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Service Quality in Natural Gas Distribution: A Study

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Abstract

Purpose: Using the SERVQUAL model in the Natural Gas Distribution business context, the research paper examines and compares the quality of service parameters of two City Gas Distribution (CGD) companies engaged in Piped Natural Gas (PNG) distribution- one from public and other from the private sector.

Research Design/Approach: Mapping of various activities pertaining to domestic (household) PNG service on the SERVQUAL dimensions was undertaken. Based on the mapping, a relevant data collection tool was deployed to collect the data on PNG service quality parameters from the respondents, who were current consumers of these companies. Hypotheses regarding various components of SERVQUAL model were tested towards the comparison of service quality of these companies. Data were analyzed by employing an appropriate statistical tool.

Findings: Statistical results reveal a significant difference between the companies in terms of the quality of services offered by them. Interpretation of study results, managerial implications and suggestions have been discussed in the paper.

Practical Implications: The study shall help in designing and implementing the quality of service parameters and subsequently devising or revising Service Level Agreements (SLA) for the domestic PNG customers of CGD companies.

Originality/Value: Not much relevant research work on service quality issues has been undertaken in the CGD Sector in general and in the domestic Piped Natural Gas (PNG) sub-sector in particular. One of the outcomes of the study is also the mapping of various activities pertaining to domestic PNG service on the SERVQUAL dimensions.

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1. Introduction

The use of Natural Gas- considered a green and clean fuel having a low carbon footprint- has a ecades long history in India starting from natural gas discoveries in Mumbai basin, North-East and other parts of India and the subsequent laying of natural gas transmission pipeline infrastructure connection western and northern parts of India (ONGC, 2021) . Natural Gas contributes approximately 6% to the primary energy mix of the country in comparison to the global average of 25% (IEA, 2021). Apart from industry, especially the fertilizer sector and power sector, Natural Gas also has usage in transport, commercial, other industrial applications and domestic (household) usage. The Government of India has a comprehensive policy for promoting wide usage of relatively very less polluting, natural gas in various applications for the domestic, industrial, commercial and transportation segments (PNGRB, 2021). Natural Gas is thus important to India's quest for less polluting fuels and hence the quality of services offered by Natural Gas downstream companies is a crucial element towards wider acceptance of this clean fuel.

As in the manufacturing context, researchers have been acknowledging the concerns for quality in services also. However given the unique nature of services due to the elements of inventory, intangibility, lack of homogeneity, and feature of simultaneous production & consumption, require that these concerns are addressed differently. (Regan, 1963). Attempts were made to distinguish services from products and also identify similarities or blurred lines between them.

Our research which is based on an identified research gap, apart from contributing into Quality of Service (QoS) aspects for City Gas Distribution (CGD) business, can also be applied for designing and implementing the quality of service parameters and subsequently devising or revising Service Level Agreements (SLA) for the domestic PNG customers of CGD companies. In addition to literature review and subsequent conceptual framework, the study is based on empirical analysis of service quality parameters of two City Gas Distribution Companies serving domestic PNG customers. Towards that, data is collected from sample customers of these companies for testing the hypotheses formed. Quality of service parameters of the CGD companies are suitably measured and compared on the basis of data analysis, hypotheses testing followed by interpretations and conclusions.

2. Literature Review

Different researchers provide conceptual frameworks for Quality of Service. Parasuraman et al (1988) stated that the impact of measurement is what a client can expect in determining service efficiency, while service satisfaction is determined by the client through level of measurement. Parasuraman et al (1988) also concluded that the contrast of perceptions with expectations results in the quality of service. Similarly,

in their study, Bolton and Drew (1991) established that an important determinant of quality of service is the difference between results and expectations. They further stated that the way a customer perceives the performance level, determines the quality of service. Woodruff et al (1983) argued that prospects should be focused on knowledge criteria (i.e. the consumers' familiarity with that particular form of service organization, should expect from a given service provider). Two separate comparison criteria for evaluation of service quality were derived by Parasuraman et al (1991): desired service (customer's assumption about the level of service that can be delivered) and appropriate service (service level that is acceptable by the customer). While measuring the quality of service in Islamic banking, Othman and Owen (2001) though developed an instrument with acronym CARTER: Compliance, Assurance, Reliability, Tangibility, Empathy, and Responsiveness; but are of the opinion that given its well-structured approach, SERVQUAL remains the predominant instrument for measuring service quality. Kitisuda (2006) cites a customer satisfaction survey of Sivalai Spa's spa services centered on SERVQUAL model. In their master thesis, ChingangNde Daniel et al (2010) researched grocery customers' quality and satisfaction issues and found a need to improve over SERVQUAL framework as there was an overlapping and regrouping of items under various dimensions. Irfan Syed Muhammad et al (2012) used an improvised version of SERVQUAL scale with eight dimensions for estimating the public perception of Pakistan's rail transport system. Ramadass and Swarnalatha (2012) have attempted to identify the service quality gap in the telecommunication industry. They found that service-perception and the anticipated service rely on individuals, but the variables that affect these entities are controllable so as to decrease the gap between customer's expectation and perception, which will increase the experience of customers and therefore boost the customer's perception of service quality. Using the SERVPERF metric, Manuel Sa'nchez Pe'rez et al (2007) studied service quality and behavioural buying intents in the government operated transport service in Spain. Safiek (2012) analyzed the SERVIQUAL metric for Municipal Services in Southern Thailand, and described the aspirations and perceptions of people about the service quality issues of a municipal corporation. Prevos et al. (2016) suggest a theoretical model for overall service quality in the delivery of networked technological services, dominated by tangible elements, with a focus on water utility customers in urban environments, where a number of methods exist to measure the level of service provided by water utilities, the majority of which focus on the essential quality of water supply.

2.1. Service Quality in Energy Sector: Some researchers have carried out work on service quality issues in the energy sector. Jernick et al (2018) developed a unique scale to measure the quality of generation of wind energy through established technology service processes. To evaluate the consistency and level of service delivery, Mutua et al (2012) examined customer satisfaction issues in the Kenyan

energy industry. Their research concludes that the reputation of a service- provider, consumer loyalty, consumer preferences, perceived -value, perceived- efficiency and the handling of complaints are key parameters that decide customer satisfaction. N. H. Abid Aown et al (2018) conducted a study to examine good governance that aids to focus on enhancing the government sector's capacity and efficiency to attain the quality of service in provision of sustainable energy in ancient monuments of Iraq. They conclude that these energy systems must be integrated into the governance of the city's heritage in order to achieve renewable and sustainable energy goals. Further, they found that the establishment of appropriate governance mechanisms shall help in the achievement of sustainable energy quality of service goals. J. Vimal Priyan & V. Karthihaiselvi., (2010) and Babasab et al , (2012) in their respective studies on LPG (Liquefied Petroleum Gas) Dealers' trade practices identified factors that help LPG dealers in serving their customers better in an increasingly buyers' market. Vinayagamoorthy et al (2012) postulated that the value of service lies in the management of customer service and stressed the need to plan and implement desirable customer-oriented practices and further adopt these to provide quality services to LPG customers that increased their satisfaction. They argue that customer service is not merely complying with government policies or perfunctory observance to the service standards, but a belief-system and professional attitude that focused on total customer satisfaction. They add that service marketers have to understand that through distinguishing by quality, competition can be well handled.

2.2. SERVQUAL Model: The present study uses the SERVQUAL model that was developed by Parasuraman et al (1985). These experts developed the service quality framework leading to SERVQUAL, which has over the decades been a preferred framework for the measurement of relevant quality of service aspects across service sector organizations. The model discusses the important parameters of good-quality service. The SERVQUAL model developed by Parasuraman et al (1985) explains service quality as a difference between the expectations of a customer from the service offering and the perception of the intended service as expressed by the customer. After analyzing the results of an empirical analysis on few service organizations, Parasuraman et al (1993) revised this model further. They found that some of the dimensions were linked. They polished it and finalized the five-component instrument, including empathy, responsiveness, reliability, assurance, and tangibles. Thus with the five main dimensions, SERVQUAL is a frequently applied framework for gauging customer expectations and their perceptions about service quality (Emin ,1993; Khodayari & Khodayari, 2011; Pakdil & Aydln, 2007; Satapathy, 2014; Zarei et al., 2012). The five dimensions are: Reliability – Provision of steady, precise service; Responsiveness –Swiftness and assistance of service staff. Assurance – Inculcating security and sureness that removes customer-anxiety about a service. Empathy - Understanding of customer issues, accessibility and politeness

of service staff. Tangibles –Pertaining to the appearance of physical elements of a service. The Service Quality model suggested by Parasuraman *et al* (1985) discusses five important gaps: Research, Planning & Design, Implementation, Communication and Reality, that-if not tackled properly- can cause problems in service delivery.

2.3. Application of SERVQUAL model in various service sector contexts: SERVQUAL model has been widely used in its original form and also at times in its revised form by various service professionals in different contexts to assess the service- gap as observed by customers. (Patrick et al, 1996). Since the adoption of the measure in 1988, service quality has been widely studied in various service contexts using the SERVQUAL model parameters. Mohammad Mizenur Rahaman et al (2011) analyzed the service quality gap of banks in Bangladesh in the context of extraneous factors and assessed whether the quality of the delivered service fulfils the expectations of customers. Warren J S Staples et al (2002) used the SERVQUAL model to assess the service quality in a call center in Australia and concluded that assurance and reliability in this context are considered as the essential elements for service delivery. Service design and service specifications in a hotel were studied by Aysun & Ali (2008) using SERVQUAL parameters initially and then using the construct of Quality Function Deployment (QFD). Many authors have researched service quality and customer preferences in different service sectors in the Indian context, using SERVQUAL. Abhijit (2011) used SERVQUAL model to evaluate the quality of O.P.D. (outpatient department) services in a hospital and found significant gaps between the dimensions of 'tangibles' and 'responsiveness.' Various aspects of customer perceived quality of service in the Indian retail banking industry and in selected private sector banks were explored by Choudhury (2008) and Dharmalingam (2011). Poonam & Veena (2011) studied the service gap in a public sector bank based in South Delhi and the analysis revealed that there was a noticeable service gap on the dimensions of transparency and responsiveness. Shainesh (2000) detected the characteristics required to be used by customers for the quality assessment of rail freight services and created a systematic instrument which he termed RAILQUAL, for the collection of inputs from industrial customers of Railways based on these dimensions. Mohammed et al (2008) explored the service gap perceived (by airline customers) by measuring different dimensions of services evaluated by them on the SERVQUAL instrument. In the electricity utility market, Satapathy (2014) has attempted to build a different model, by the name of Service Quality Enhancement. The findings show that in addition to SERVQUAL dimensions, electricity service is also additionally linked to the dimensions of security and stability. Saini (2018) delved into the domain of service quality of electricity distribution utilities in which various notable studies have been undertaken for measurement and analysis of quality of the services with its pros and cons with SERVQUAL model. Besides the study of state-of-the-art of the service quality analysis in power utilities, various strategies which should be taken

care by the electricity utilities for upgrading their level of service -quality has also been briefed in the study.

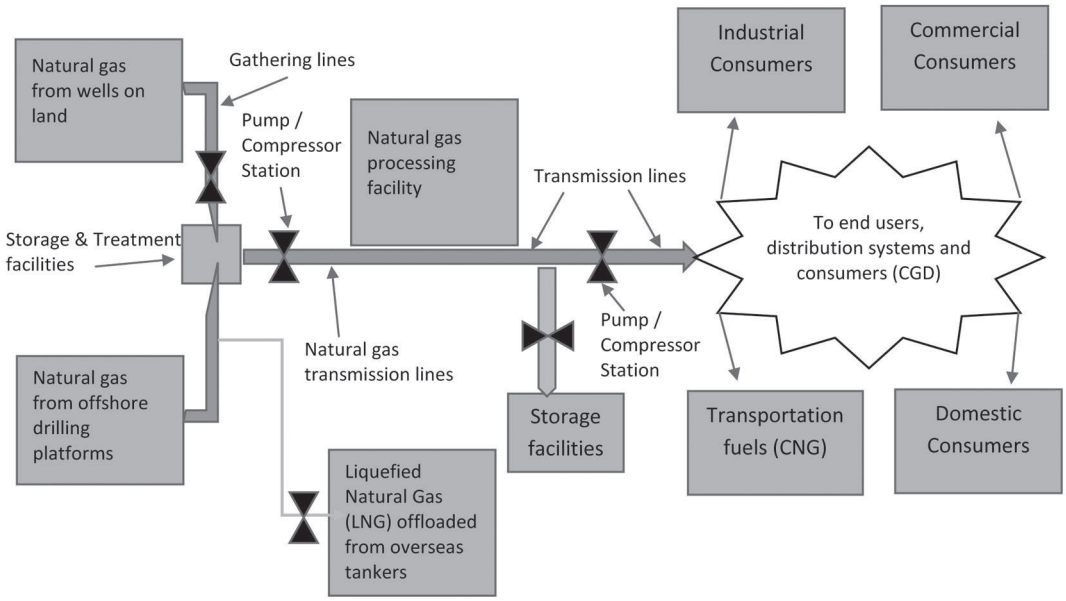
3. Conceptual Background and Context of the Study

Following sub-sections shall discuss the concept frame contextual to the study.

3.1. Defining City Gas Distribution (CGD)

Local or City Gas Distribution (CGD) network is a grid of pipelines capable of carrying natural gas at varied pressures and delivering the gas at requisite pressures to the end users comprising domestic (household), commercial, industrial and transportation customers. The CGD network receives the natural gas from high-pressure transmission pipeline and also consists of pressure-valves, measurement-meters and leak detection mechanism. (Figure 1)

Figure 1: City Gas Distribution Grid



Source: Authors

3.1.1 City Gas Distribution Market Segmentation

The CGD system is a gas pipeline grid that is interconnected. CGD network includes the accompanying equipment for transmission of natural gas through high-pressure transportation pipelines to a distribution network that operates on medium-pressure, followed by pipelines that supply natural gas at different pressures to the residential (domestic), manufacturing (industrial), and commercial establishments, as well as the CNG stations. Two types of markets are contextual in CGD business: Piped Natural Gas (PNG) and Compressed Natural Gas (CNG). Domestic, commercial, and

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industrial customers fall into the first category, while vehicle fuel falls into the second category.

1. **PNG**: Delivers natural gas through a pipeline network to the domestic, industrial, and commercial segment customers.

   a. **Domestic PNG:** The segment of PNG which supplies gas to the household customers at a very low and manageable gas pressure.

   b. **Commercial PNG:** Includes the supply of natural gas to commercial / institutional customers like healthcare establishments, inns & eateries and dairies etc. and further to industrial sector customers which include medium and micro manufacturing units, at intermediate gas pressures.

   c. **Industrial PNG:** Includes power plants, fertilizer plants, steam-boilers, heating equipment and any other industry that requires natural gas in bulk at high gas pressures.

2. **CNG**: By compressing natural gas through a compressor, it provides natural gas to the vehicle fuel market. There are CNG stations that sell the fuel. The use of natural gas in the transportation sector has made a major contribution to emissions reduction. (Paliwal & Yadav, 2019)

3.2 City Gas Distribution (CGD) in India

A major portion of the energy demand of the Indian residential sector-particularly rural- has been mainly fulfilled by kerosene and biomass. This is likely to go down due to gradual urbanization and increase in disposable incomes, and hence Piped Natural Gas (PNG) may find more acceptances in households. Given the economic progress and thrust for the usage of clean energy-particularly in the urban centersin India, natural gas usage for homes, commercial, industrial and transport applications have been envisaged to increase (MoHUPA, 2011). Subsequently, Government of India has facilitated both infrastructure development and regulatory framework to cope up with the increase in usage of natural gas for varied applications. On the supply side, being aware of the constraints of availability of indigenous natural gas, the Government of India, through its Ministry of Petroleum and Natural Gas (MOPNG) has also facilitated imports of bulk natural gas in liquefied state {LNG (Liquefied Natural Gas)} through marine route by creating infrastructure for receiving LNG cargos/Re-Gasification and also developing a par, contractual regime. The government has also formulated policies that prioritize the allocation of Natural Gas for city gas distribution. Similarly, the natural gas industry regulatory body in India, PNGRB (Petroleum & Natural Gas Regulatory Board) engages with the natural gas industry stakeholders to

promote city gas distribution at various levels. This includes inviting viable entities to become license holders to start city gas distribution operations in various markets, defining quality, technical standards, developing customer-dissonance resolution mechanisms, ensuring supply-security of natural gas and deciding pipeline tariffs for gas transportation and distribution etc.

Table 1: CGD: All India Network

Customer Type	Connections*/Retail Stations** (in 000s)****
Piped Natural Gas (Domestic)	559.6
Piped Natural Gas (Commercial)	28
Piped Natural Gas (Industrial)	9
Compressed Natural Gas (Transportation Fuel)	1.76

*In case of Piped Natural Gas; **For Compressed Natural Gas ****June 2019

Source: PNGRB (2019)

Indian CGD market is dominated by a few major players in the regions of Gujarat, Delhi and Mumbai. In addition to that several other companies from the public and private sector have been formed to participate in CGD sector development happening across the country. Some of them have been very aggressive in bidding for licenses to operate in new markets. Few companies have also been created under Public Private Participation (PPP) mode. Recent times have also witnessed foreign players entering the business.

3.3. Context of the Study

The study deals with two companies, operating in Natural Gas Distribution. Brief about two companies are as follows:

Company A: It is one of the leading Natural Gas distribution companies operated by a private entity which has created a comprehensive CGD Network to supply PNG to the industrial, commercial and domestic (residential) customers and CNG to the transportation sector in the geographic region of an Indian state (province). The company is also planning to expand in the new geographical markets in the other parts of India and has been granted the authorization to lay CGD network by the Petroleum and Natural Gas Regulatory Board (PNGRB), which regulates Natural Gas Distribution business in India. It is commonly thought to have a strong consumer orientation due to its lineage and management. This company, which caters to all the consumer segments, has implemented some of the best customer management practices available. The company's customer-centric approach is reflected in every aspect of its business, including customer acquisition, providing tailored solutions,

integrated marketing communications, and quick resolution of customer service issues. It also believes in adequately equipping its marketing staff to offer the best possible customer support. This involves continuing education and training of its marketing staff.

Company B: A Public Sector company**,** it has been promoted for developing City Gas Distribution Network in all the major districts of the same Indian state in which Company A operates. It is also one of the leading CGD companies of the country to supply PNG to industries, domestic and commercial establishments, to the cities and adjoining villages and CNG to transportation customers. Alike Company A, this company is also planning to expand in the new geographic areas in the other parts of India and also has been granted authorization to lay CGD network by the PNGRB. Company B, though beingis having the distinction of one of the prominent players in the Natural Gas distribution business, sometimes finds it difficult to shed the perception (which may or may not be true) of lacking a typical marketing organizational culture. Its public sector lineage perhaps may be responsible for such perceptions. Other reasons could be constraints posed by the convention of bureaucratic procedures prevalent in the company which may hamper quick decision making and leaves little room for flexibility. While there is a little doubt about the company's adherence to health, safety and environmental (HSE) norms, owing to its public sector roots, sometimes it may lack the culture of innovation and initiative-taking. This becomes all the more stark when a reference point in the form of a peer organization (from the private sector) is available. The research shall thus examine how true the perceptions of customers are when these two companies are juxtaposed on SERVQUAL model.

3.4. Quality of Service Regulations for CGD Business

After having undertaken literature review along with conceptual background and context of study, followed by an overview of CGD Business in India, an overview of service obligations by CGD companies is contextual. The service standards established by the Petroleum and Natural Gas Regulatory Board (PNGRB), which regulates the CGD industry, must be followed by the Indian CGD industry. The customers of the CGD network are entitled to receive an uninterrupted supply of piped natural gas from distribution companies with all the service support required from time to time. Customers could be put through unnecessary difficulties in the absence of coherent supply and ensuing service support. It is likely that they could attempt to escape their obligation if left up to distribution companies. It is therefore up to the regulator to devise the necessary regulations. These regulations discuss requirements relating to the provision of consistent supplies of natural gas and the services required by consumers. (Paliwal & Yadav, 2019). Following is a summary of these service regulations:

A: *Service norms for PNG customers*: Determination of viability, speed of providing connection, moving existing connection, transferring existing connection to other willing customers, metering system accuracy, sufficient pipeline pressure, reconciliation of bill and payments, redress of gas leakage complaint, network interruptions, reliability of supply and connection-cessation request.

B: *Service norms for CNG (Transportation Fuel) network customers*: Time taken for refilling, adequate CNG pressure, safety, amenities at the CNG Station, emergency care, display of price etc.

C: *Other general service requirements* by the CGD companies include the following: Setting up of formal Complaint Cell, appointment of authorized executives for complaint management; nomination of a trained and professional independent adjudicator to address consumer complaints that remains unresolved at the nodal officer level, documentation on complaint redress and organizing customer satisfaction surveys. Understanding of service regulations shall facilitate the contextualization of CGD Sector service aspects with SERVQUAL model in the current study.

3.5. Conceptual Framework and Hypothesis Development

Based on literature review, conceptual background and context of study above, the identification of research gap helped in arriving at a suitable conceptual framework, subsequent hypotheses formation and appropriate research method to tackle this research gap.

3.5.1. Research Gap: Contextual literature review throws a research gap in the area of QoS for the residential (domestic) PNG utility companies. Significant research work has been done in the area of quality of service regulations and customer- satisfaction in other utility sectors such as telecom, electricity and water. However the study of quality of service regulations in the City Gas Distribution (CGD)/Natural Gas Distribution sector seems to be an unexplored area where still there is a scope as so far no structured research work has been conducted. Unlike in other developed markets globally where such studies have been carried out by market regulators (OFGEM, 2019), PNGRB (Petroleum and Natural Gas Regulatory Board), the industry regulator of CGD sector in India has not commissioned any such study or research which assesses the impact of quality of service (QoS). Even the Indian CGD sector has not made any attempt so far to carry out any structured study to critically evaluate QoS regulations and their impacts on the companies as well as customers. Moreover with a couple of exceptions (Kumar & Hundal, 2019; Salleh & Yusof, 2016) hardly any studies have been carried out from the aspect of using service quality models for clean energy and hence this is an unexplored area. Our study deals with quality of service in CGD

for domestic Piped Natural Gas (PNG) customers in the same way as applicable/ adopted or correlated in other public utilities like electricity , telecommunications, public transportation and water supply etc.so that overall quality of service can be measured and subsequently improved. Literature review shows that the available research work largely concentrates on service sectors like financial, aviation, tourism and hospitality. Not much relevant research work has been undertaken in the CGD Sector. This clearly indicates the research gap in service quality for CGD sector in general and in domestic Piped Natural Gas (PNG) sub-sector in particular. To tackle this research gap, authors have used SERVQUAL model to contextualize domestic PNG service on various dimensions of the model. Thus based on literature review, conceptual background, authors' CGD Sector experience and interactions with CGD sector professionals over a period of time, various activities pertaining to domestic PNG service on the SERVQUAL dimensions have been mapped (Table 2). This mapping, apart from arriving at corresponding hypotheses (for each SERVQUAL dimension) also facilitate development of data collection tool.

Table 2: Mapping of Domestic PNG Service on SERVQUAL Dimensions

SERVQUAL Dimensions	Meaning	Context of Domestic PNG Service
Tangibles	Relating to appearance of physical elements of Domestic PNG service	PNG infrastructure at customer-end (meters; burner; pipeline; valves etc.); Pipeline pressure; Calorific content per unit volume of fuel; Physical facilities at Customer Service Centers; Company portal and its (ease of) navigation; PNG service van; ease of interpretation of fuel-bill; Mobile apps for customer convenience
Reliability	Provision of steady, precise Domestic PNG service	Steady supplies; 24x7 availability of PNG; Zero-error leakage-free operations; Qualified and dependable service staff.
Responsiveness	Swiftness and assistance of service staff of CGD/PNG companies	Promptness in case of service failure/supply disruption/damages to pipelines or metering systems; Swift response over phone/e-mail/ personal visit to Customer Service Centre; Least waiting time
Assurance	Inculcating a sense of security and confidence that removes customer-anxiety about Domestic PNG service	Secure online and offline transactions; professional service staff; Zero post-installation/service/maintenance dissonance; No anxieties about fuel safety and health; Regular preventative maintenance

Empathy	Considerate of customer issues, accessibility and politeness of service staff of CGD/PNG companies	Sense of tailor-made service; Operating hours based on convenience of customers.

Source: Authors' work

Mapping of domestic PNG service on SERVQUAL dimensions facilitated formation of corresponding hypotheses on each dimension in context with both the companies as follows:

H1: There is no difference between the service quality of company A and that of company B on 'tangibility' facet of SERVQUAL model

H2: There is no difference between the service quality of company A and that of company B on 'reliability' facet of SERVQUAL model

H3: There is no difference between the service quality of company A and that of company B on 'responsiveness' facet of SERVQUAL model

H4: There is no difference between the service quality of company A and that of company B difference on 'assurance' facet of SERVQUAL model is insignificant.

H5: There is no difference between the service quality of company A and that of company B on 'empathy' facet of SERVQUAL model

4. Research Method

After identifying research gap and subsequent SERVQUAL Model mapping based hypotheses formulation in the previous section, this section deals with research objectives, tackling hypotheses, research tool, data collection, descriptive statistics and data analysis. As mentioned in the previous sections, the study, apart from literature review based insights, industry background and development of a conceptual framework, also covers two undisclosed City Gas Distribution Companies serving domestic PNG customers. Hypotheses have been formulated for various SERVQUAL parameters for both companies and these hypotheses shall be put to test. For that purpose, data is collected from sample customers of 250 numbers each for these two companies. Quality of service parameters of these two CGD companies are measured and compared on the basis of this data analysis and hypotheses testing.

The **research objectives** of study are as follows:

1. *To examine and compare the quality of service parameters of two different CGD companies A & B –from private and public sector respectively-using the SERVQUAL model parameters for their domestic PNG customers.*

2. *To discover scope for service quality improvement in domestic PNG business.*

4.1. Data Collection: A questionnaire constructed based on some previous similar studies (in another service sector companies) and the authors' mapping of domestic PNG service on SERVQUAL dimensions was deployed for the study. The questionnaire apart from capturing demographic information (anonymously) consisted of 15 questions that captured the two companies' service quality from the customers' perspective which include the 5 SERVQUAL facets of Tangibles, Reliability, Responsiveness, Assurance, and Empathy, with questions relevant to domestic PNG service on each dimension. The authors' mapping of domestic PNG service activities on SERVQUAL dimensions (Table 2) was useful in the creation of this questionnaire. Respondents based on convenient, non-probability sampling responded on a 5-point Likert Scale ranging from Strongly Disagree to Strongly Agree. About 500 responses (250 from each company) were sought towards thisthe purpose. The field survey was carried where a total of 495 useful questionnaires from the sample customers of both the companies were collected in the first instance. 6 incomplete responses were discarded. Later additional 11 complete responses were also obtained to make the total valid responses as 500.

4.2. Descriptive Statistics & Data Analysis: The t-test comparative analysis to compare SERVQUAL dimensions between two companies, shows that all the five independent variables, "Tangibles, Reliability, Empathy, Responsiveness, and Assurance" (sig. value = 0.01), make statistically significant unique contributions to overall service quality. Responses show that Company A exhibits a higher mean-score on service quality while Company B's score was lower than that of Company A on service quality. The difference between Company A and Company B were statistically significant for Tangibles, Reliability, Empathy, Responsiveness, and Assurance (significance value = 0.01).

Table – 3: Calculation of t value for Service Quality Dimensions

Components	Company	N	Mean	Standard Deviation	Standard Error Mean	t
Tangibles	A	250	12.60	2.712	0.086	18.02
	B	250	10.72	1.876	0.059	
Reliability	A	250	22.38	3.982	0.126	23.36
	B	250	18.48	3.483	0.110	
Empathy	A	250	12.47	0.778	0.025	18.55
	B	250	11.48	1.503	0.048	
Responsiveness	A	250	16.07	2.418	0.076	36.46
	B	250	11.92	2.658	0.084	
Assurance	A	250	12.44	3.334	0.105	43.49
	B	250	7.70	0.888	0.028	

't' value was 18.02 (Tangibles), 23.36 (Reliability), 36.46 (Responsiveness), 43.49 (Assurance), and 18.55 (Empathy). The *t*-test threw statistically significant differences for entire SERVQUAL components at significance value of 0.01. Company A exhibited greater mean scores than Company B on all the SERVQUAL components viz. Tangibles, Reliability, Empathy, Responsiveness, and Assurance (Table 2). The differences between the mean scores were also statistically significant. This confirms the notion that Company 'A' sets service quality as a top agenda whereas Company B perhaps focuses on some other factors. It can thus be seen that all hypotheses viz. H_1, H_2, H_3, H_4 and H_5 were rejected.

5. Discussion & Managerial Implications

The notion of service quality has come out to be very relevant as competition in the service sector has increased. Service marketers have realized that delivering the best-quality service maintains consumers and ensures market sustainability and growth. A crucial issue in the industry thus is improving the quality of service. The study finds that: There are significant differences between SERVQUAL parameters of Company A and Company B. Similarly based on the mean scores of parameters, it is observed that customers of Company A perceive their company much better than what the customers of Company B perceive their company (i.e. Company B) on all these parameters. One of the plausible reasons for rejection of all hypotheses and putting Company A, above Company B on all dimensions may be the robust service practices of Company A that belongs to the private sector. Maybe the public sector company (B) can match these parameters if it also strategically develops a good system of customer service (Whelan et al, 2010; Chi-kuang et al, 2005; Musa et al, 2012; Wenyuan et al, 2019; Nese et al, 2020). As mentioned in the operational definitions of Company A and Company B, both these companies have typical

customer service systems and hence their customers may view them differently. While previously many studies (as cited above) on service quality in the service sector have been conducted, but rarely any studies on aspects of examining service quality in Natural Gas distribution industry have been undertaken. Particularly, scant research on service quality in the CGD industry is available. This study attempts to throw some important insight into on service quality in the CGD industry. The service gap analysis offers a scope of improvement for organizations and suggests the way for implementing changes to enhance service quality offered to domestic PNG customers. Marketing professionals of CGD-PNG Services may take the following specific steps:

a) Companies should arrange appropriate training for service staff to augment their customer-orientations (Kelly, 1992) so that empathy factors such as addressing customer issues, offering considerate services to specific customers, etc. can be enhanced;

b) To provide effective uninterrupted emergency operation & repair services, CGD companies should develop and maintain their gas distribution infrastructure, i.e. the pipeline network, the most tangible aspect of service. Employees concerned with health, safety, and environmental (HSE) issues should be well-appointed with their field's latest instruments and techniques;

c) Improving the quality assurance & safety parameters; authorizing personnel for taking decisions regarding customer issues and increasing budgetary allocation for customer service department;

d) Companies need to improve post-sales services such as gas pipeline alteration & shifting, renewal of connection, and discontinuing connection etc. with an aim on best customer service;

e) They must ensure that any dissension resulting from issues relating to billing and payments is resolved promptly.

The broad commitment of a company is consumer attention, customer interaction and customer support. Some companies perform better than others because of their superior customer service practices (Donavan et al, 2004). Those who have been alate adopters are not at a disadvantage because customer service orientation is not something that companies cannot master. But they need to recognize the customer service gaps before they can do that. SERVQUAL is an adequate framework to understand these gaps. As Indian CGD business becomes more competitive, the provision of quality service by CGD companies will be crucial to sustain in business.

6. Future Directions of Research

This paper is limited to the, 'Quality of Service' parameter, study of which was conducted for residential consumers of two companies based at two different cities of a state of India. It could not be undertaken for the other cities of the same state due to geographic spread, time and resource constraints. Similar studies can be conducted for CGD companies located in different states/cities of India. Petroleum & Natural Gas Regulatory Board (www.pngrb.gov.in), who has defined, formulated and notified Quality of Service regulations for City Gas Distribution sector in India, can undertake independent field studies on companies belonging to this sector, on various dimensions of SERVQUAL model relevant to the sector. That would help PNGRB to not only assess its own set of regulations, but also undertake course correction. Moreover the scope of future studies may be extended to other market segments like industrial, commercial and transportation. Cross sector comparative studies on Service Quality aspects on two or more energy & resources utilities (like gas distribution, electricity, LPG, water-supply) on same set of consumers can also be conducted.

7. Conclusion

CGD companies have to be proactive in their response to Service Quality issues. Moreover, as many CGD markets have structured customer service regulations, they must be enforced methodically by the CGD firms. To solve customer service management problems, CGD organizations should implement modern technology including digital technologies. CGD companies need to provide the highest quality of service to customers like interactive websites, round-the-clock customer care, virtual assistants, mobile applications, automated metering and billing systems, the use of leakage- identification equipment , service- vans with the requisite tools and equipment, and so on. All these efforts contribute significantly to ensure the adherence of Service Quality to CGD companies 'customers. In general, the utility consumers have been very demanding about expected customer services. With sustainable energy utilities, like natural gas distribution firms, their quality of service expectations are becoming more pronounced. That's because natural gas utilities have an additional obligation to attract customers currently using traditional fuels by convincing them not only on the basis of fuel advantages, reliability and fuel economy but also on the basis of an enhanced product-service proposition that plays a significant role in services. And thus evaluation of services on an appropriate model and subsequent corrective actions is an important activity for Natural Gas Distribution companies. Studies such as the one discussed in our paper contribute in deciphering and addressing all these relevant issues in this context. Moreover the study also helps identifying the difference of approach between different energy utility companies and how energy distribution companies can fine-tune their customer service to add value to Service Quality.

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