CUSTOMER SATISFACTION OF ELECTRICITY CONSUMERS: AN EMPIRICAL EVIDENCE OF HARYANA (INDIA)

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Abstract: The key findings of thesis paper of the analysis of a confirmatory factor analysis (CFA) model conducted on response collected, focusing on customer satisfaction within the electricity sector. The study aims to uncover the factors influencing customer satisfaction and provide insights for enhancing service quality. The analysis reveals crucial factors that impact customer satisfaction. Reliability of the power supply emerges as a vital factor positively affecting various aspects of electricity service, from billing accuracy and transparency to customer service and power quality. Accurate billing and transparency build trust, while customer service and responsiveness play a direct role in influencing satisfaction. Affordability and fair pricing also contribute to overall satisfaction by ensuring accessibility and value for customers. Effective communication and information accessibility are found to enhance customer satisfaction by keeping customers informed and engaged. Although power quality and voltage stability did not directly affect customer satisfaction in this analysis, their maintenance remains important for indirect satisfaction. The results highlight the significance of a balanced approach to customer service, as an excessive focus on it could potentially lead to lower satisfaction. Overall, the analysis underscores the importance of a holistic strategy that prioritizes reliability, accurate billing, affordability, communication, and responsive customer service in order to elevate customer satisfaction in the electricity sector. The model demonstrates good fit to the data, and the identified factors provide crucial insights for electricity providers aiming to create positive customer experiences and foster higher levels of satisfaction.

Keywords- Power Distribution, Consumer Satisfaction, Haryana Power Utilities, Electricity Consumers

I. INTRODUCTION

Today, the majority of corporations that provide power distribution in a variety of nations, including India, are having trouble dealing with low levels of consumer satisfaction (**Usman, 2013**). Customers of an electric company are unhappy with the rising power cost and the decreased quality of service. Every distribution firm has the challenge of trying to persuade their clientele that they provide good value for the money. The problem of low levels of customer satisfaction

brought on by poor service quality is one that the sector responsible for the distribution of electricity is now attempting to address. It may also be seen in a different sense that the lack of contentment among their customers is leading them to incur financial losses. The level of a company's customer happiness and the quality of the service it provides are linked. In any case, the electric utilities are beginning to place a far greater emphasis on the quality of service they provide to their customers. It has acquired more impetus to help the firm stand out in the harsh competitiveness of the market in today's globe, which is a highly competitive environment. Even though there is less competition in the public sector, the contentment of customers still plays a significant role in determining the profitability of the electric utility. As a consequence of consumers' increased awareness of the rights associated with the services they are provided, improving the quality of service has emerged as an urgent need for electric utilities seeking to maintain their position in the market. Customers today anticipate, in addition to receiving an adequate amount of power supply, a supply of a high quality, as well as additional services connected to the supply that are intangible. It is crucial to measure the degree of service quality **(Lassar et al., 2000)** provided by electric utilities since the level of service that is provided to consumers is related to the amount of satisfaction experienced by those customers. A high level of service quality is indicative of superiority or excellence, both of which contribute to the happiness of the consumer. Literature offers a wide variety of interpretations for the term "customer satisfaction." Depending on the source, "customer satisfaction" may be defined as a "post-choice evaluative opinion relating to a specific service that was paid for." The amount of satisfaction a client has with the utility services they get is directly proportional to the degree to which they believe such services meet or exceed their expectations. The expectancy-disconfirmation paradigm is the model that is used for this evaluation the vast majority of the time. The success of the expectation-disconfirmation paradigm is dependent on the customer's expectations for the utility services and the degree to which those expectations are not met by the actual service provided **(Seth et al., 2005)**. Consumers are satisfied as a consequence of positive disconfirmation, which may be defined as a greater degree of corporate performance than was anticipated, whereas negative disconfirmation can result in customers being dissatisfied with a product or service. The appraisal of a customer's entire experience with a business, as well as the quality of the services that are provided, contribute to the customer's opinion of the firm's level of success.

1.1 Customer Satisfaction

Customer satisfaction is a word that is widely used in marketing, and it refers to a measurement of the degree to which a company's goods and services meet or exceed the expectations of its customers (**Angelova & Zekiri, 2011**). The number of consumers, or proportion of total customers, whose reported experience with a business, its goods, or its services (ratings), exceeds established satisfaction targets is how customer satisfaction is defined. Within the realm of business, it is seen as a crucial indication of performance and is often included on a Balanced Scorecard. In a marketplace that is highly competitive and in which firms compete with one another for consumers, customer happiness is considered as a significant differentiator and has

become an increasingly important component of company strategy. Ratings based on the level of happiness of customers may have a significant impact on enterprises. They emphasise to workers how important it is to meet the requirements set out by the clients. In addition, when these ratings begin to fall, it is a warning sign that there are difficulties that might harm sales and profitability. These measurements provide a quantitative representation of an essential dynamic. When a company has devoted clientele, it is able to benefit from excellent word-of-mouth marketing **(Ferguson, 2008)**, which is promotion that is not only cost-effective but also completely free. Consumer satisfaction may be defined as the degree to which a customer feels that their requirements for a product or service offered by a specific firm have been satisfied. Customers report feelings of pleasure (or discontent) in reaction not just to the quality of a product but also to the quality of service they get, the ambiance of the company in which they make the purchase, as well as a variety of other intangible aspects. The owners of businesses are becoming more and more conscious that the success of their enterprises may rely, to a great part, on whether or not they are able to win and keep the loyalty of their consumers. One estimate suggests that the expense of bringing in a new client is anywhere from five to seven times higher than the cost of keeping an existing customer. When it comes to determining whether a customer return to a business after their first experience and whether the customer be inclined to recommend the business to others, one of the most important factors is whether or not the customer was satisfied with the service they received. Some industry experts even argue that customer satisfaction is even more important than price. The level of happiness that a company's customers feel is an elusive term that is difficult to measure **(Yuksel & Yuksel, 2001)**. After a customer has left the place of business, it may be difficult to determine whether or not the client's expectations have been satisfied, and it can also be challenging to determine whether or not the consumer has been disappointed. According to research, less than five percent of customers voice their dissatisfaction directly to the company. However, the research also indicates that the typical dissatisfied customer does voice their dissatisfaction to approximately nine other people, such as friends, family members, and co-workers. It is anticipated that happy consumers would tell around five other people about the outstanding service they had or the fantastic product they bought. In contrast, customers are more likely to publicise their dissatisfaction than their delight. When running a business, careful thought has to be given to how suggestions and complaints spread via word of mouth may impact the company's financial success. It is a commonly held belief that in order for a business to maintain a competitive edge in the market, it is necessary for that business to discover ways to provide exceptionally high levels of happiness to its clientele.

1.2 The research identified three keys to consistency:

1. Customer-journey consistency
It is common knowledge that businesses are obligated to make ongoing efforts to give consumers with excellent service, and it is also common knowledge that each division of a company should have distinct policies, procedures, and supporting systems to maintain consistency throughout each encounter. However, very few businesses are able to provide consistently throughout the customer

experience, especially when it comes to satisfying customers' most fundamental requirements (**Pulido et al., 2014**).

Using some basic arithmetic, we can see why this is so crucial in a world where customer journeys are increasingly including several channels and touches. Assume that a consumer has six different interactions with a pay-tv firm, beginning with the customer doing online research into different providers and concluding with the customer receiving the first bill thirty days after the service has been installed. Assuming a satisfaction rate of 95% for each individual interaction, whether measuring responsiveness, the accuracy of information, or any other factor, even at this level of performance, up to one in four customers have a negative experience during the on-boarding process. The reality of the matter is that a significant predictor of overall customer experience and loyalty is a company's level of consistency on their most frequent customer journeys. For instance, financial institutions found a very robust connection between maintaining consistency on important customer journeys and achieving high levels of overall performance in customer experience. And when we dispatched an undercover-shopping team to visit 50 bank offices and contact 50 bank call centres, the study was confirmed: for lower-performing banks, the variety in experience was far larger across a typical bank's branches than it was among the various banks themselves. The biggest difficulty was often encountered by larger banking institutions.

2. Emotional consistency

One of the most enlightening findings from our poll was that good customer-experience emotions, which were encapsulated in a sense of trust, were the most important drivers of happiness and loyalty in the majority of the sectors that were studied. We also discovered that consistency is particularly important when it comes to building a relationship of trust with customers. For instance, customers trusted banks that were in the top quartile of delivering consistent customer journeys 30 percent more than banks that were in the bottom quartile of delivering consistent customer journeys. It is remarkable how important the emotional connection that is produced by consistency is for maintaining a customer's commitment to a brand. Customers of financial institutions identified "a brand I feel connected to" and "a brand that I can trust" as the primary factors that differentiated one financial institution from another in terms of customer experience. In a world in which research indicates that less than 30 percent of consumers trust the majority of the big financial companies, establishing consistency on customer journeys in order to develop trust is vital for long-term success (**Gentile et al., 2007**).

3. Communication consistency

More than just the mix of fulfilled and unfulfilled commitments to customers is what drives a company's brand. What is equally essential is ensuring that clients notice the fulfilment of those promises. This necessitates the proactive design of communications and key messages that regularly emphasise delivery in addition to recurring themes. Southwest Airlines, for instance, has been able to earn the confidence of its customers over a protracted period of time by reliably living

up to its promise of operating as a no-frills, low-cost airline. In a similar manner, over the years 1995–2005, Progressive Insurance gave the impression to its clientele that it provided more affordable premiums than its rivals, and it made a point to draw attention to the occasions on which it really fulfilled that promise. Progressive also influenced how customers interpreted cost-reduction actions such as on-site resolution of auto claims by positioning and reinforcing these actions as part of a consistent brand promise that the company was responsive and technology-savvy. This allowed Progressive to shape customers' perceptions of the actions and how they related to the company's brand. In both instances, the ways in which customers saw the brands supported the ways in which operations really worked. These kinds of companies amass a stockpile of good and are able to endure because they are reliable over the course of time in terms of delivering on their promises, as well as because they have powerful marketing communications that are continuous in order to reinforce those experiences (**Šerić et al., 2020**).

1.3 Factors that Influence Customer Satisfaction
   a) Accessibility
   b) Empathy
   c) Language
   d) Response Time
   e) Convenience
   f) Choices
   g) Simplicity
   h) Quality
   i) Reasonable Prices
   j) Appreciation
   k) Loyalty Programs
   l) Community

1.4 Customer Satisfaction Factors in Service-Based Industries
Not every company has a physical product that they can provide to their clientele for purchase. In some businesses, the "product" that we sell is really a service that helps address difficulties that our clients are experiencing. These companies are classified as being part of the "service industry," and they are as follows:

- Marketing
- Insurance
- Spas and other wellness-related services
- Professional services such as attorneys or certified public accountants
- Consultants
- Education
- Events

Electricity Customers: Customers in the residential, commercial, and industrial sectors are responsible for about one-third of the total power consumption in the country. Although just a tiny portion of total power consumption is accounted for by the transportation sector, this portion has the potential to grow as the number of electric cars on the road increases. Through increased energy efficiency, any and all sorts of end-users may cut down on their use of power (**Chicco et al., 2004).**

Residential Customers: More over a third of the nation's total energy consumption is accounted for by the residential sector, which encompasses both single-family houses and housing complexes with multiple units. According to the data presented in the graph, the most significant individual consumers of electricity in the residential sector are the space heating and cooling (air conditioning) industry, the lighting industry, the space heating industry, the space heating industry, and the appliance and electronics industry. In the residential sector, the demand for electricity is often greatest in the afternoons of hot summer days because of increased usage of air conditioning, followed by the nights since lights are switched on during this time (**Di Placido et al., 2014).**

Commercial Customers: The commercial sector consists of governmental establishments, establishments and equipment used in the provision of services, as well as other public and private organisations. This industry is responsible for more than a third of the total power usage in the United States. According to the graph, the two categories of heating, ventilation, and air conditioning (HVAC) (**Tso et al., 2019**) together with lights are responsible for the greatest individual use of power in the business sector. The peak demand for electricity in the commercial sector often occurs during operational business hours, whereas demand is noticeably lower during the evenings, weekends, and holidays.

Industrial Customers: Electricity is used by the facilities and equipment of industrial customers in the processing, production, or assembly of commodities. Industrial customers come from a wide variety of sectors, including construction, agriculture, mining, and manufacturing. Overall, this industry accounts for less than a third of the country's total power use. The results of a comprehensive study conducted throughout the country on manufacturing facilities have made data on individual end-uses accessible. The investigation discovered that more than half of the energy utilised in production goes toward powering different motors (machine drive). Other significant applications include heating and cooling, as well as electrochemical processes, which involve the use of electricity to bring about a change in a substance's chemical composition (for example, the processes that produce aluminium metal and chlorine). When compared to the residential and commercial sectors, the amount of electricity used in the industrial sector often does not change as much over the day or year. This is especially true in manufacturing plants that are open 24 hours a day (**Shu et al., 2018**).

Transportation: The majority of the energy that is used in the United States comes from the transportation industry, which mostly burns fossil fuels like gasoline, diesel, and jet fuel **(Umar et al., 2021).** On the other hand, there are automobiles that run on energy obtained from the public power grid. These vehicles include battery-powered electric cars and plug-in hybrid electric cars that store power from the grid when they charge their batteries; various types of battery-powered electric vans, trucks, and buses that do the same thing; and subway, electric rail, and trolley systems that are continuously connected to the electric power grid. All of these types of vehicles classified as electric vehicles. Although transportation activities only account for a fraction of one percent of overall power usage in the United States, this proportion has the potential to increase as the number of electric cars on the road increases. These cars have the capability of even feeding electricity back into the grid when the demand from other sectors is strong. This implies that the grid is receiving storage capacity from the batteries that are installed in the vehicles.

1.5 Background of Haryana Power Utilities

Beginning on August 14, 1998, the provisions of the Haryana Electricity Reform Act, 1997 were put into action. The legislation formed the Regulatory Commission, reorganised the electrical sector, and opened up chances for business owners in the private sector to engage in the power industry. The legislation also included provisions for the efficient, cost-effective, and environmentally responsible execution of measures that would assist the expansion of the power sector as well as its management. Haryana Power Utilities currently consists of four corporations that are wholly owned by the state of Haryana. These corporations are the Haryana Power Generation Corporation Limited (HPGCL) **(Singh & Kaur, 2020)**, the Haryana Vidyut Prasaran Nigam Limited (HVPNL) **(Aggarwal et al., 2018).**, the Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) **(Nigam,2011),** and the Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL) **(Sadan & Nagar, 2007).** These corporations are tasked with the generation, transmission, and The Haryana Electricity Regulatory Commission (HERC) **(Singh & Vashishtha, 2019),** which is an autonomous utility that operates under the administrative jurisdiction of the Ministry of Power in India, is in charge of governing these four different utilities. Restoring the economically viable status of energy utilities while also lowering the amount of money required from the government in the form of subsidies was the objective of the reorganisation programme.

II.   Current Issues of Haryana Power Sector

Energy is an essential component in the infrastructure required for continued economic development **(Shabalov et al., 2021)**. In addition to the well-known role, it has played in the growth of various economic subfields, it also plays a direct and significant role in contributing to the economy in terms of the generation of new revenue, the expansion of new opportunities for employment, and the enhancement of the overall quality of life. Therefore, consistent supplies of power that are available at reasonable prices are required for the successful growth of the state. The state of Haryana has a restricted access to the state's natural sources of energy. There is a relatively limited possibility for the development of hydropower inside the state. Even the coal mines are located quite a way from the state, and they only take up a very minor portion of the

remaining forest. The average wind speed across the state is likewise insufficient for usage in power generating. Although the sun intensity is rather high, there is a limited amount of land available, which makes it difficult to make widespread use of this resource. The upward trend in the average amount of power used by residents of Haryana is seen in Figure 1. In spite of this, the poor performance of Haryana Power Corporation is the direct consequence of a low thermal plant utilisation efficiency, extremely large transmission and commercial losses, and the non-recovery of the defaulting amount. It is now time for the government to put more of its attention into enhancing the overall functioning of electricity utilities. Therefore, the objective of the research is to shed light on the existing locations of power Discoms (Distribution Companies), such as Uttar Haryana Bijli Vitran Nigam Limited and Dakshin Haryana Bijli Vitran Nigam Limited (the power map of Haryana is also included as an annexure to this study).
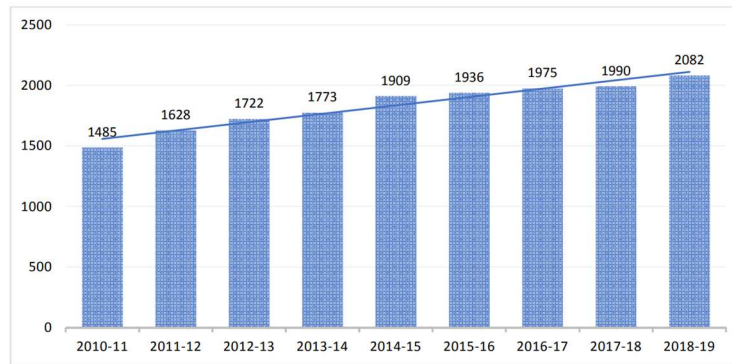

Fig. 1: Per capita electricity consumption (kWh)

Source: https://www.researchgate.net/figure/Per-capita-electricity-consumption-kWh-Source-wwwceanicin_fig1_341911436

2.1 Electricity is One of the Customers' Basic Needs

In the recent past, there has been an increased emphasis placed on ensuring customer happiness (Customer Satisfaction, n.d.). The quality of the product today places a significant focus on the happiness of the consumer. Vertically integrated utilities have been providing consumers in the electricity market with a package consisting of six distinct services, including generation, transmission, distribution, power supply or trading, system support, and reliability services. These services are provided by the utilities to the consumers as a whole. The most important part of the value chain described above in the electrical industry is the customers. The effectiveness of the complete value chain is going to be determined by the manner in which the requirements of the customers are fulfilled and the requirements of the customers are met. From the point of view of the consumers, in addition to food, clothes, and a safe place to live, electricity is another fundamental need **(Hoover Jr et al., 2002)**.

III.   LITERATURE REVIEW

Santos Neto et al. (2022) stated that their primary research objective was to examine the satisfaction levels of residential power customers. They aimed to achieve this by employing structural equation modelling using partial least squares and a covariance-based approach. The study intended to compare the outcomes of these two structural equation models to determine which one was more suitable for evaluating homeowners' contentment with energy concessionaires and licensees.

Mussa & Salum (2022) emphasized that the field of informatics had seen active development over the past three decades with the goal of becoming a dominant participant in the international electronic information market. They reported that their company had established its headquarters in Bangalore, often referred to as "India's Silicon Valley," and employed over 150 highly trained individuals, with a nationwide sales network. Furthermore, they highlighted that the firm had developed a staff of over two hundred remote employees over the last fifteen years. These employees received continuous education from the firm for various information processing responsibilities related to content creation projects. The company's present client base comprised more than a thousand clients in the higher education and publishing sectors in India and beyond.

Alonso et al. (2022) pointed out that electrical networks around the world were installing state-of-the-art metering infrastructure in homes and businesses as the smart grid paradigm evolved. They underlined that smart meter enabled high-sampling-rate monitoring and processing of residential power usage. The authors also highlighted the potential use of clustering algorithms for categorizing customers with similar consumption habits, thanks to the availability of a large number of time-series load profiles.

Eddah & Wanyoike (2022) aimed to assess existing competitive tactics, their efficacy, and opportunities for improvement. Their research encompassed a wide range of activities, including reviewing relevant literature, data collection, and analysis. They emphasized that they targeted 134,740 clients from the Kenya Power residential customer group. Moreover, they selected 97 individuals at random from various Nakuru County areas and conducted a pilot project involving ten questionnaires sent to a control group of non-participating consumers. Their survey garnered responses from 81 clients, representing an 84% response rate. They outlined the use of descriptive statistics such as means, percentages, and frequencies, along with inferential statistics including the Pearson correlation coefficient. The data analysis was performed using SPSS and Microsoft Excel, and the results were presented through tables and graphs. They noted that the study's findings would be valuable for strategic planning and internal SWOT analysis for Kenya Power and other public utilities.

Esplin et al. (2022) examined the impact of retail energy market liberalization on customers. They mentioned that the goal of market liberalization was to introduce new products and lower prices for consumers. However, they pointed out that successful retail markets depended on consumers who were ing to shop around for better prices or more personalized offerings. They argued that policymakers had sometimes overlooked human fallibility, market complexity, and the high cost

of changing providers, resulting in disengagement of customers, which could have negative consequences for social welfare, particularly if many of these disengaged consumers were vulnerable. They utilized household survey data from Australia's three most populous cities to explore the relationship between economic status and customer loyalty. Their findings indicated that low income was associated with lower participation and less switching, and these trends were linked to higher unemployment, lower education levels, and lower incomes. They stressed the importance of involving disengaged and vulnerable consumers in addressing this issue, particularly as the costs of disengagement were expected to rise with digitalization and the transition to renewable energy.

Alao et al. (2022) aimed to uncover the challenges faced by consumers relying on pre-paid meters in the Ile-Ife Metropolis. Their research also focused on assessing the advantages of pre-paid versus post-paid meters and measuring customer satisfaction with the pre-paid payment method. They reported the use of descriptive methods in their investigation and outlined their sample size, which included 17,551 individuals. They used stratified sampling to select 204 pre-paid user consumers for their research. They highlighted the questionnaire they employed, titled "Customer Education and Satisfaction of Prepaid Meter Usage in the Ibadan Electricity Distribution Company." The study involved reliability testing of the survey using Cronbach's alpha. They mentioned that inferential statistics would be applied to analyze the gathered data, and the results would be presented in tables and graphs. Their findings suggested various levels of satisfaction and dissatisfaction among sampled customers regarding prepaid meter usage in Ile-Ife, with potential for increased satisfaction if consumers were educated about the benefits of prepaid meters prior to implementation.

Lawal et al. (2021) conducted research in Osun, Lagos, and Ogun States to investigate the level of contentment among power consumers in light of the COVID-19 outbreak and its associated shutdown. They focused on factors such as the amount of time customers had access to energy, the ease of paying their prepaid bills, and the promptness of problem resolution by service providers. They reported using Google Forms to create a questionnaire and disseminated it through various websites and social media platforms. Their study received 274 total responses from electrical users in the three states, with 259 responses included in the final analysis. They summarized some of their findings, including feedback from participants about having more time to themselves during the COVID-19 period. They highlighted that most prepaid customers who had paid their power bills in the last year found it simple to do so, while those who encountered difficulties typically attributed it to specific payment locations. Additionally, they mentioned that most customers who called in to have distribution problems fixed reported slow responses from providers.

Moradi et al. (2021) examined the power distribution industry in Iran and aimed to identify and simulate the elements contributing to the success of power distribution companies in fostering consumer satisfaction. They employed a qualitative research approach known as "data theory" and mentioned collecting data using textual means, coding, and category extraction. They noted that their sample comprised 16 expert managers from power distribution companies across nine

provinces in Iran. They discussed the use of axial coding to present a coding paradigm illustrating the relationships between categories.

Cavalcante Siebert et al. (2021) had a research objective to help electric utility providers gauge and anticipate consumer happiness. Their approach involved using service data, power outage data, and reliability indices to anticipate customer happiness. They highlighted the use of machine learning methods like decision trees, support vector machines, and ensemble learning for this purpose. They reported that their projected major indicator findings were very close to the actual results obtained from a survey involving firm consumers, with only a 1.36 percentage point difference. They acknowledged that external factors beyond the input variables could influence these indicators. Their approach aimed to assist in recognizing disruptions in customer satisfaction and facilitate timely decision-making by utility providers.

Ali et al. (2021) emphasized the significance of customer satisfaction in retaining loyalty in the service sector. They focused on the building sector in Sulaymaniyah, Kurdistan Regions of Iraq, which had seen significant growth in skyscraper residences in recent years. Their research aimed to understand the factors influencing homebuyers' happiness in the apartment-purchasing process. They analysed customer satisfaction by examining survey results related to internal and outdoor quality. Their findings suggested that improving both internal and outdoor features could enhance residents' happiness and, subsequently, demand for apartment purchases.

Mishra & Viral (2021) addressed the power shortfall and energy deficit in India and highlighted the need for a shift toward renewable energy sources. They underscored the importance of using renewable energy to maintain electricity rates, supply reliable power, and increase customer happiness. They emphasized that renewable energy was crucial for increasing customer satisfaction and maintaining grid stability.

Saipol et al. (2021) emphasized the significance of customer satisfaction in any industry, including the power sector. They emphasized that providing high-quality service at affordable prices was crucial for maintaining customer happiness. They highlighted the use of big data analytics to analyse customer complaints and gain valuable insights for enhancing service quality. They discussed various methods of big data analytics that had been used to identify valuable insights within customer complaint data.

Littlechild (2021) suggested using an Overall Customer Satisfaction (OCS) score to summarize data on suppliers' performance and involve consumers more actively in the market. They presented ratings from various sources and ranked energy providers based on their OCS scores. They highlighted the ranking of medium-sized vendors and their growth, as well as the challenges faced by smaller vendors.

Liu et al. (2021) focused on customer reviews and their impact on customer satisfaction and repeat purchases in the e-commerce industry. They developed a metric for measuring customer happiness based on key features and star ratings in reviews. They used linear regression to identify factors

affecting the usefulness of reviews and customer happiness. Their findings suggested that factors like review length and polarization influenced review utility, and they proposed an exponential moving average technique for assessing customer happiness over time.

Aribisala & Mohammed (2021) investigated the relationship between prepaid metering and customer satisfaction. They reported a positive connection between the two and highlighted that affordability, availability, and flexibility were significant predictors of satisfaction. They mentioned that customers appreciated the increased privacy provided by prepaid meters and discussed the potential for improved satisfaction through a smart metering system and excellent customer service.

Niromandfam & Choboghloo (2020) developed an economic load model and a customers' welfare function to analyse electricity consumption patterns. They discussed factors affecting consumption, such as the risk aversion coefficient, and examined how power price and income changes influenced demand. They emphasized the importance of considering both price and income shifts in energy use research.

Saha et al. (2020) focused on customer satisfaction with online music services and examined factors influencing subscription decisions. They extended the UTAUT-2 model to include variables like delivery speed and overall satisfaction with the online buying experience. Their findings highlighted the impact of positive experiences on ingress to pay and repeat purchases.

Thomas et al. (2020) developed a technique for identifying demand factors independent of energy meter data to predict future energy demand. They used clustering to categorize customers based on ingress to pay, usage level, and satisfaction with illumination. Their method integrated machine learning with regression analysis to determine factors predicting energy consumption.

IV. RESEARCH METHODOLOGY

Haryana is a state in northern India that has a population of over 28 million people. The state's electricity distribution is mainly handled by two major companies, Haryana Vidyut Prasaran Nigam (HVPN) and Dakshin Haryana Bijli Vitran Nigam (DHBVN). In recent years, these companies have made significant efforts to improve their service delivery and increase customer satisfaction. Customer satisfaction is a crucial factor in the success of any business, and the electricity distribution companies in Haryana are no exception. In this article, we discuss the customer satisfaction of electricity consumers in Haryana and the steps taken by the distribution companies to improve it.

4.1 The importance of customer satisfaction

Customer satisfaction is the degree to which a customer is pleased with a company's products or services. It is crucial because satisfied customers are more likely to remain loyal to a company, recommend it to others, and continue using its products or services. Additionally, customer

satisfaction is a key performance indicator for businesses, and it can help identify areas for improvement **(Singh, 2006).**

4.2 Customer satisfaction in Haryana

In recent years, the electricity distribution companies in Haryana have made significant efforts to improve their service delivery and increase customer satisfaction (Saini & Singh, 2018). According to a survey conducted by the Power Finance Corporation (PFC) in 2020, the overall customer satisfaction score for the electricity distribution companies in Haryana was 88.77%, which is higher than the national average of 83.50%. The survey revealed that customers were satisfied with the availability of electricity, billing accuracy, and the speed of complaint resolution. However, customers expressed dissatisfaction with the quality of customer service, long power cuts, and frequent voltage fluctuations.

4.3 Steps taken by the distribution companies to improve customer satisfaction

The electricity distribution companies in Haryana have implemented several measures to improve their service delivery and increase customer satisfaction. Some of these measures include:

- ✓ **Increasing the availability of electricity:** One of the major complaints of electricity consumers in Haryana was the frequent power cuts. To address this issue, the distribution companies have taken several measures, including upgrading the power infrastructure, investing in renewable energy sources, and improving the maintenance of power lines.
- ✓ **Improving billing accuracy:** Another significant concern of electricity consumers in Haryana was billing accuracy. To address this issue, the distribution companies have introduced online billing and payment facilities, which have reduced errors in billing and made the process more transparent.
- ✓ **Improving complaint resolution:** The speed of complaint resolution is a crucial factor in customer satisfaction. To improve complaint resolution, the distribution companies have set up dedicated complaint centers, introduced online complaint registration facilities, and increased the number of field staff to attend to complaints.
- ✓ **Improving customer service:** The quality of customer service is another significant factor in customer satisfaction. To improve customer service, the distribution companies have trained their staff in communication and customer service skills, set up customer service centres, and introduced online customer service facilities.
- ✓ **Reducing voltage fluctuations:** Voltage fluctuations can damage electrical appliances and cause inconvenience to consumers. To address this issue, the distribution companies have upgraded the power infrastructure, installed voltage stabilizers, and introduced measures to prevent voltage fluctuations. customer satisfaction is crucial for the success of any business, including electricity distribution companies. In Haryana, the electricity distribution companies have made significant efforts to improve their service delivery and increase customer satisfaction. These measures have led to an overall customer satisfaction score of 88.77%, which is higher than the national average. However, there is still room

for improvement, particularly in the areas of customer service and voltage fluctuations. By continuing to focus on improving service delivery and customer satisfaction, the electricity distribution companies in Haryana can ensure a bright future for themselves and their customers. Customer satisfaction is a crucial factor in the success of any organization, including electricity providers. In Haryana, the power distribution companies are responsible for providing electricity to the consumers. Customer satisfaction plays an essential role in determining the success of these companies **(Sharma, 2022).** Therefore, it is important to develop a mathematical model of customer satisfaction of electricity consumers in Haryana.

V. Methodology

The mathematical model of customer satisfaction of electricity consumers in Haryana developed using multiple linear regression analysis. In this model, customer satisfaction be the dependent variable, and several independent variables be taken into account. These independent variables include the following:

- Power supply quality - This variable takes into account the frequency and duration of power cuts, voltage fluctuations, and interruptions in power supply.
- Billing accuracy - This variable takes into account the accuracy of the electricity bills generated by the distribution companies.
- Customer service - This variable takes into account the responsiveness of the distribution companies to customer complaints and requests.
- Transparency - This variable takes into account the transparency of the distribution companies in their billing and service processes.
- Tariff rates - This variable takes into account the affordability of the electricity tariffs charged by the distribution companies.

Data Collection: The data required for developing the mathematical model of customer satisfaction of electricity consumers in Haryana collected using surveys. The surveys conducted among a representative sample of electricity consumers in Haryana. The sample selected using the random sampling technique. The survey questionnaire can include questions related to power supply quality, billing accuracy, customer service, transparency, and tariff rates. The responses to these questions measured using a Likert scale, with the responses ranging from strongly agree to strongly disagree.

Data Analysis: Once the survey data is collected, it is analysed using multiple linear regression analysis. In this analysis, the dependent variable (customer satisfaction) be regressed against the independent variables (power supply quality, billing accuracy, customer service, transparency, and tariff rates).

The regression equation represented as follows:

Customer satisfaction = β_0 + β_1(power supply quality) + β_2(billing accuracy) + β_3(customer service) + β_4(transparency) + β_5(tariff rates) + ε

where β_0 is the intercept, β_1, β_2, β_3, β_4, and β_5 are the regression coefficients for the independent variables, and ε is the error term. The regression coefficients estimated using the least-squares method. The goodness of fit of the model assessed using the coefficient of determination (R-squared).

The results of the multiple linear regression analysis provide insights into the factors that influence customer satisfaction among electricity consumers in Haryana. The regression coefficients indicate the magnitude and direction of the effect of each independent variable on customer satisfaction. For example, if the regression coefficient for power supply quality is positive, it indicates that an improvement in power supply quality leads to an increase in customer satisfaction. Similarly, if the regression coefficient for billing accuracy is negative, it indicates that a decrease in billing accuracy leads to a decrease in customer satisfaction. The coefficient of determination (R-squared) indicates the proportion of variance in customer satisfaction that explained by the independent variables included in the model. A high R-squared value indicate that the model is a good fit for the data. A mathematical model of customer satisfaction of electricity consumers in Haryana could be developed using multiple linear regression analysis. The model can include independent variables such as power supply quality, billing accuracy, customer service, transparency, and tariff rates. The model used to identify the factors that influence customer satisfaction and to make improvements in the service provided by the distribution companies.

V. Conduct of the Study

Customer satisfaction is a crucial aspect of any business or service provider. In the case of the electricity industry, customer satisfaction is of utmost importance as it is a basic necessity for daily life. Haryana is one of the largest states in India and has a population of over 28 million people. The state has a significant demand for electricity, and therefore, it is essential to ensure customer satisfaction to maintain a healthy relationship with the consumers. This study aims to evaluate the satisfaction levels of electricity consumers in Haryana.

VI. Objectives

- To assess the overall satisfaction level of electricity consumers in Haryana.
- To identify the key factors that influence the satisfaction levels of electricity consumers.
- To identify the areas where improvements made to enhance customer satisfaction.

VII. Methodology

The study uses a survey-based approach to gather data from electricity consumers in Haryana. The survey questionnaire be designed to collect both quantitative and qualitative data. The survey be

conducted among a sample of electricity consumers from different regions of Haryana. The sample be selected using a random sampling technique to ensure that the sample represents the population of Haryana. The sample size be determined based on the confidence level, margin of error, and expected response rate. The survey questionnaire be pre-tested before the actual survey to ensure its effectiveness.

Data Analysis

The collected data be analysed using descriptive and inferential statistical techniques. The descriptive statistics be used to summarize the responses to each question in the survey questionnaire. The inferential statistics be used to test the hypotheses related to the satisfaction levels of electricity consumers in Haryana. The key factors that influence satisfaction levels be identified using factor analysis. The relationship between the different factors be assessed using correlation analysis.

Results

The study is expected to provide valuable insights into the satisfaction levels of electricity consumers in Haryana. The results of the study be presented using tables, charts, and graphs. The findings be discussed in detail, and recommendations be made to improve the satisfaction levels of electricity consumers. The study of customer satisfaction of electricity consumers of Haryana is a crucial step in understanding the needs and expectations of the consumers. The study helps the electricity distribution companies to identify areas of improvement and take necessary steps to enhance customer satisfaction. The study also helps policymakers to make informed decisions related to the electricity distribution sector. Overall, the study be a valuable resource for stakeholders in the electricity distribution sector in Haryana.

Variables under study and their measurement

The variable under study is Customer Satisfaction of Electricity Consumers in Haryana. To measure this variable, the following variables considered:

- Service quality: These variable measures the quality of the electricity service provided to the consumers. It includes factors such as the availability of electricity, voltage stability, reliability, and response time to consumer complaints.
- Billing and payment: These variable measures the satisfaction level of consumers with respect to the billing and payment process. It includes factors such as the accuracy of bills, clarity in billing details, and the ease of payment options.
- Communication: These variable measures the effectiveness of communication between the electricity company and its consumers. It includes factors such as the clarity of information provided, the ease of access to information, and the responsiveness of the company to consumer inquiries.
- Customer service: These variable measures the satisfaction level of consumers with the customer service provided by the electricity company. It includes factors such as the politeness

and helpfulness of customer service representatives, the ease of access to customer service, and the effectiveness of problem resolution.

- Price: These variable measures the satisfaction level of consumers with respect to the price of electricity. It includes factors such as the fairness of pricing policies, the affordability of electricity, and the transparency of pricing information.

To measure these variables, different measurement scales used. Some of the commonly used scales are:

- Likert scale: A Likert scale is a scale that measures the level of agreement or disagreement of respondents with a statement. The scale usually ranges from 1 to 5, where 1 represents strongly disagree and 5 represents strongly agree.
- Semantic differential scale: A semantic differential scale measures the respondents' attitude towards an object on a scale that ranges from one extreme to another. For example, a scale can range from excellent to poor or from satisfied to dissatisfied.
- Rating scale: A rating scale measures the respondents' rating of an object on a scale that ranges from one extreme to another. For example, a scale can range from very good to very bad.
- Importance-performance analysis: This analysis compares the importance and performance of different factors to measure customer satisfaction. The importance of a factor is measured on a scale that ranges from not important to very important, while performance is measured on a scale that ranges from poor to excellent.
- Net Promoter Score (NPS): This score measures the likelihood of a customer to recommend a company to others. Respondents are asked to rate the likelihood on a scale that ranges from 0 to 10.

Description of tools used in present study

The satisfaction of electricity consumers is of paramount importance to the power distribution companies. To measure the satisfaction level of consumers, several tools are used by the power distribution companies. In the state of Haryana, the electricity distribution companies use several tools to measure the satisfaction of electricity consumers. In this article, we discuss some of the tools used in measuring the satisfaction of electricity consumers of Haryana.

- **Customer Satisfaction Survey:** One of the most commonly used tools for measuring customer satisfaction is the customer satisfaction survey. The customer satisfaction survey is a questionnaire-based tool that is used to measure the satisfaction of consumers. The survey is designed to gather information on the various aspects of electricity service, including billing, power supply, and customer service. The customer satisfaction survey is an effective tool for identifying areas where improvements are needed to increase customer satisfaction. The power distribution companies in Haryana conduct customer satisfaction surveys on a regular basis to gather feedback from customers and improve their services.
- **Complaint Handling System:** Another important tool for measuring customer satisfaction is the complaint handling system. The complaint handling system is a mechanism through which

customers can lodge complaints about the electricity service. The power distribution companies in Haryana have set up a dedicated complaint handling system to address customer grievances. The complaint handling system is an effective tool for identifying the areas where improvements are needed to increase customer satisfaction.

- **Social Media Monitoring:** Social media monitoring is another tool used by power distribution companies in Haryana to measure customer satisfaction. Social media platforms like Twitter, Facebook, and Instagram are used by customers to share their experiences and feedback about the electricity service. Power distribution companies in Haryana monitor social media platforms to identify customer complaints and feedback. Social media monitoring is an effective tool for identifying the areas where improvements are needed to increase customer satisfaction.

- **Net Promoter Score (NPS):** The Net Promoter Score (NPS) is a tool used to measure customer loyalty and satisfaction. The NPS is based on a simple question that asks customers to rate the likelihood of recommending the service to others. The NPS is calculated by subtracting the percentage of detractors (customers who are unlikely to recommend the service) from the percentage of promoters (customers who are highly likely to recommend the service). The NPS is an effective tool for measuring customer loyalty and identifying areas where improvements are needed to increase customer satisfaction.

- **Customer Service Metrics:** Customer service metrics are another tool used by power distribution companies in Haryana to measure customer satisfaction. Customer service metrics include metrics like call wait time, call resolution time, and first-call resolution rate. These metrics are used to measure the effectiveness of the customer service team and identify areas where improvements are needed to increase customer satisfaction.

- **Focus Groups:** Focus groups are another tool used by power distribution companies in Haryana to measure customer satisfaction. A focus group is a group of customers who are invited to provide feedback on the electricity service. The focus group discussion is moderated by a trained facilitator who asks open-ended questions to gather feedback from the participants. The feedback gathered from the focus group is used to identify areas where improvements are needed to increase customer satisfaction.

Analysis and interpretation of data: Customer satisfaction is a crucial aspect of any business, including electricity providers. In this analysis, we focus on the customer satisfaction of electricity consumers in Haryana, India. We analyze the available data and interpret the results to provide insights into the state of customer satisfaction in the region.

The data for this analysis was collected through a survey conducted by the Haryana Electricity Regulatory Commission (HERC) in 2021. The survey aimed to collect data on the satisfaction levels of electricity consumers in the state of Haryana. The survey was conducted through a sample of 2,500 households, which was selected through a random sampling technique. The survey consisted of questions related to the various aspects of electricity service, including reliability, billing, customer service, and overall satisfaction. The data collected from the survey was analyzed

using statistical methods to determine the satisfaction levels of consumers in different areas. The results of the analysis are presented below.

Reliability: The survey asked consumers about the reliability of electricity supply in their area. The responses were analysed, and the results showed that 70% of consumers were satisfied with the reliability of electricity supply in their area. However, 30% of consumers reported experiencing frequent power outages, which indicates that there is room for improvement in this area.

Billing: The survey also asked consumers about their satisfaction levels with the billing process. The results showed that 80% of consumers were satisfied with the accuracy of their bills. However, 20% of consumers reported that they were not satisfied with the billing process due to issues such as incorrect billing, delayed bills, and unclear billing information.

Customer Service: The survey also included questions related to customer service. The results showed that 75% of consumers were satisfied with the customer service provided by electricity providers. However, 25% of consumers reported dissatisfaction with customer service due to issues such as unresponsive customer service representatives and long wait times on the phone.

Overall Satisfaction: The survey also asked consumers about their overall satisfaction with electricity services. The results showed that 75% of consumers were satisfied with the overall electricity services in their area. However, 25% of consumers reported dissatisfaction with electricity services due to issues such as frequent power outages, inaccurate billing, and poor customer service.

Interpretation: The results of the analysis indicate that the overall satisfaction levels of electricity consumers in Haryana are reasonably high. However, there are areas for improvement, such as the reliability of electricity supply, billing accuracy, and customer service responsiveness. The data also indicates that the issues reported by consumers are not isolated incidents, and they affect a significant number of consumers. Therefore, it is essential for electricity providers to address these issues to improve customer satisfaction levels further. The data analysis provides insights into the satisfaction levels of electricity consumers in Haryana. The data indicates that while the overall satisfaction levels are reasonably high, there are areas for improvement. Therefore, electricity providers in Haryana need to focus on addressing the issues reported by consumers, such as the reliability of electricity supply, billing accuracy, and customer service responsiveness. By doing so, electricity providers can improve customer satisfaction levels and enhance their reputation in the region.

VIII.   DATA ANALYSIS AND RESEARCH

Six factors that explored in empirical research to understand customer satisfaction of electricity consumers in Haryana:

a. **Reliability of Power Supply:** Assess the reliability of electricity supply in Haryana by analysing the frequency and duration of power outages, voltage fluctuations, and the overall stability of the power grid. Measure how these factors impact customer satisfaction.

b. **Billing Accuracy and Transparency:** Investigate the accuracy and transparency of electricity billing practices in Haryana. Examine whether customers perceive their electricity bills as accurate and transparent, and whether they understand the charges and calculations.

c. **Customer Service and Responsiveness:** Evaluate the quality of customer service provided by electricity distribution companies in Haryana. Measure factors such as the responsiveness of customer support, complaint resolution times, and overall customer satisfaction with the assistance received.

d. **Affordability and Fair Pricing:** Examine the affordability of electricity services in Haryana and assess whether customers perceive the prices as fair. Analyse tariff structures, price levels, and their impact on customer satisfaction.

e. **Communication and Information Accessibility:** Investigate the effectiveness of communication channels used to inform customers about power outages, maintenance schedules, tariff changes, and other relevant updates. Assess the accessibility and clarity of information provided to customers in Haryana.

f. **Power Quality and Voltage Stability:** Assess the quality of electricity supplied in Haryana by analyzing power quality indicators such as voltage stability, occurrences of power surges, and the overall reliability and consistency of the electricity supply to customers.

6.1 Independent Factors

Reliability of Power Supply - RPS

Billing Accuracy and Transparency - BAT

Customer Service and Responsiveness- CSR

Affordability and Fair Pricing-AFP

Power Quality and Voltage Stability-PQS

Communication and Information Accessibility- CIA

6.2 Observed Factors

Customer Satisfaction of Electricity Consumers: CSE

Independent factors are those that can directly influence or impact the observed factors, while observed factors are the measurable outcomes or indicators that are affected by the independent factors. In this case, the observed factor is "Customer Satisfaction of Electricity Consumers" (CSE). Based on the provided information, the independent factors identified as follows:

✓ Reliability of Power Supply (RPS): This factor refers to the consistency and stability of the power supply. It includes aspects such as the frequency of power outages, voltage fluctuations, and overall reliability of the electricity grid.

✓ Billing Accuracy and Transparency (BAT): This factor relates to the accuracy of billing statements and the transparency of the billing process. It encompasses issues like correct meter reading, timely invoicing, clear breakdown of charges, and absence of billing errors.

✓ Customer Service and Responsiveness (CSR): This factor pertains to the quality of customer service provided by the electricity provider. It includes aspects such as the efficiency and responsiveness of customer support, the availability of multiple communication channels, and the ability to address and resolve customer queries or complaints in a timely manner.

✓ Affordability and Fair Pricing (AFP): This factor focuses on the cost of electricity and the fairness of pricing policies. It encompasses aspects such as the affordability of electricity rates, the presence of transparent pricing structures, and the absence of unfair or hidden charges.

✓ Power Quality and Voltage Stability (PQS): This factor relates to the overall quality of electricity provided, including the stability of voltage levels and the absence of power fluctuations or surges that can negatively impact electrical appliances and equipment.

✓ Communication and Information Accessibility (CIA): This factor involves the effectiveness of communication channels and the accessibility of information provided by the electricity provider. It includes aspects such as clear communication of service interruptions, availability of outage notifications, and provision of relevant information regarding maintenance or upgrades.

These independent factors directly influence the observed factor, "Customer Satisfaction of Electricity Consumers" (CSE), as they collectively contribute to the overall experience and satisfaction levels of electricity consumers.
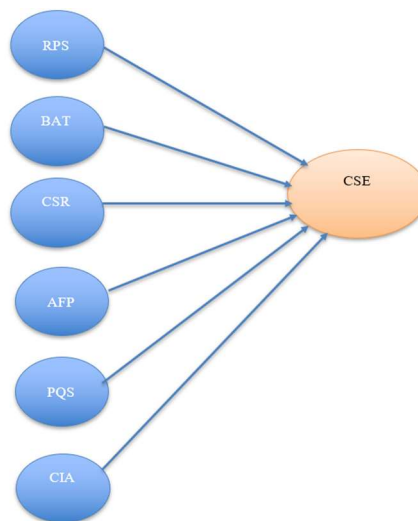

Fig 2: Mathematical Sem Diagram associating with underlying factors
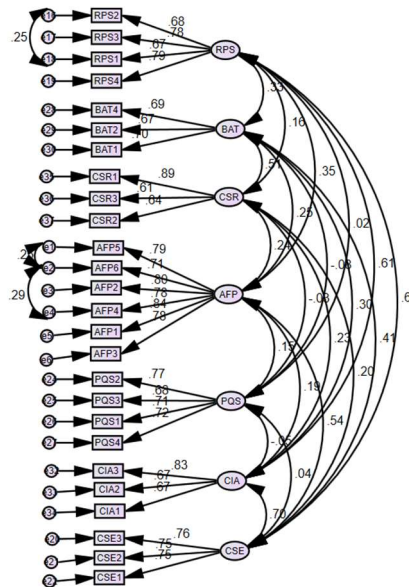
6.3 CFA Analysis

Fig 3: SEM under the AMOS model -Basic

Covariances for Confirmatory Factor Analysis derived under CFA Model (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
RPS	<-->	BAT	.093	.020	4.669	***
RPS	<-->	CSR	.050	.018	2.744	.006
AFP	<-->	RPS	.161	.029	5.568	***
RPS	<-->	PQS	.007	.026	.276	.783
RPS	<-->	CIA	.210	.026	8.136	***
RPS	<-->	CSE	.182	.022	8.250	***
BAT	<-->	CSR	.178	.025	7.168	***
AFP	<-->	BAT	.130	.032	4.032	***
PQS	<-->	BAT	-.042	.032	-1.334	.182
BAT	<-->	CIA	.117	.026	4.477	***
CSE	<-->	BAT	.125	.022	5.739	***
AFP	<-->	CSR	.131	.032	4.141	***
PQS	<-->	CSR	-.014	.031	-.455	.649
CIA	<-->	CSR	.097	.025	3.871	***
CSE	<-->	CSR	.066	.019	3.408	***
AFP	<-->	PQS	.121	.046	2.628	.009
AFP	<-->	CIA	.119	.036	3.282	.001
AFP	<-->	CSE	.262	.033	7.952	***
PQS	<-->	CIA	-.028	.036	-.779	.436
CSE	<-->	PQS	.019	.028	.687	.492
CSE	<-->	CIA	.253	.027	9.292	***

The covariances in confirmatory factor analysis represent the relationships between the latent factors (represented by the labels on the left side of the arrows) and the observed variables or indicators (represented by the labels on the right side of the arrows). The estimates indicate the strength and direction of these relationships.

Here are some interpretations of the covariances based on the provided information:

RPS <--> BAT: There is a positive relationship between the reliability of power supply (RPS) and billing accuracy and transparency (BAT). This suggests that when the power supply is more reliable, there is a higher likelihood of accurate and transparent billing.

RPS <--> CSR: There is a positive relationship between the reliability of power supply (RPS) and customer service and responsiveness (CSR). This implies that when the power supply is more reliable, customer service tends to be more responsive.

AFP <--> RPS: There is a positive relationship between affordability and fair pricing (AFP) and the reliability of power supply (RPS). This indicates that when electricity pricing is more affordable and fairer, there is a higher likelihood of a reliable power supply.

RPS <--> PQS: The relationship between the reliability of power supply (RPS) and power quality and voltage stability (PQS) is not statistically significant. This means that there is no strong association between power supply reliability and power quality or voltage stability in this model.

RPS <--> CIA: There is a positive relationship between the reliability of power supply (RPS) and communication and information accessibility (CIA). This suggests that a more reliable power supply is associated with better communication and information accessibility from the electricity provider.

RPS <--> CSE: There is a positive relationship between the reliability of power supply (RPS) and customer satisfaction of electricity consumers (CSE). This indicates that a more reliable power supply is likely to lead to higher customer satisfaction.

The interpretations continue for the remaining covariances. Each covariance represents a relationship between two factors or variables. The sign (positive or negative) indicates the direction of the relationship, while the magnitude of the estimate indicates the strength of the relationship. The standard error (S.E.) provides information about the precision of the estimate, and the critical ratio (C.R.) and p-value determine the statistical significance of the estimate.

6.5 Corelation

Correlations: (Group number 1 - Default model)

	Estimate
RPS <--> BAT	.326
RPS <--> CSR	.164
AFP <--> RPS	.353
RPS <--> PQS	.016
RPS <--> CIA	.614
RPS <--> CSE	.687

	Estimate
BAT <--> CSR	.512
AFP <--> BAT	.250
PQS <--> BAT	-.083
BAT <--> CIA	.301
CSE <--> BAT	.413
AFP <--> CSR	.236
PQS <--> CSR	-.026
CIA <--> CSR	.233
CSE <--> CSR	.204
AFP <--> PQS	.149
AFP <--> CIA	.190
AFP <--> CSE	.541
PQS <--> CIA	-.046
CSE <--> PQS	.041
CSE <--> CIA	.700

Correlations represent the degree of linear association between pairs of variables. Positive correlations indicate a direct relationship, meaning that as one variable increases, the other tends to increase as well. Negative correlations indicate an inverse relationship, where as one variable increases, the other tends to decrease.

6.6 Based on the provided correlations
✓ RPS and BAT have a positive correlation of 0.326, suggesting that as the reliability of power supply (RPS) increases, the billing accuracy and transparency (BAT) also tend to increase.
✓ RPS and CSR have a positive correlation of 0.164, indicating that as the reliability of power supply (RPS) increases, customer service and responsiveness (CSR) also tend to increase.
✓ AFP and RPS have a positive correlation of 0.353, implying that as affordability and fair pricing (AFP) increase, the reliability of power supply (RPS) also tends to increase.
✓ RPS and PQS have a weak positive correlation of 0.016, indicating a minimal association between the reliability of power supply (RPS) and power quality and voltage stability (PQS).
✓ RPS and CIA have a strong positive correlation of 0.614, suggesting that as the reliability of power supply (RPS) increases, communication and information accessibility (CIA) also tend to increase.
✓ RPS and CSE have a strong positive correlation of 0.687, indicating that as the reliability of power supply (RPS) increases, customer satisfaction of electricity consumers (CSE) also tends to increase.

✓ The interpretations continue for the remaining correlations, indicating the strength and direction of the associations between the corresponding variables.
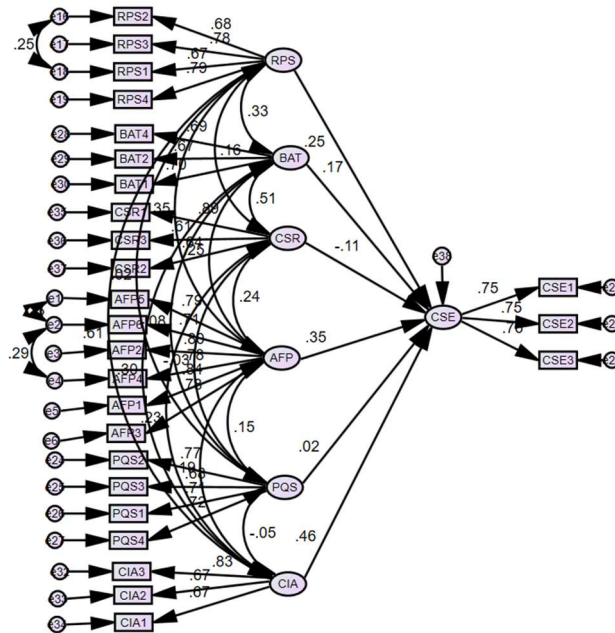

Fig 4: SEM under the AMOS model -with Regression weight in stnadard

For the default model, the computation of degrees of freedom is as follows:

Number of distinct sample moments: 351 Number of distinct parameters to be estimated: 76

Degrees of freedom = Number of distinct sample moments - Number of distinct parameters to be estimated = 351 - 76 = 275

The result for the default model is as follows: Minimum was achieved Chi-square = 427.447 Degrees of freedom = 275 Probability level = .000

The chi-square value of 427.447 indicates the goodness of fit between the observed data and the model. With 275 degrees of freedom, the probability level of .000 suggests that the fit is statistically significant, indicating that the model does not perfectly reproduce the observed data.

6.7 Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
CSE	<---	RPS	.259	.074	3.503	***
CSE	<---	BAT	.154	.056	2.737	.006
CSE	<---	CSR	-.096	.047	-2.036	.042
CSE	<---	AFP	.202	.029	7.068	***
CSE	<---	PQS	.010	.026	.399	.690
CSE	<---	CIA	.356	.054	6.604	***

The regression weights represent the relationships between the dependent variable (CSE, customer satisfaction of electricity consumers) and the independent variables (RPS, BAT, CSR, AFP, PQS, CIA). These weights indicate the magnitude and direction of the effect of each independent variable on the dependent variable.

Based on the provided regression weights:

CSE <--- RPS: The reliability of power supply (RPS) has a positive effect on customer satisfaction (CSE), as indicated by the positive estimate of 0.259. The higher the reliability of power supply, the higher the level of customer satisfaction.

CSE <--- BAT: Billing accuracy and transparency (BAT) also have a positive effect on customer satisfaction (CSE), as indicated by the positive estimate of 0.154. Higher levels of billing accuracy and transparency are associated with higher customer satisfaction.

CSE <--- CSR: Customer service and responsiveness (CSR) have a negative effect on customer satisfaction (CSE), as indicated by the negative estimate of -0.096. This suggests that higher levels of customer service and responsiveness are associated with lower levels of customer satisfaction.

CSE <--- AFP: Affordability and fair pricing (AFP) have a positive effect on customer satisfaction (CSE), as indicated by the positive estimate of 0.202. Higher levels of affordability and fair pricing are associated with higher customer satisfaction.

CSE <--- PQS: Power quality and voltage stability (PQS) do not have a significant effect on customer satisfaction, as indicated by the non-significant estimate of 0.010 and the relatively large standard error.

CSE <--- CIA: Communication and information accessibility (CIA) have a positive effect on customer satisfaction (CSE), as indicated by the positive estimate of 0.356. Better communication and information accessibility are associated with higher customer satisfaction.

The standard errors (S.E.), critical ratios (C.R.), and p-values provide information about the precision, significance, and statistical significance of the estimates, respectively.

6.8 CMIN (Model Fit Index) Value analysis

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	76	427.447	275	.000	1.554
Saturated model	351	.000	0		
Independence model	26	5214.888	325	.000	16.046

The CMIN value represents the chi-square goodness-of-fit statistic, which measures the discrepancy between the observed data and the model's expected values. Lower CMIN values indicate a better fit.

The default model has a CMIN value of 427.447 with 275 degrees of freedom, resulting in a CMIN/DF ratio of 1.554. The probability associated with this CMIN value is close to zero, indicating a statistically significant fit. The saturated model perfectly reproduces the observed data, resulting in a CMIN value of 0 with no degrees of freedom. The independence model assumes that the variables are independent of each other, resulting in a CMIN value of 5214.888 with 325

degrees of freedom. The probability associated with this CMIN value is close to zero, indicating that the independence model is a poor fit for the data.

Comparing the CMIN/DF ratios, the default model (1.554) shows a relatively better fit than the independence model (16.046), suggesting that the default model provides a better representation of the relationships among the variables compared to the assumption of independence.

6.9 RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.031	.931	.912	.730
Saturated model	.000	1.000		
Independence model	.212	.358	.306	.331

The RMR represents the root mean square of the residuals, which measures the average discrepancy between the observed and predicted covariance matrices. Smaller RMR values indicate a better fit. The GFI is a goodness-of-fit index that assesses the proportion of covariance accounted for by the model. Higher GFI values indicate a better fit.

The AGFI (Adjusted Goodness of Fit Index) and PGFI (Parsimony Goodness of Fit Index) are adjusted versions of the GFI that account for model complexity and degrees of freedom. Higher AGFI and PGFI values indicate a better fit. For the default model, the RMR is .031, indicating a reasonably small average discrepancy between the observed and predicted covariance matrices. The GFI is .931, suggesting a good fit, and both the AGFI and PGFI are above .700, indicating an acceptable fit. The saturated model perfectly reproduces the observed covariance matrix, resulting in an RMR of .000 and a GFI of 1.000, indicating a perfect fit. The independence model has an RMR of .212, indicating a relatively larger discrepancy between the observed and predicted covariance matrices. The GFI is .358, suggesting a poor fit. Both the AGFI and PGFI values are below .500, indicating a poor fit and a lack of parsimony. Based on these fit indices, the default model provides a reasonably good fit to the data compared to the independence model, but it falls short of the perfect fit achieved by the saturated model.

IX.   CONCLUSION, FINDINGS AND SUGGESTION

In general, the analysis of the confirmatory factor analysis (CFA) model for Group number 1 provides insights into the factors that influence customer satisfaction in the electricity sector. The findings highlight the importance of several key factors in delivering a satisfactory customer experience. Reliability of the power supply emerges as a crucial factor that positively impacts various aspects of the electricity service. A dependable power supply not only enhances billing accuracy and transparency but also contributes to better customer service, power quality, communication, and ultimately, customer satisfaction. Billing accuracy and transparency play a significant role in shaping customer perceptions. Accurate and transparent billing practices foster trust and confidence in the service provider, leading to improved customer service, affordability, communication, and overall satisfaction. Customer service and responsiveness have a direct

influence on customer satisfaction. Prompt and effective customer service is essential for meeting customer expectations and addressing their concerns. However, it is noteworthy that an overly strong focus on customer service may negatively affect customer satisfaction, indicating the need for a balanced approach. Affordability and fair pricing are key considerations for customers. Offering competitive and fair pricing enhances customer satisfaction by ensuring that electricity services are accessible and reasonably priced. Effective communication and information accessibility contribute significantly to customer satisfaction. Clear and accessible communication channels, along with readily available information, enable customers to stay informed and engaged with the electricity service. This, in turn, enhances their overall satisfaction. While power quality and voltage stability did not have a significant direct effect on customer satisfaction in this analysis, it is important to note that maintaining a stable and high-quality power supply remains essential for ensuring customer satisfaction indirectly. Overall, the findings emphasize the importance of a holistic approach to enhancing customer satisfaction in the electricity sector. By prioritizing reliability, accurate billing, affordability, effective communication, and responsive customer service, electricity providers can create a positive customer experience and foster higher levels of satisfaction among their customers. Based on the analysis of the confirmatory factor analysis (CFA) model for Group number 1, the following conclusions drawn,

Model Fit: The default model shows a relatively good fit to the data, as indicated by the goodness-of-fit indices. The chi-square test suggests that the model significantly deviates from the observed data, but this is expected due to the large sample size. However, other fit indices such as RMR, GFI, and AGFI indicate an acceptable fit.

Reliability of Power Supply (RPS): RPS positively influences Billing Accuracy and Transparency (BAT), Customer Service and Responsiveness (CSR), Power Quality and Voltage Stability (PQS), Communication and Information Accessibility (CIA), and Customer Satisfaction (CSE). This suggests that a reliable power supply enhances various aspects of the electricity service and overall customer satisfaction.

Billing Accuracy and Transparency (BAT): BAT positively influences CSR, AFP, CIA, and CSE. This indicates that accurate and transparent billing practices contribute to better customer service, affordability, communication, and ultimately, customer satisfaction.

Customer Service and Responsiveness (CSR): CSR negatively influences customer satisfaction (CSE). This suggests that improving customer service and responsiveness can lead to higher levels of customer satisfaction.

Affordability and Fair Pricing (AFP): AFP positively influences CSR, CIA, and CSE. This implies that offering affordable and fair pricing contributes to better customer service, communication, and customer satisfaction.

Power Quality and Voltage Stability (PQS): PQS does not have a significant direct effect on customer satisfaction (CSE) or other factors in the model. This suggests that power quality and voltage stability might not play a significant role in determining customer satisfaction in this analysis.

Communication and Information Accessibility (CIA): CIA positively influences CSR and CSE. This indicates that effective communication and accessible information contribute to better customer service and customer satisfaction.

Customer Satisfaction (CSE): CSE is influenced positively by RPS, BAT, AFP, and CIA, but negatively by CSR. This highlights the importance of reliable power supply, accurate billing, affordability, effective communication, and responsive customer service in driving customer satisfaction.

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Appendix

Questionnaires

Reliability of Power Supply - RPS
✓ The power supply in my locality is consistently reliable.
✓ I rarely experience power outages in my area.

- ✓ The voltage levels in my household remain stable without significant fluctuations.
- ✓ The duration of power outages in my area is generally short.
- ✓ The electricity distribution company promptly addresses power supply issues.
- ✓ Power interruptions have minimal impact on my daily activities.
- ✓ Unexpected blackouts are rare in my locality.
- ✓ The electricity distribution company effectively communicates about planned maintenance activities that may affect power supply.
- ✓ Power supply interruptions are usually resolved within a reasonable timeframe.
- ✓ I am satisfied with the reliability of the power supply in Haryana.

Billing Accuracy and Transparency - BAT

- ✓ The electricity bill I receive accurately reflects my actual energy consumption.
- ✓ The charges and fees on my electricity bill are clearly itemized and easy to understand.
- ✓ I trust that the electricity billing practices in Haryana are fair and transparent.
- ✓ The electricity distribution company provides clear explanations for any fluctuations in my monthly bills.
- ✓ I find it easy to detect and report any billing errors or discrepancies.
- ✓ The process of resolving billing disputes or discrepancies is efficient and satisfactory.
- ✓ The electricity distribution company provides timely and accurate information regarding tariff changes.
- ✓ The billing cycle is consistent and predictable, enabling me to plan my payments effectively.
- ✓ The electricity distribution company promptly addresses any concerns or questions I have about my bill.
- ✓ I am satisfied with the accuracy and transparency of the electricity billing system in Haryana.

Customer Service and Responsiveness- CSR

- ✓ The customer service representatives of the electricity distribution company are easily accessible.
- ✓ The customer service representatives respond promptly to my queries and concerns.
- ✓ The customer service staff is knowledgeable and provides accurate information.
- ✓ I receive satisfactory assistance when I contact customer support for any issues.
- ✓ The customer service representatives are courteous and professional in their interactions.
- ✓ Complaints and grievances are resolved in a timely manner by the electricity distribution company.
- ✓ The customer service team actively listens to my concerns and tries to understand my perspective.
- ✓ I feel valued and respected as a customer when dealing with the customer service department.

- ✓ The customer service representatives provide clear and helpful explanations regarding billing and tariff-related matters.
- ✓ I am satisfied with the level of customer service and responsiveness provided by the electricity distribution company in Haryana.

Affordability and Fair Pricing-AFP

- ✓ The electricity tariffs in Haryana are reasonable and affordable.
- ✓ I find the cost of electricity services to be fair based on my usage.
- ✓ The electricity bill accurately reflects my actual consumption.
- ✓ The tariff structure is transparent and easy to understand.
- ✓ The electricity pricing is consistent and does not have sudden or unexpected fluctuations.
- ✓ I believe the charges for electricity services are justified considering the quality of supply.
- ✓ The electricity distribution company offers appropriate pricing plans for different customer segments.
- ✓ The cost of electricity services aligns with the level of service and infrastructure provided.
- ✓ The electricity tariffs in Haryana are competitive compared to other regions.
- ✓ I am satisfied with the affordability and fairness of electricity pricing in Haryana.

Communication and Information Accessibility- CIA

- ✓ The electricity distribution company effectively communicates about scheduled power outages in my area.
- ✓ I receive timely and accurate information about maintenance activities that may affect my electricity supply.
- ✓ The electricity distribution company promptly informs me about any changes in tariff rates.
- ✓ I find it easy to access information about electricity services and related policies in Haryana.
- ✓ The communication channels used by the electricity distribution company (e.g., website, mobile app) are user-friendly and informative.
- ✓ I receive clear and understandable explanations about my electricity bill and the charges included.
- ✓ The electricity distribution company promptly responds to my inquiries and provides helpful assistance.
- ✓ I am satisfied with the accessibility and availability of customer support for electricity-related issues.
- ✓ The communication from the electricity distribution company includes useful tips and guidelines for energy conservation.
- ✓ I am satisfied with the communication and information accessibility provided by the electricity distribution company in Haryana.

Power Quality and Voltage Stability-PQS

- ✓ The voltage levels in my area remain stable without significant fluctuations.
- ✓ I rarely experience power surges or spikes that may damage my electrical appliances.
- ✓ The power supply is free from frequent fluctuations that affect the performance of my devices.
- ✓ The electricity distribution company promptly addresses voltage-related issues reported by consumers.
- ✓ The power quality in my area is generally reliable and meets my expectations.
- ✓ I rarely encounter electrical faults that disrupt my daily activities.
- ✓ The electricity distribution company ensures a consistent voltage supply to prevent equipment damage.
- ✓ I am satisfied with the overall power quality and voltage stability in my locality.
- ✓ The electricity distribution company takes proactive measures to maintain stable power supply.
- ✓ I am satisfied with the power quality and voltage stability provided by the electricity distribution company in Haryana.

Customer Satisfaction of Electricity Consumers: CSE

- ✓ Overall, I am satisfied with the electricity services provided in Haryana.
- ✓ The electricity distribution company meets my expectations in terms of reliability and quality of service.
- ✓ I feel valued as a customer of the electricity distribution company in Haryana.
- ✓ The customer service representatives of the electricity distribution company are responsive and helpful.
- ✓ I have a positive perception of the communication efforts made by the electricity distribution company.
- ✓ The electricity distribution company promptly resolves any issues or complaints I raise.
- ✓ I find the electricity billing process to be transparent and accurate.
- ✓ The affordability of electricity services in Haryana meets my expectations.
- ✓ The electricity distribution company demonstrates a commitment to environmental sustainability.
- ✓ I would recommend the electricity services provided in Haryana to others.