior of the Meter Inspectors and the pricing policy, billing system, bill payment systems and corporate imagery and consumer relationship. The present research was conducted with the use of a specially developed website questionnaire containing thirteen questions and consumers feedbacks were collected from February to March, 2021. The results were analyzed with a Fuzzy logic based consumer satisfaction index (CSI) developed by using the data obtained from the responses of the consumer feedback. Areas of improvements have been identified and mapped on the basis of survey results and to take corrective actions accordingly as recommended to enhance consumer satisfaction and consumer loyalty, which is the main purpose of the project work. This empirical study may serve as a reference for Any electricity provider who desires to carry out similar studies in the future.*

Keywords: *Consumer Satisfaction, Consumer Relationship Management, Electricity, Fuzzy Logic, Performance Parameter, West Bengal.*

INTRODUCTION

Over the past decade, consumer satisfaction has been a very critical strategy for every type of firm. Firms are fully aware of the determining role of their consumers' satisfaction concerning their overall success. Furthermore, many researchers have recognized the role of consumer satisfaction in creating and maintaining a strategic competitive advantage.

Consumer surveys are frequently used to assess the quality of their services and consumer relations, but deriving effective managerial strategies from survey results can be quite challenging. Survey results depend on respondents' expectations and groups of consumers may have different frames of reference. Carefully designed survey instruments

can help to provide a consistent frame of reference for survey respondents but consumers in different market segments (demographic or geographic) may still demonstrate systematic bias in their ratings of service on various dimensions.

In this study we have attempted to measure and analyze the satisfaction level of consumers of electricity provider. It further comprehended the consumer expectation with respect to eight performance parameters viz. Quality of power supply, Metering, Billing, New connection, Bill payments, Complaint Handling, Communication and Corporate imagery. The results were analyzed with a Fuzzy logic based consumer satisfaction index (CSI) developed by using the data obtained from the responses of the consumer feedback. Finally, it identified the areas of improvement with respect to

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the services rendered with electricity provider and suggested corrective actions for the same.

LITERATURE REVIEW

During the last year, many researchers viz., Drosos et al. (2018), Zerva et al. (2018), Drosos, Skordoulis and Chalikias (2019), Golovkova et al. (2019) have signified that firms' adaptation to consumer needs and changing choices is a vital precondition to their long-term success.

The research, undertaken by Cheng et al. (2019), Fang, Chiu and Wang (2011), Kadlubek and Grabara (2015), Tsafarakis, Kokotas and Pantouvakis (2015), Park (2019), Drosos and Tsotsolas (2014), on consumer satisfaction and the analysis of comparable results provide policy makers with a unique insight into the motivations and satisfaction of consumers. Furthermore, some researchers viz., Parasuraman, Zeithaml and Berry (1988), Bolton and Drew (1991), Bitner (1990) argue that consumer satisfaction precedes quality, while others viz., Oliver (1993), Parasuraman, Zeithaml and Berry (1994), Fornell et al. (1996), Grönroos (2000) support the opposite.

There have been several research viz., Letcher and Neves (2010) that attempts for its definition, quantification, and measurement of impacting consumer satisfaction in social contexts. According to Oliver and DeSarbo (1988), consumer satisfaction is directly associated with the subjective judgment of satisfying consumers through the personal experiences accumulated in educational contexts. Yi (1990) denoted the variable definitions of consumer satisfaction, which are determined by the focus subject and the level of clarification. Such a valuation refers mainly to the key aspects of satisfaction from a product or service, the buying decision experience, the performance attribute, the consume - use experience, the company shop or department, and the pre-buying experience. Kotler (1991) determined consumer satisfaction from a marketing side, where consumer satisfaction is related to the complacency or discontent of a person while comparing his/her expectations with the performance or the result of a product or service. In this context, Kotler and Armstrong (2012) conceptualized consumer satisfaction while considering expectations generated from the post-purchase evaluation of products or services.

According to Caceres and Paparoidamis (2007), Carrillat, Jaramillo and Mulki (2009), Chenet, Dagger and O' Sullivan (2010), Hussain, Al Nasser and Hussain (2015), Sitorus and Yustisia (2018), Iqbal, Hassan and Habibah (2018), service quality is linked to several consumer outcomes, such as purchase intentions, consumer satisfaction, and consumer loyalty.

Service quality is dependent on two variables - expected services and perceived services. Throughout the last few years, many researchers viz., Parasuraman, Zeithaml and Berry (1988), Parasuraman, Zeithaml and Berry (1985), Miranda, Tavares and Queiró (2018) have shown that perceived service quality and expected service quality are an antecedent of consumer satisfaction. Grönroos (1982) identified two service quality dimensions: the functional aspect (how the service is provided) and the technical aspect (what service is provided).

Two years later, Grönroos (1984) again conducted a new model of service quality, which is known as the "Technical and Functional Quality Model." In this model, the service quality is conceptualized as a three-dimensional construct: functional quality, technical quality, and image. Delivery of services from an electric utility occurs constantly (24 hours per day). Apart from paying their bills, most consumers interact with the utility infrequently - usually to report or inquire about rare power outages, deal with a billing issue, or to participate in a program for efficient use of energy and also electric cooking. This combination of continuous service and very intermittent contact complicates the collection and interpretation of information about consumers' satisfaction with a utility's services. Sullivan et al. (1996) found, regarding power quality and reliability, that residential consumers "differ dramatically in their expectations for the utility's performance along these dimensions" and that "most residential consumers cannot distinguish high reliability service from low reliability service."

Sharma (2010) found that satisfaction ratings of electricity consumers in India (where there is much greater variance in quality and reliability of power than in the U.S.) were influenced by the utilities' pricing practices and the consumers' experience in dealing with the company. In a similar vein but different realm, Van Riel et al. (2012) saw waiting times at the checkout significantly affect consumers' ratings of overall store image of grocery stores.

Garg, Rahman and Qureshi (2014) conceive of consumer experience in service industries (banks, in their case) as involving an emotional connection between the consumer and the organization. They hypothesize that the nature of the experience is completely internal to a consumer and dependent on the nature of interaction in moments of contact. In a few moments, experience with a call-center representative or technician, might therefore alter a consumer's general perception about the overall quality and value of the actual product (electrical service, in our case). Formbrun and Shanley (1990) suggest that consumers build a picture of a company's reputation based on "available information about the firm's activities, which could come both directly from the firms themselves and indirectly

through the media.” Jin and Yeo (2011) found that consumers who are exposed to positive news stories about an organization are more likely to favor that organization.

DATA, SAMPLE AND METHODOLOGY

A structured questionnaire was used for the collection of the data for this specific research. The non-probability sampling method of convenience samples was used for the collection of the answers. A Mamdani based Fuzzy Inference System was implemented on the collected questionnaires to obtain the final CSI. It is assumed that the demographic status of the all consumers (age, education, occupation etc.) are similar except locations.

The survey period started in January, 2021 and lasted for 2 months. It is an academic project and convenient sampling has been done to conduct the survey. 13 questions were circulated to 150 consumers of different places in Kolkata and its surrounding area. But a total of 91 answers were recorded. The results were analyzed with the Fuzzy based method. This empirical study may serve as a reference for any electricity provider who desires to carry out similar studies in the future. In this project work, we investigate possible sources of such bias and discuss how to mitigate them. We addressed the following questions:

- Are you getting steady supply Voltage in your area?
- What is the supply restoration time in case of supply outage?
- How do you rate the regularity of meter reading by the personnel of electricity provider?
- How satisfied are you with the meter inspectors who visits your premises for reading regularly?
- Do you get monthly electricity bill from electricity provider regularly?
- Can you understand the details given by electricity provider in the electricity bill?
- How do you rate your experience if you have taken new connection?
- Is the process of getting new connection from electricity provider simple?
- Is it easy to pay electricity bill?
- Is it simple to lodge a complaint in electricity provider in case of power failure?
- Does electricity provider communicate promptly before and after meter reading?
- Communications from electricity provider regarding billing and payments are received regularly?

- What is your perception about the corporate image of electricity provider?

We focused our analysis on eight key dimensions of electric-utility performance assessed by electricity provider in their annual benchmarking surveys. These performance metrics, which are used widely in the industry, assess:

- Quality of Power Supply
- Metering
- Billing
- New Connection
- Bill Payments
- Complaint Handling
- Communication
- Corporate Imagery

Measures of overall consumer satisfaction with the utility's services and details about the consumers' assessments for these eight dimensions were obtained from an in-depth survey that was administered quarterly by an independent research firm to a stratified random sample of the utility's consumers. Data for this study were obtained from the surveys conducted in 2020-2021. Questions were used to generate consumer scores (on a Likert scale) for overall performance and for each of the eight performance dimensions. For some dimensions of performance, the survey contained a single question that provided a direct measure. For others, we created a factor from several related questions by using the simple average of the contributing scores. Scores for our major measures of corporate performance were thus:

- Satisfaction level on New Connection from the response to two questions.
- Reliability and quality from the response to two questions.
- Regarding metering from the response to two questions.
- Billing systems from responses to two questions.
- On bill payments single question has been set.
- Corporate image as the average score from responses to single questions.
- Communications effectiveness from the response to two questions.
- Complaint handling from responses to single question.

When drawing inferences from consumer-survey data and developing programs for consumer relationship index (CSI), an electric utility confronts several questions:

- What are the main drivers of consumer satisfaction?
- To what extent does variation in consumers' perceptions on one dimension of performance relate to variation in other dimensions?

- How does a consumer's recall of power outages align with actual outages experienced at the service address?
- To what extent do actual service-delivery statistics, objective consumer data from consumer records, transactional data, and other publicly available household data explain variation in consumers' ratings?
- How much additional information is provided in data from commercial services which segment consumers for consumer marketing?

To address these questions, we first investigated how consumers' ratings on the eight dimensions of performance are related to one another and to the consumers' overall assessment of satisfaction with the utility's service. Then, we examined systematic relationships between these individual measures of satisfaction and:

- Responses to individual questions on the detailed consumer survey about power reliability, outage experience, household demographics, communications with the company engagement in energy-savings programs sponsored by the utility, service geography, etc.
- Actual frequency and duration of power outages, as revealed by historical data for the last step-down transformer serving the household (provided from network statistics archived by the utility).
- Historical bill payments for electrical service on the consumer's account (from consumer account records archived by the utility).
- Whether the consumer had received aid in making payments from some program in the prior year (from consumer account records maintained by the utility).
- Whether the company had taken a collection action on the account in the prior year (provides from consumer account records maintained by the utility).

Finally, a fuzzy based Consumer Satisfaction Index (CSI) measuring system was developed to identify the area of improvement to build better consumer relationship and consumer loyalty.

Fuzzy Logic is a branch of logic specially designed for representing knowledge and human reasoning in such a way that it is amenable to processing by a computer. Thus it is applicable to artificial intelligence, knowledge engineering and expert systems. The more traditional, propositional and predicate logic do not allow for degrees and impression, indicated by words as fairly, very and quite possibly. Instead of truth values such as true and false, it is possible to introduce a multi-valued logic, which uses sets and predicates of this kind. The main concepts of fuzzy logic are fuzzy sets, linguistic variables, possibility distributions and fuzzy IF-THEN rules.

ANALYSIS AND FINDINGS

Quality of Power Supply

- *Steady Supply Voltage:* Steady supply voltage is needed for running any electrical and electronic equipment and devices etc. Fluctuating voltage may damage these machineries and devices. Steady voltage is also needed for steady lighting systems. Sophisticated devices subjected to voltage fluctuations could malfunction and have reduced efficiency, which are costly in terms of downtime and rejects. Most electrical and electronic equipment are designed to operate properly and within their specifications if the voltage supply varies within $\pm 10\%$ of nominal. However, some sensitive devices require stable incoming voltage for them to perform accurately, such as computers, medical laboratories, telecommunications and test equipment. Fig. 1 presents that majority (72.6%) of the consumers strongly agree that there is steady supply voltage.

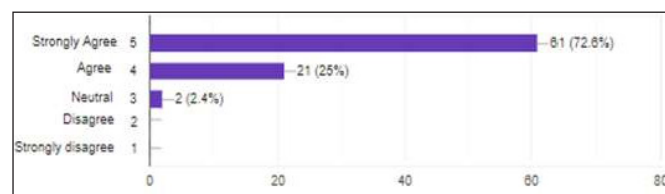


Fig. 1: Survey Results on Steady Supply Voltage

- *Supply Restoration Time:* In conventional reliability analysis, the duration of interruptions relied on the input parameter of mean time to repair (MTTR) values in the network components. For certain criteria without network automation, reconfiguration functionalities and/or energy regulator requirements to protect consumers from long excessive duration of interruptions, the use of MTTR input seems reasonable. Since modern distribution networks are shifting towards smart grid, some factors must be considered in the reliability assessment process. For networks that apply reconfiguration functionalities and/or network automation, the duration of interruptions experienced by a consumer due to faulty network components should be addressed with an automation switch or manual action time that does not exceed the regulator supply restoration time.

This is an important criteria or parameter of the operating efficiency of a utility. Every consumer expects an interruption free supply. Lesser the time of supply restoration in case of power failure higher will be the consumer satisfaction level.

Fig. 2 presents that supply restoration time is less than 1 hr in most power failure cases. Between 1 to 2 hrs restoration time is also in higher proportion.

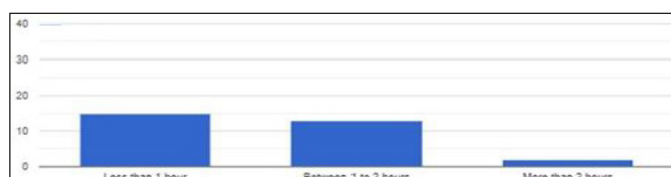
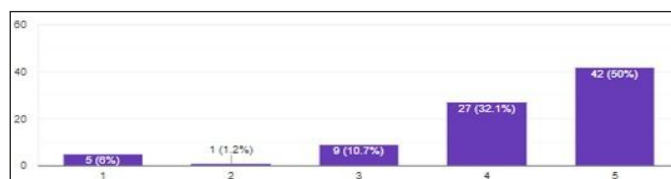


Fig. 2: Survey Results on Restoration Time in Case of Power Failure as Per Consumer's Feedback

Metering

Meter readings and energy rates are the two most important elements that make up energy bills.

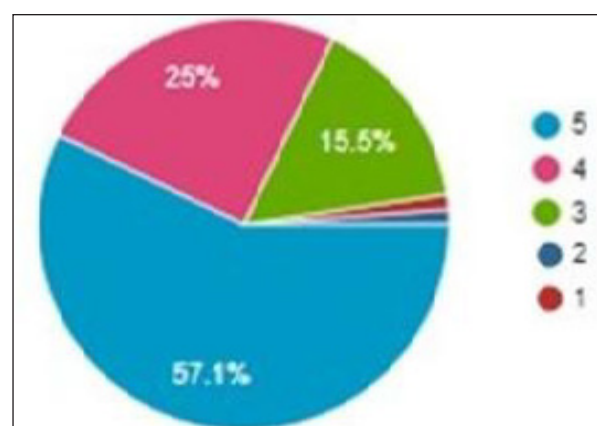
- Regularity of Meter Reading:** Giving meter readings to consumer ensure that they pay for the correct amount of usage. Without them your consumer will not be able to estimate how much energy they are using. Energy rates on the other hand are how much the supplier charges for each unit of energy that a consumer consumes. Accurate energy bills are an important factor for managing the household finances, especially in these difficult times. If more has been used, more than estimated, then this can be a surprise for the consumer. Meter reading is one of the most important parts of energy supply. Accurate meter reading is required to register the actual consumptions and to prepare bills accordingly. Fig. 3 shows that 50% of consumers were extremely satisfied with reliability and accuracy of meter reading taken by Meter Inspectors.



1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 3: Survey Reports of Satisfaction Level of Consumers on Reliability and Accuracy of Meter Reading Taken by Meter Inspectors

- Meter Inspector:** Meter readers work for companies that provide utilities or services to consumers. They are responsible for traveling to different residential and commercial locations on assigned routes and gathering accurate data regarding the amount of utilities used. Fig. 4 shows that majority (57.1%) of the consumers are highly satisfied on behaviour of meter inspector.

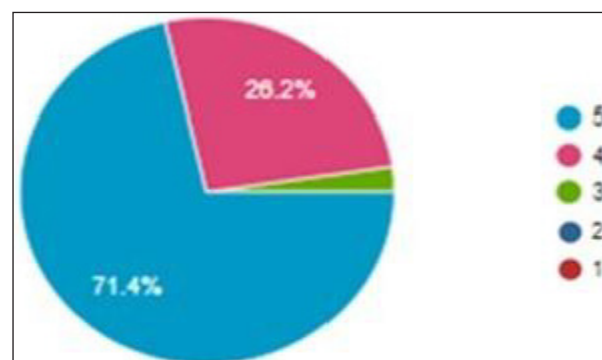


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 4: Survey Results of Consumer Satisfaction on Behaviour of Meter Inspector

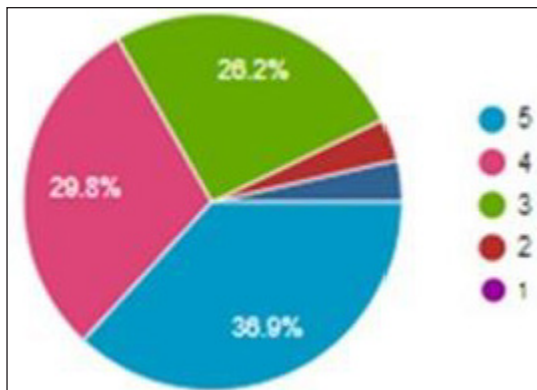
Billing

Billing is also another important aspect. Consumers are given complete information regarding their consumption of electricity and its billing amount with due date of payment. An electricity bill is a detailed invoice, issued and paid once a month (once in three months) from utilities. The details that energy and sustainability managers can get from a business' utility bill are the basic information such as the account number, invoice number, service address (different from the billing address; this is the address of the building or facility being managed), and service period. Then for each meter, one can also see its usage, units, rates, and amount due. Fig. 5 shows that majority (71.4%) strongly agree that they receive electricity bill regularly. 35.9% of consumers are highly satisfied and 29.8% are satisfied regarding clarity of details given in electricity bills (Fig. 6).



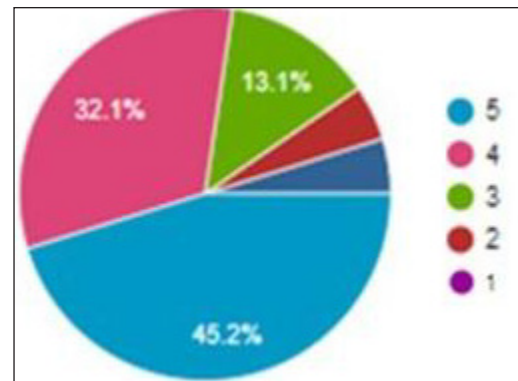
1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 5: Survey Results on Regularity of Receiving Electricity Bill



1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 6: Consumer's Opinion on Clarity of Details Given in Electricity Bills

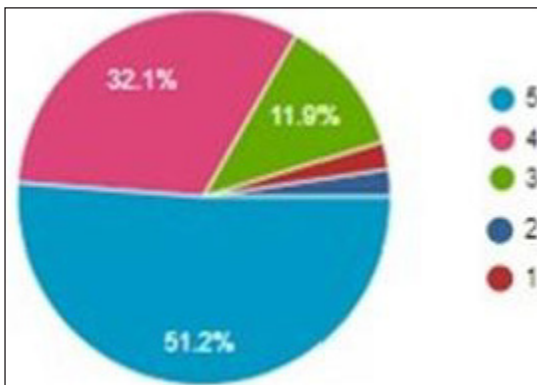


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 8: Consumers' Experience on Simplicity of New Application Process

New Connection

Ministry of Power has undertaken several reforms measures to ease the process of 'Getting Electricity' over a period of last two years. These measures will drastically reduced the time taken for getting an electricity connection and will benefited citizens and industry alike. Fig. 7 shows 51.2% consumers are highly satisfied while taking new connection. 45.2% of consumers are highly satisfied and 32.1% are satisfied on simplicity of new application process (Fig. 8).

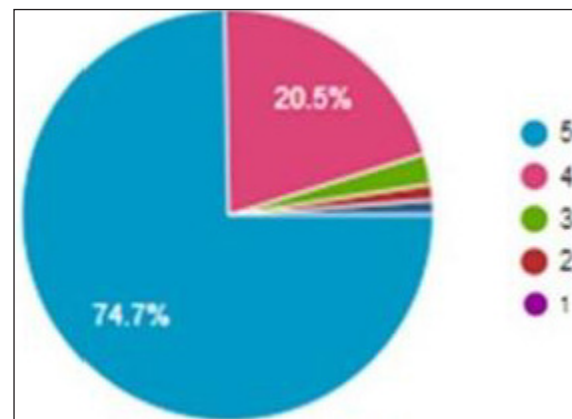


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 7: Consumers Experience while Taking New Connection

Bill Payments

This is also an important part of the system and hence different online and offline modes are provided to pay electricity bills. Often, special electricity bill payment offers are provided such as cash back or discounts on electricity bill payments made through PayTM, PhonePay and AmazonPay etc. in addition to 1% online rebate. Fig. 9 shows 74.7% are highly satisfied on bill payment system.

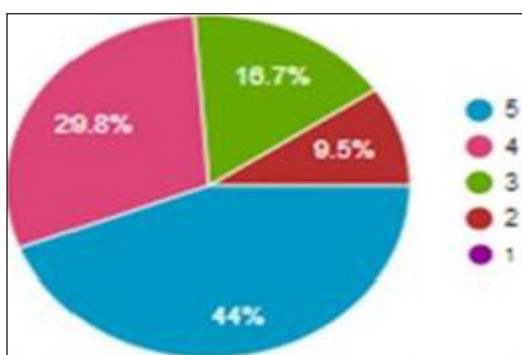


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 9: Output of Survey on Bill Payment System

Complaint Handling

The term complaint management describes the handling of consumer complaints within a company in an efficient way. Criticism is supposed to be evaluated in a way that is systematic and orderly and used to create a positive impact. It is also supposed to resolve the issue that prompted the consumer's criticism. The goal of complaint management is to strengthen consumer loyalty as well as quality assurance. Operating efficiency of utility and its reputation are mainly depending upon the efficient complaint handling capacity and their feedback receiving methods. Fig. 10 shows that 44% of the consumers highly satisfied and 29.8% are satisfied with the complaint handling mechanism.

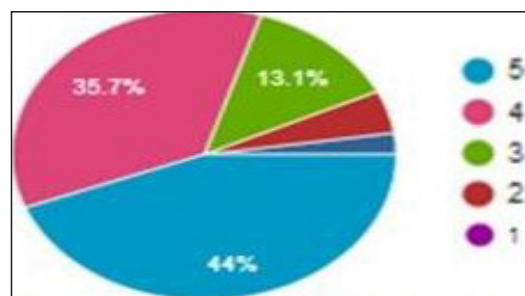


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 10: Survey Results on Complaint Handling

Communication

Obtaining consumer feedback is essential in order to understand business successes and failures. Having the ability to integrate the feedback into a consumer profile and respond to the feedback provides a huge benefit to any business. Businesses who think of consumer communications as an essential part of the CRM process will be positioned to succeed. Different modes of communication with electricity consumers viz., 24x7 customer care service, social media (facebook and twitter), SMS, Whatsapp, Website, public events, advertisement, branding, chatbot system etc. Consumers can give their feedbacks through these media. Fig. 11 shows that 44% of the consumers are highly satisfied and 35.7% are satisfied with the mode of communication made by electricity provider.

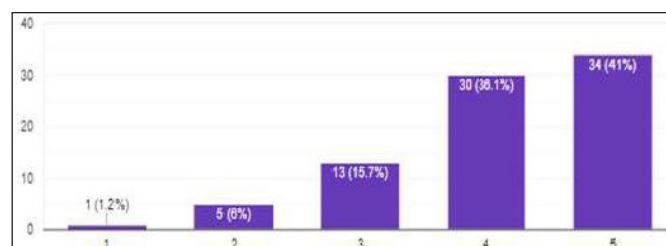


1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 11: Survey Results on Communication Made by Electricity Provider

Corporate Imagery

A good corporate imagery is also required to gain the brand value of the company in the electricity market in India and also to develop the consumer loyalty through Consumer Relationship Management (CRM). Fig. 12 shows that 41% of the consumers are highly satisfied and 36.1% are satisfied with corporate image.



1: Highly Dissatisfied; 2: Dissatisfied; 3: Neutral; 4: Satisfied; 5: Highly Satisfied

Fig. 12: Response Received from Survey on Corporate Image

Results Analysis using Fuzzy Logic

- Fuzzy Inference System Implication:** This section explains the fuzzy logic based approach to calculate the Consumer Satisfaction Index (CSI) that can indicate the quality of the consumer satisfaction. CSI developed is a single value that represents an amalgamation of the existing eight parameters. Fig. 13 shows the architecture of CSI and Fig. 14 represents the schematic diagram of CSI module.

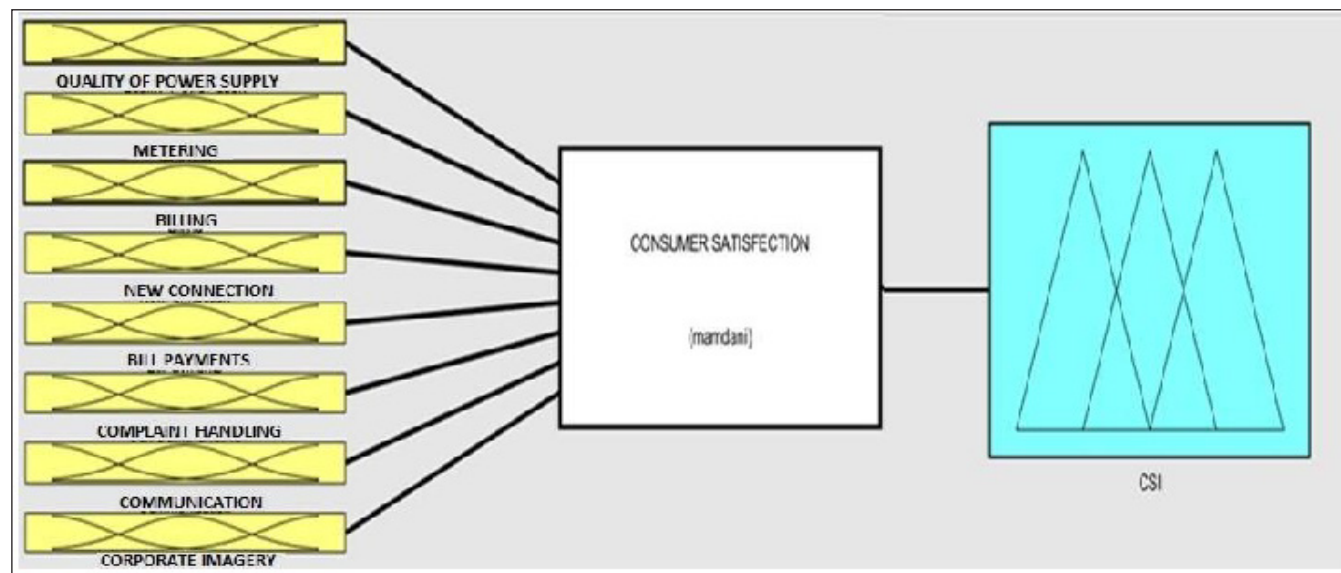


Fig. 13: Architecture of CSI Module

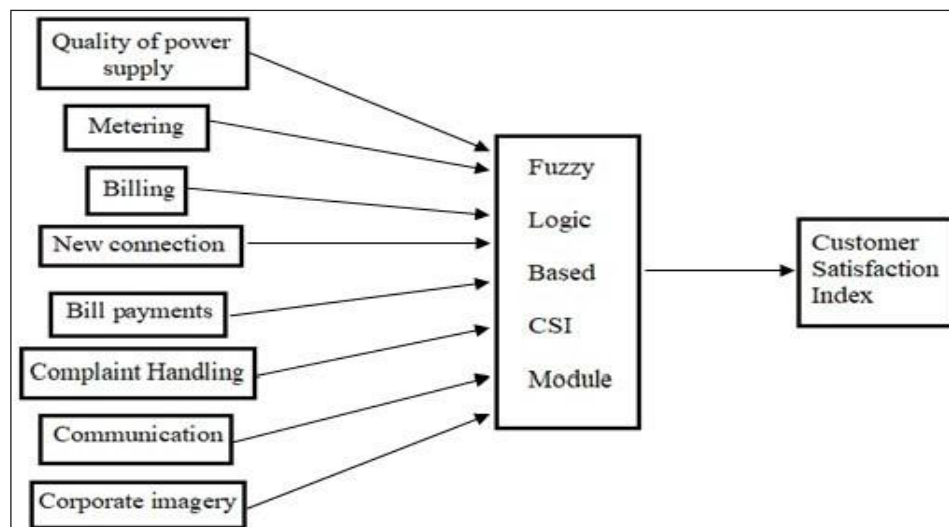


Fig. 14: Schematic Diagram of CSI Module

- Input and Output Fuzzification:** Eight parameters have been used to represent consumer satisfaction index via single universal index. Triangular membership functions are used for each input variable to represent the new CSI at the output with three linguistic variables: low (L-POOR), medium (M-AVERAGE), high (H-EXCELLENT). The new index varies from 0 to 1 where 0 indicates very poor consumer satisfaction

and 1 indicates very good consumer satisfaction. The input and output membership functions are shown in Fig. 15. The membership functions of the new consumer satisfaction index are shown in Fig. 16.

- (a) Quality of Power Supply (b) Metering (c) Billing (d) New Connection (e) Bill Payments (f) Complaint Handling (g) Communication (h) Corporate Imagery

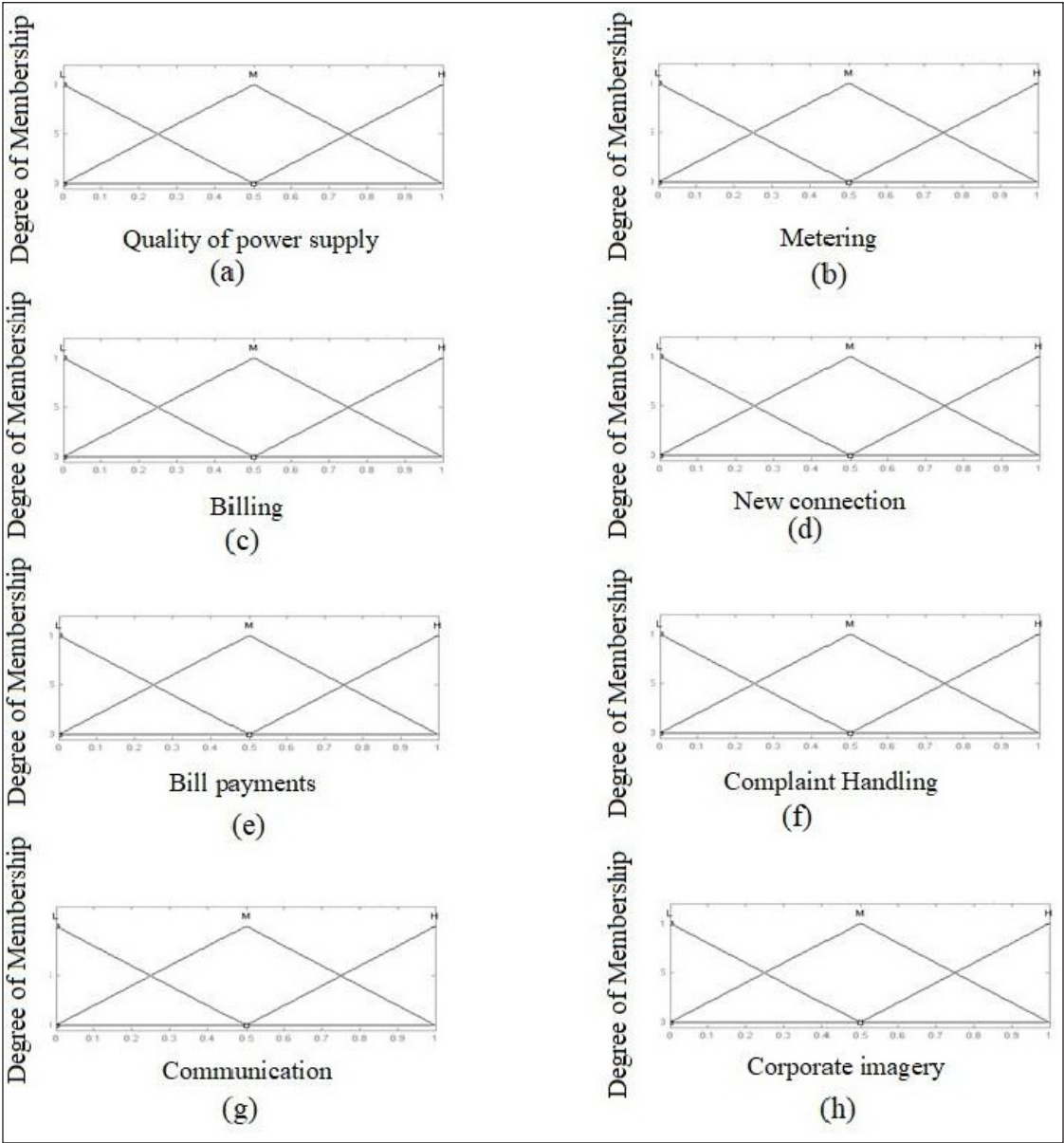


Fig. 15: Membership Functions of Input Variable of CSI

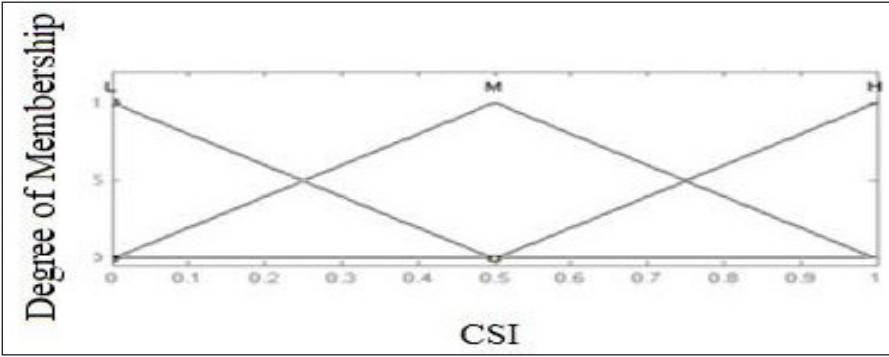


Fig. 16: Membership Function of CSI

- *Fuzzy IF-THEN Rules:* IF-THEN rules represent the knowledge base for the fuzzy logic based module. 64 rules are used in the CSI module. Some of them are:

Rules for CSI

- If (Quality of power supply is L) and (Metering is L) and (Billing is L) and (New connection is L) and (Bill payments is L) and (Complaint Handling is L) and (Communication is L) and (Corporate imagery is L) then (CSI is POOR).
- If (Quality of power supply is M) and (Metering is M) and (Billing is M) and (New connection is M) and (Bill payments is M) and (Complaint Handling is M) and (Communication is M) and (Corporate imagery is M) then (CSI is AVERAGE).
- If (Quality of power supply is H) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is H) and (Complaint Handling is H) and (Communication is H) and (Corporate imagery is H) then (CSI is EXCELLENT).
- If (Quality of power supply is H) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is M) and (Complaint Handling is M) and (Communication is M) and (Corporate imagery is M) then (CSI is AVERAGE).
- If (Quality of power supply is M) and (Metering is M) and (Billing is M) and (New connection is M) and (Bill payments is H) and (Complaint Handling is H) and (Communication is H) and (Corporate imagery is H) then (CSI is AVERAGE).
- If (Quality of power supply is M) and (Metering is M) and (Billing is H) and (New connection is H) and (Bill payments is H) and (Complaint Handling is H) and (Communication is H) and (Corporate imagery is H) then (CSI is EXCELLENT).
- If (Quality of power supply is M) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is H) and (Complaint Handling is H) and (Communication is H) and (Corporate imagery is H) then (CSI is EXCELLENT).
- If (Quality of power supply is H) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is H) and (Complaint Handling is H) and (Communication is M) and (Corporate imagery is M) then (CSI is EXCELLENT).

- If (Quality of power supply is H) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is H) and (Complaint Handling is M) and (Communication is M) and (Corporate imagery is M) then (CSI is EXCELLENT).
- If (Quality of power supply is H) and (Metering is H) and (Billing is H) and (New connection is H) and (Bill payments is L) and (Complaint Handling is L) and (Communication is L) and (Corporate imagery is L) then (CSI is AVERAGE).
- *Fuzzy Inference Mechanism (FIM):* The fuzzy algebraic product is used for the implication process while the maximum operator is used as the aggregation operator.
- *Output Defuzzification:* The center of gravity method is used as the defuzzification method while Mamdani's fuzzy inference system is used to perform the implication and the aggregation processes.
- *The Utility of Fuzzy Systems:* Fuzzy systems are universal approximators to algebraic functions; it is not this attribute that actually makes them valuable to us in understanding new or evolving problems. The primary benefit of fuzzy systems theory is to approximate system behavior where analytic functions or numerical relations do not exist.
- Alternatively fuzzy system theory can have utility in assessing sum of our more conventional less complex systems. For example, for some problems exact solutions are not always necessary. An approximate but fast solution can be useful in making preliminary design decisions or as an initial estimate in a more accurate numerical technique to save computational cost or in the myriad of situations where by inputs to a problem are vague or not known at all.
- *Results:* Fig. 17 shows the resultant CSI when Quality of power supply=0.5; Metering=0.5; Billing=0.5; New connection=0.5; Bill payments=0.5; Complaint Handling=0.5; Communication=0.5; Corporate imagery=0.5. The value of CSI is 0.5. Fig. 18 shows the resultant CSI when Quality of power supply=1; Metering=1; Billing=1; New connection=1; Complaint Handling=1; Communication=1; Corporate imagery=1. The value of CSI = 1. Fig. 19 shows the CSI when Quality of power supply=0.8; Metering=0.7; Billing=0.7; New connection=0.7; Bill payments=1; Complaint Handling=0.8; Communication=0.8; Corporate imagery=0.8. The value of CSI=0.8.

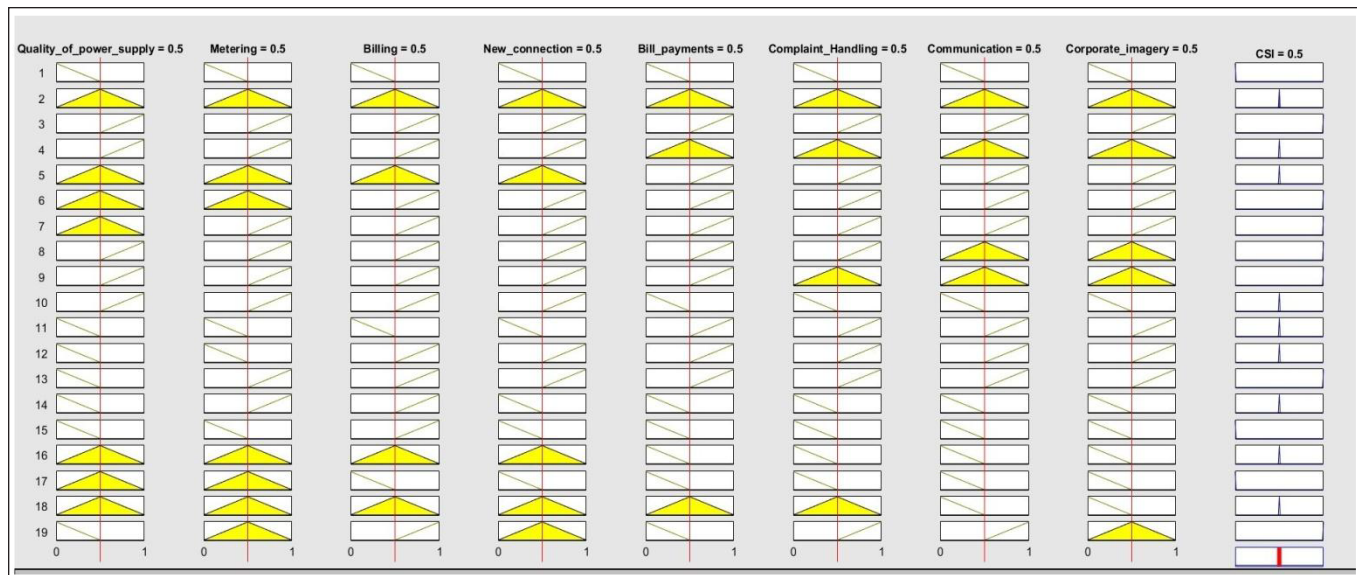


Fig. 17: CSI when Quality of Power Supply=0.5; Metering=0.5; Billing=0.5; New Connection=0.5; Bill Payments=0.5; Complaint Handling=0.5; Communication=0.5; Corporate Imagery=0.5

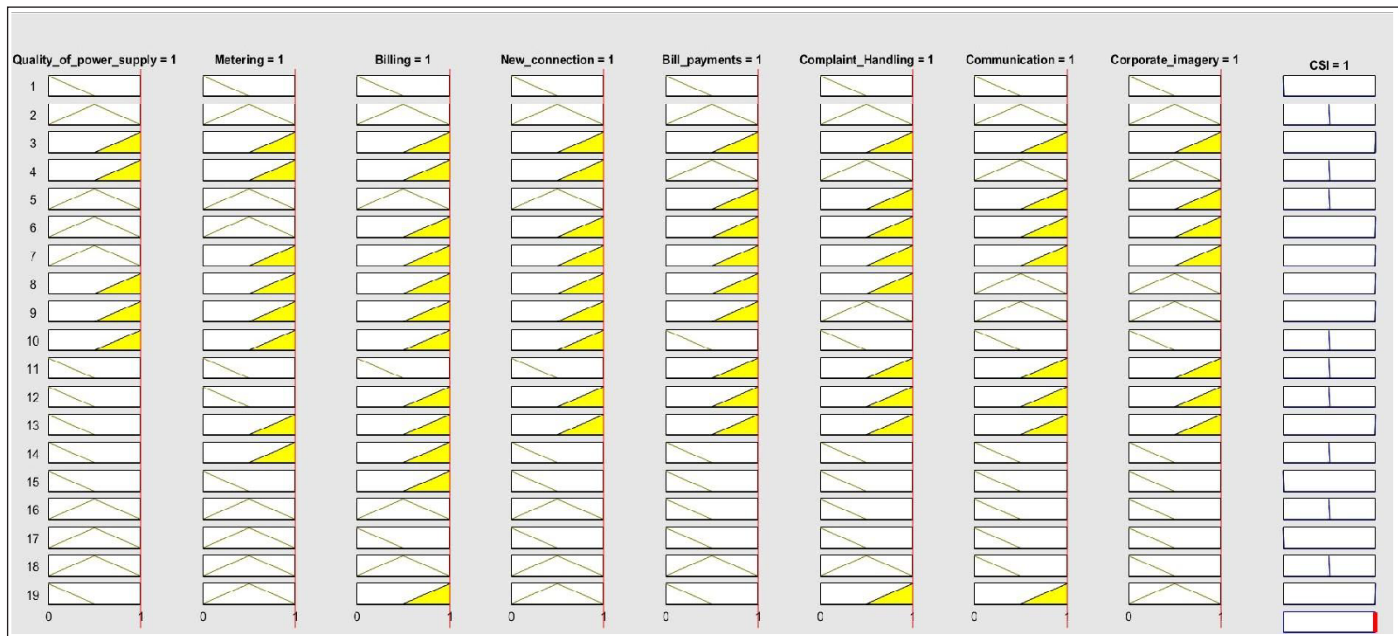


Fig. 18: CSI when Quality of Power Supply=1; Metering=1; Billing=1; New connection=1; Bill Payments=1; Complaint Handling=1; Communication=1; Corporate Imagery=1

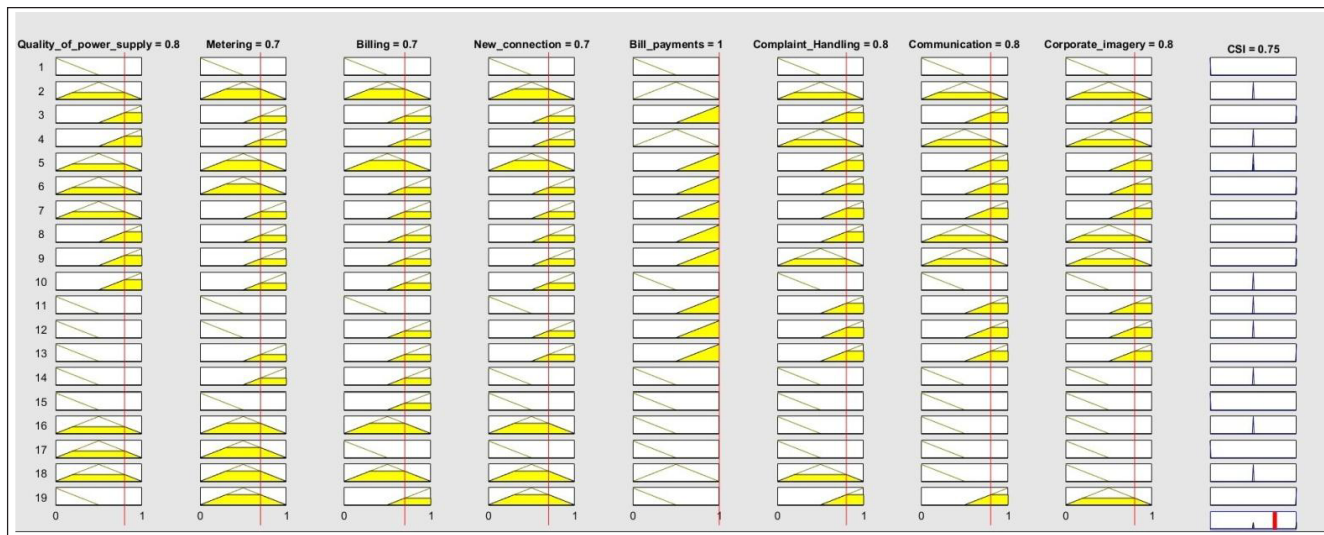


Fig. 19: CSI when Quality of Power Supply=0.8; Metering=0.7; Billing=0.7; New Connection=0.7; Bill Payments=1; Complaint Handling=0.8; Communication=0.8; Corporate Imagery=0.8

$$\begin{aligned}
 \text{Over all CSI} &= \frac{\sum \text{Individual CSIs}}{\text{Number of Population}} \times 100 \% \\
 &= \frac{78.894}{91} \times 100 \\
 &= 87.66\%
 \end{aligned} \quad (1)$$

We have found that Consumer Satisfaction Index (CSI) is varying with the consumers according to their perceptions. So we have derived average CSI which is 87.66%.

CONCLUSION AND RECOMMENDATION

The investigated techno-commercial and qualitative service indices of consumer satisfaction unveiled that the domestic consumers are quite satisfied, sustaining an average consumer satisfaction index of 87.66%. The project outcomes also reveals that perceived service quality by consumers and their satisfaction towards public utility is determined by eight parameters viz. Quality of power supply, Metering, Billing, New connection, Bill payments, Complaint Handling, Communication and Corporate imagery. A consumer will be delighted if he/she gets uninterrupted supply with accurate meter reading and perfect billing. Consumer wants new connection within three days and wants a very simple and user friendly payment system. Consumers will be happy if they get complaint addressed in minimum time with sharp response by the company. A satisfied consumer always prefer to make a relationship with a company which has a very good corporate image.

It is clear from the analysis that 72.6% consumers are satisfied with the supply voltage. Supply restoration time is less than 1 hr in most power failure cases. Between 1 to 2 hrs restoration time is also in higher proportion. 50% consumers are highly satisfied with regularity of meter reading by the personnel of electricity provider and 57.1% consumers are happy with the behavior of the meter inspector. It has been observed from the analysis that 71.4% consumers get electricity bills regularly and more or less 67% consumers understand the details given in the electricity bills. 51.2% consumers are highly satisfied while taking new connection. 45.2% of consumers are highly satisfied and 32.1% are satisfied on simplicity of new application process. It is pertinent from the analysis that 74.7% consumers are satisfied with bill payment system. 44% of the consumers highly satisfied and 29.8% are satisfied with the complaint handling mechanism. 44% of the consumers are highly satisfied and 35.7% are satisfied with the mode of communication made by electricity provider. From the analysis it is seen that 41% of the consumers are highly satisfied and 36.1% are satisfied with corporate image.

Consumer satisfaction management is a basic and constant requirement for any organization. Satisfied consumers lead to the growth of the organization. It is an important aspect of both strategic and operational planning and is an integral part of marketing and quality improvement initiatives. The measurement of consumer satisfaction is an ongoing requirement and it is also needed to assess the performance of the company so that continual improvements can be made.

Following recommendations may be adopted to overcome the existing bottlenecks:

- Consumer Satisfaction Index (CSI) is 87.6% which is very good score and also in the power utilities in India. Electricity provider is driving for excellence, so necessary steps are to be taken to make it more than 90%.
- Supply voltage is highly steady (in 97.6% cases) in most of the area. Action to be taken to the area of responses where neutral responses (2.4% cases) are received.
- Supply restoration time is best in class. There are 4 cases where consumers are satisfied but not delighted because in those cases supply restoration time is between 1 to 2 hrs. They are to be managed by adopting necessary actions on case to case basis.
- Additional care is required to improve the reach and quality of communication.

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