

# An Empirical Investigation of Service Quality Gap at CNG Outlets Using SERVQUAL Measure

T. Nandakumar<sup>1</sup> and Akhil Damodaran<sup>2</sup>

<sup>1</sup>GAIL (India) Ltd, Jubilee Tower, B-35, Sector 1, Noida 201301 UP India

<sup>2</sup> Department of Management Studies, Indian Institute of Technology, New Delhi 110016 India

<sup>1</sup>nandkumar.thenmani@gmail.com, <sup>2</sup>akhil887@gmail.com

**Abstract -- Indian utility sectors are gradually liberalised, allowing more private parties to enter the arena hitherto exclusively reserved for public sector units and this has increased competition. One such sector is the City Gas Distribution (CGD) of natural gas as Compressed Natural Gas (CNG) for vehicular fuels and Piped Natural Gas (PNG) for households. New players are entering in this lucrative market. As Natural gas is a commodity, possibility of product differentiation is ruled out and CGD utilities have to increasingly rely on services differentiation to retain and grow the customer base. One way the services may be offered to derive competitive advantage is to provide quality services. To identify the current level of service quality, a study of the performance of the IGL CNG outlets are carried out using SERVQUAL measure to see the service quality gap. It is also an eye-opener for the CGD utility concerned as well as new CGD players and regulatory authorities to see the gap between customer expectation and perceptions regarding the current quality of services provided which should further act as a motivation for managerial/regulatory intervention to improve the same.**

*Keywords: Service quality gap, SERVQUAL, CNG Outlets, Perception, Expectation.*

## I. INTRODUCTION

NATURAL gas use in India really started to grow in the late 1970s after the first major gas finds in the western offshore and the development of the first transmission pipeline in the northern region. Currently Natural gas contribution to countries energy mix is around 10% in comparison to global average of 25%. Presently, Natural gas is mostly used in the industry, especially fertilizer sector and power sector and its usage in transport and household sector is minuscule. But the environment and public health in cities demand its greater application in the transportation sector where the conventional fuels are the source of extremely toxic emissions and high human exposure. Keeping this in view Government of India, through clear policy guidelines, promoting City Gas Distribution (CGD) to improve the availability of natural gas to the industrial, domestic and commercial segments of a region i.e through Compressed Natural Gas (CNG) and Piped Natural Gas (PNG). In the present situation CGD consumes nearly 10% of total Natural gas supply.

To have a conducive regulatory environment for CGD network development, Ministry of Petroleum & Natural Gas (MoPNG) established the Petroleum and Natural Gas Regulatory Board (PNGRB) in 2007, under the PNGRB Act 2006. The implementation of CGD network in various cities is being taken up in a phased manner through bidding rounds. The CGD sector which is slowly but steadily evolving at a CAGR of 8%. The partial deregulation of CGD sector enabled entry of various private players in parallel with public sector utilities for commercialising this underlying market potential.

Currently the main active players in CGD sector are Gujarat State Petroleum Corporation (GSPC) Gas, Gujarat Gas Company Ltd (GGCL), IGL (Indraprastha Gas Limited) and MGL (Mahanagar Gas Limited) accounting for around 88% of the total CGD volumes in India. The other companies who are actively participating or won in the bidding process are GAIL Gas Limited, Adani, IOC, Reliance Gas, DSM infratech, Essar projects, Lanco infratech etc

## II. IMPERATIVE OF SERVICE QUALITY IN CGD SECTOR

Under the PNGRB Act, 2006, new entrants/incumbents will enjoy monopoly with regards to network provision for 25 years and marketing exclusivity for five years, from the date of authorisation although the marketing exclusivity is for five years, the actual period works out much shorter as network construction itself takes two to three years. After the marketing exclusivity period is over, there is the risk that the CGD Company's customers and several untapped consumers would migrate to a different gas provider if the quality of service provided is not matching with the expectation of customer. This may require some tweaking/fine tuning of marketing mix to close that gap.

Further, larger margin and profitability of the existing players (MGL, IGL and GGCL), coupled with the strong demand growth (spurred by the favourable cost economics of gas versus competing fuels), has attracted a large number of companies, including several from sectors other than oil & gas, to the CGD business and due to their negligible prior experience/expertise in this area necessitates for proper service quality measurement to identify the gap with customer perception.

Moreover this will also help the regulator to set up a benchmark for a minimum service quality in the CGD sector.

### III. LITERATURE REVIEW

In this literature review, SERVQUAL, a popular scale / measurement for service quality based on consumer perception and its application to various sectors of service at International and National (Indian) level are discussed to identify the research gap.

*Service Quality & SERVQUAL Instrument:* Sectoral liberalisation and subsequent competition introduced lot of pressure on both top line and bottom line of the organisations. Further due to ease of technological diffusion and absorption, the product features differentiations, which are a strategic marketing tool, are fast becoming less strategic. This put organisations in a situation to improve their product/service delivery methods to retain the customer. Thus service quality has become an important strategic marketing tool. Service quality can be defined as the difference between customers' expectations for service performance prior to the service encounter and their perceptions of the service received. (Patrick Asubonteng *et al.*, 1996)

Thus Measuring and identifying the differences in the service quality is an important prerequisite for marketing managers to improve the consumer satisfaction. Satisfaction occurs when the quality of outcome perceived by consumer is more than the expectation. These expectations may be based on their previous experience or based on vicarious experience. It is based on the premise that the quality leads to satisfaction (Stephen W Brown *et al.*, 1989). One broad conclusion about the service quality is that their assessment is strongly linked to perceived value and behavioural intentions of customer (A.Parasuraman *et al.*, 2005).

Various studies indicate that repurchase behaviour is reinforced by customer satisfaction. High consumer satisfaction is positively linked to customer retention and increased spending by consumer and positive word of mouth. Based on a favourable attitude towards a service provider, customers may develop preference loyalty (LerzanAksoy *et al.*, 2008). Thus it is pertinent to measure this service gap using a reliable tool.

A highly valid and reliable service quality measurement tool called SERVQUAL scale developed by Parasuraman (1988) of the Marketing Science Institute is widely used for measuring the service quality. This tool is widely used across different service sectors to measure the perceived service gap from consumer perspective.

The scale captures five dimensions of service quality that are applicable to service-providing organizations in general. These dimensions are: (1) **reliability** -ability to perform the promised

service dependably and accurately;; (2)**assurance**-knowledge and courtesy of employees and their ability to inspire trust and confidence; (3) **tangibles**-physical facilities, equipment, and appearance of personnel (4)**empathy** -caring, the individualized attention the firm provides its customers; and (5) **responsiveness**/ willingness to help customers and provide prompt service. The acronym RATER indicates these five dimensions. These five dimensions contain nearly 22 items/ attributes which are industry specific to measure consumer expectations and consumer perceptions on the level of service provided by the service industry. Mathematically the perceived service quality may be represented as follows (Mohammed Naved Khan *et al.*, (2008);

$$SG_i = \sum (P_{ij} - E_{ij})$$

Where SG= Perceived service gap of individual 'i'

P= Service quality perception of individual 'i' for attribute 'j'

E=Service quality expectation of individual 'i' for attribute 'j'

In various SERVQUAL study, the reliability and validity of various attributes considered under the RATER dimensions are measured using the Cronbach's alpha reliability coefficients and discriminant and face validity.

Critics of SERVQUAL argue that there is a problem in applying this scale/measure universally across industries. But further study indicates that small ingenious adjustments as per the sectoral specific dimensions see that the scale is applicable in different sectors since SERVQUAL items represents core evaluation criteria that transcends specific companies and industries. (A. Parasuraman *et al.*, 2001).

### IV. APPLICATIONS OF SERVQUAL IN VARIOUS SERVICE SECTORS

SERVQUAL in its original form or with its modified form has been widely used across different service sector under different settings to measure the service gap as perceived by the consumer (Patrick Asubonteng *et al.*, 1996).

*International Studies:* Service quality in Banking, Hospital, Tourism and education sectors are widely studied using SERVQUAL dimensions since the introduction of the measure in 1988. Here some of the recent studies are indicated.

Mohammad Mizener Rahaman *et al.*, (2011) studied Bangladesh Private commercial banks service quality gap from the perspective of external sectors and measured how the delivered service quality equalise consumers' expectations.

Service quality in a call centre in Australia was evaluated by Warren J S Staples *et al.* (2002) using SERVQUAL model

and concluded that that assurance and reliability are considered critical elements for service delivery in this context.

Aysun Kapucugillkiz *et al.*, (2008) studied service design and service requirement in Hotel using SERVQUAL dimensions as starting point and then using quality function deployment.

1. ChingangNde Daniel *et al.*, (2010) in their master thesis studied service quality and consumer satisfaction for grocery stores in Umea and concluded that the SERVQUAL model was not a good instrument to measure service quality because some of the items under the dimensions overlapped and regrouped under different dimensions.

In their study on Customs quality service in Iran, Mohammad Ali Abdolvand *et al.*, (2011) used Fuzzy multi criterion approach in conjunction with SERVQUAL and considered this method is more close to human thinking.

Literature on Estimation of service quality for public services is very limited but it is fast catching up. Chris Gibson (2009) Studied using SERVQUAL to assess the customer satisfaction level of the Investigative Service Center (ISC) Analytical Unit of Oregon High Intensity Drug Trafficking Area (HIDTA) for increasing the effectiveness and efficiency of this service units providing a bench mark for the performance monitoring.

Syed Muhammad Irfan *et al.*, (2012) estimated the public perception about Pakistan rail transport system using modified SERVQUAL scale with eight dimensions.

Manuel Sa´nchezPe´rez *et al.*, (2007) studied and established service quality and behavioural purchase intentions in the public-sector transport industry in Spain using SERVPERF measure.

Feng Fen Ling *et al.*, assessed the performance of Railway Frights service in the context of China using SERVQUAL, SERVPERF and Key event Method and concluded that even though all of the three methods can be applied in evaluating the services due to special nature of fright services the SERVQUAL measure is more apt.

SERVQUAL measure for Municipal Services was explored by Safiek Mokhlis (2012) in Southern Thailand to identify the peoples expectations and perceptions on the service quality of Municipal corporation.

Recently on line service provider quality is also assessed using modified SERVQUAL tools. The measurement of online self-service quality has been carried out by David Xin Din *et al* (2010) using modified form of SERVQUAL called e-SELFQUAL,

for examining the relationships between online service qualities through customer perception. An E-SERVQUAL scale was designed by Farnaz Behesti Zaverah *et al.* (2012) to construct e-Service Quality (e-SQ) for internet banking services and studied its the impact on e-Customer Satisfaction (e-CS).

Rudolf O Large *et al* (2008) developed a new frame work for internal service gap of purchasing department and based on the SERVQUAL and the general gap model of service quality. Ramaon A carasco and others (2012) studied quality service in e-financial services sector by integrating SERVQUAL with fuzzy linguistic model.

Enzhan Akhalaghiet al., (2011/2012) assessed the quality of technical and vocational educational services from students' perspective, via SERVQUAL model. Yun Lok Lee and others (1996) demonstrated how easily and inexpensively the SERVQUAL instrument can be used to identify the strengths and weaknesses of individual restaurants' service dimensions and the management can improve upon weak aspects on identifying the same.

Fatma Pakdil & Others (2007) measured airline service quality based on data collected at a Turkish airline using SERVQUAL scores weighted by loadings derived from factor analysis. and demonstrated that "responsiveness" dimension is the most important, while "availability" is the least important element of quality.

An E-SERVQUAL scale was designed by Farnaz Behesti Zaverah & others (2012) to construct e-Service Quality (e-SQ) for internet banking services. In addition, it attempted to examine the effect of e-SQ on e-Customer Satisfaction (e-CS).

Emin Babakus and W Glynn Mangold (1993) investigated SERVQUAL for its potential usefulness in a hospital service environment and The completed expectations and perception scales met various criteria for reliability and validity dimensions pertaining to Hospital Industry.

#### *Indian studies:*

In the Indian context many authors has studied service quality and customer expectation in various service sectors using SERVQUAL as such or with its modified version in association various methodologies like AHP, TOPSIS etc.

Evaluation of service quality of hospital outpatient department services employing SERVQUAL as the survey instrument was carried out by Abhijit Chakravarty (2011) in Pune Army Hospital and established significant gaps across the dimensions of 'tangibles' and 'responsiveness'.

Koushiki Choudhury (2008) and Darmalingam (2011)

explored the various dimensions of customer perceived service quality in the context of the Indian retail banking industry and in select private sector bank. Poonam Kumar et al., (2011) analysed the service Gap in South Delhi based public sector bank and the study concludes that perceptible service gap exists in responsibility and responsiveness.

Shainesh (2000) identified the attributes which customers expected to use it for evaluation of quality in railway freight services and based on these new dimensions developed a comprehensive instrument, RAILQUAL, for collecting feedback from the industrial customers.

Mohammed Naved Khan, Vippan Raj Dutt, and S.C. Bansal (2008) examined the service gap perceived by the customers (key stakeholders) after the introduction of free sky policy in the civil aviation sector in India by measuring various dimension of services valued by the passengers by applying the SERVQUAL instrument.

#### V. RATIONALE FOR STUDY OF SERVICE QUALITY GAP IN NATURAL GAS UTILITY SECTOR

Studies reveal that the introduction of quality variables positively affects performance comparisons across utilities. Quality of service has emerged as an important issue in post-reform regulation of utilities like electricity distribution networks and city gas distribution networks etc. Yet above literature survey clearly indicates that the majority of available studies on customer services are confined to the specific services sector like hospital, hotel, tourism, banking, library, education and airline etc and there is a perceived research deficiency in identifying and mitigating service gap between consumer expectation and perceptions in Natural gas utility sectors.

In the above context our present empirical study will try to identify the service quality expectation in the City Gas distribution utilities i.e. CNG Services. The analysis of various dimensions of service will help us evolve a model of service parameters that CGD utilities may adopt.

#### VI. THE SCOPE AND RESEARCH OBJECTIVES

The Scope of study for this research Project is an Indian City Gas Distribution utility. In this case expectation & perception of service quality at the IGL (Indraprastha Gas limited) outlets are measured as they are the sole CGD utility in the Delhi region. The main research objectives are

- i. To Measure overall service quality in City Gas distribution i.e. CNG service outlets of IGL
- ii. To find how customer expect and perceive (experience) about services provided at CNG stations of IGL
- iii. To test & identify the dimensions of service that is important using SERVQUAL model at CNG outlets through factor analysis.

- iv. To perform GAP analysis and to identify areas of improvements in service quality

#### VII. RESEARCH METHODOLOGY

As the developers of SERVQUAL have pointed out, SERVQUAL "can be adapted or supplemented to fit the characteristics or specific research needs of a particular organization." Therefore our first step is to identify and ensure inclusion of specific attributes pertaining to CGD utility in RATER dimensions. This is achieved through expert opinion generation. The resultant scale will be in Likert response format and will be administered to a sample of current consumers and then validity assessment will be done using correlation and factor analyses.

Accordingly, questionnaires containing 20 questions are prepared (Appendix) to measure the variables/attributes in a 7 point Likert scale on Expectation & Perception and are administered to people who are using CNG as fuel in their vehicle. Samples are collected using & convenience sampling technique.

In the questioner serial no 1 to 4 represents the tangible (Physical) aspect of the CNG services outlet like CNG compressor, metering and safety system etc, Serial no 5 to 8 represents the reliability aspect of services like availability of round the clock facility with sufficient CNG pressure etc. Questions from 9 to 12 represent the responsiveness of service outlets in the form of providing prompt care and quick responses etc. The factors 13 to 16 indicate the assurance and safety aspect of CNG outlets like providing careful and safe service etc. The elements 16 to 20 capture the empathy aspect of services like providing individual attention, extending focused and integrated services etc.

#### VIII. IGL ORGANISATION OVERVIEW

IGL was incorporated in 1998 as a Joint venture initiative of GAIL (India) Ltd and Bharat Petroleum Corporation Ltd. (BPCL) for providing natural gas supply in the entire capital region. The main Business objectives of IGL is to

- To provide safe, convenient and reliable natural gas supply to its customers in the domestic and commercial sectors.
- To provide a cleaner, environment-friendly alternative as auto fuel to Delhi's residents. This will considerably bring down the alarmingly high levels of pollution

In the year 2012-13, IGL had sold nearly 1000 MMSCMD (Million Metric Standard Cubic Meter) of CNG through 324 CNG stations and the installed compression capacity went up from 59.56 Lakhs Kg/day in March 2012 to 63.82 Lakhs Kg/day in March 2013.

The Company has been showing consistently good financial performance both in terms of turnover and profitability. The turnover was Rs. 3724 crores and Profit after tax was Rs. 354 crores in 2012-13.

IX. SERVQUAL DATA ANALYSIS

The SERVQUAL questioner was administered among CNG vehicle users and responses of 60 responders are obtained. As indicated earlier the perception (experience) and expectation gap is obtained by the formula  $SG_i = \sum(P_{ij} - E_{ij})$

where SG=Service gap

P-Perception (Experience)-arrived by the arithmetic average of score obtained in the survey

E-Expectation-arrived by arithmetic average of score obtained through the survey.

The results obtained are indicated in Table 1.

Table1- ATTRIBUTES & SERVICE GAP SCORES.

Attributes	P	E	SG
Tangible	3.42	4.63	-1.21
Reliability	3.26	5.15	-1.89
Responsive	3.55	4.73	-1.18
Assurance(Safety)	3.6	4.88	-1.28
Empathy	3.825	4.85	-1.025
Overall	3.531	4.85	-1.319

Factor analysis of perception factors and expectation factors are analyzed using the statistical technique of principal component analysis of SPSS software. The results obtained are indicated in Fig.1 through Fig.4.

**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.531	22.657	22.657	4.531	22.657	22.657	2.491	12.457	12.457
2	2.397	11.985	34.642	2.397	11.985	34.642	2.256	11.282	23.739
3	1.822	9.109	43.752	1.822	9.109	43.752	2.132	10.659	34.398
4	1.473	7.366	51.118	1.473	7.366	51.118	1.902	9.508	43.906
5	1.275	6.374	57.492	1.275	6.374	57.492	1.806	9.030	52.935
6	1.194	5.970	63.462	1.194	5.970	63.462	1.666	8.328	61.263
7	1.014	5.072	68.534	1.014	5.072	68.534	1.454	7.270	68.534
8	.920	4.599	73.133						
9	.813	4.063	77.196						
10	.773	3.865	81.061						
11	.680	3.402	84.464						
12	.560	2.800	87.263						
13	.503	2.516	89.780						
14	.433	2.165	91.945						
15	.398	1.991	93.935						
16	.329	1.646	95.581						
17	.320	1.600	97.180						
18	.267	1.335	98.516						
19	.163	.816	99.332						
20	.134	.668	100.000						

Extraction Method: Principal Component Analysis.

Figure 1. Total variance of Perception factors.

**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.991	14.956	14.956	2.991	14.956	14.956	2.374	11.870	11.870
2	1.946	9.730	24.686	1.946	9.730	24.686	1.801	9.003	20.872
3	1.737	8.686	33.373	1.737	8.686	33.373	1.679	8.394	29.267
4	1.582	7.908	41.281	1.582	7.908	41.281	1.676	8.382	37.649
5	1.349	6.744	48.024	1.349	6.744	48.024	1.544	7.718	45.367
6	1.279	6.393	54.418	1.279	6.393	54.418	1.505	7.524	52.891
7	1.169	5.845	60.263	1.169	5.845	60.263	1.474	7.371	60.263
8	.997	4.986	65.249						
9	.930	4.651	69.900						
10	.847	4.237	74.137						
11	.764	3.819	77.956						
12	.723	3.613	81.569						
13	.680	3.398	84.968						
14	.631	3.155	88.123						
15	.587	2.936	91.059						
16	.486	2.432	93.491						
17	.456	2.281	95.771						
18	.370	1.850	97.621						
19	.328	1.641	99.262						
20	.148	.738	100.000						

Extraction Method: Principal Component Analysis.

Figure 2. Total variance of Expectation factors.

**Rotated Component Matrix<sup>a</sup>**

	Component						
	1	2	3	4	5	6	7
T1				.661			
T2				.717			
T3				.646			
T4		.505					
RL1							.752
RL2						-.586	
RL3					.782		
RL4		.633					
RS1			.590				
RS2							-.524
RS3		.597					
RS4		.777					
A1			.878				
A2							
A3			.580				
A4					.699		
E1						.817	
E2	.716						
E3	.670						
E4	.816						

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization.  
 a. Rotation converged in 14 iterations.

Figure 3. Factor analysis of Perception factors

**Rotated Component Matrix<sup>a</sup>**

	Component						
	1	2	3	4	5	6	7
T1						-.648	
T2							.725
T3							
T4							
RL1							
RL2			.753				
RL3		.627					
RL4							-.693
RS1					.820		
RS2			.757				
RS3	.644						
RS4							
A1							
A2						.734	
A3		-.543					
A4				.619			
E1				-.823			
E2	.613						
E3	.627						
E4		.667					

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization.  
 a. Rotation converged in 14 iterations.

Figure4. Factor analysis of Expectation factors.

**X. RESULTS & DISCUSSION**

From the Table.1it can be readily seen that there is over all perceptible service gap at CNG outlets of IGL. There were serious gaps observed in all five attributes with respect to service quality. Reliability dimension of services shows the

largest service gap followed by assurance/safety and tangible physical infrastructure aspect. From the factor analysis it can be inferred that from both among perception & expectation factors nearly 68 and 60 % of variance is explained by first seven no of elements.

The factor analysis of perception & expectation score results in fig 3 & 4 indicate that the 20 items do not match the five-factor structure as described by Parasuraman et al. (1998). Only empathy and tangible dimensions are loaded properly in case of perception factors while other items have mixed and have high loading for a no of factors both in case of perception as well as in expectation. Other rotation methods also failed to improve the factors' loading and factor structure. This shows that other factors also play an important role in determining the service quality at CNG stations. However the simple gap analysis arrived for individual items in the questionnaire and for each dimension using the simple averages of the scores for all items that belong to that dimension is throwing a valuable insight in to the current services gap existing at CNG service stations.

#### XI. MANAGERIAL IMPLICATIONS

The gap analysis provides the areas of improvement for the organisation and provides the direction for implementing changes to enhance service quality. The following specific areas of improvement is suggested for IGL managers

1. Company should provide more training to the service station employees to enhance their customer centric attitude so that it may improve the empathy factors like solving the customer problem, extending courteous services to individual customers etc.
2. Company should enhance its physical infrastructure, the tangible aspects of service, to provide a reliable 24X7 services.
3. To enhance the assurance & safety aspects, the station managers' decision making power has to be enhanced with improved resource allocation to attend the customer problem.

#### XII. CONCLUSION

SERVQUAL based service quality measurement has undoubtedly had a major influence on the service business. Although this study shows that the data collected do not support the five factor dimension as proposed by Parasuraman et al. (1988), the five factor dimensions are still useful as a foundation for discussion of and determination of areas for improvement in an organization's service quality. In this study SERVQUAL instrument is applied for IGL's, CNG outlet service stations to identify the service gap and important areas for improvement are suggested. This is the first study carried out to test the validity of the five-dimension structure of service quality and the reliability of the SERVQUAL instrument in the CNG distribution utility in India.

It is expected that the findings of the study will help other CGD in evaluating the level of existing services being offered and the service gap thereby to re-evaluate their service orientation and it also will help regulatory bodies to understand the gap and subsequently evaluate the policies for future i.e. Policy

prescription and specifying bench mark (min. infrastructure required) for mandatory services to protect the safety and interest of consumers.

#### XIII. LIMITATION OF STUDY

This study has been confined only to CNG outlets of IGL by collecting data from CNG customers at Delhi and not done at other geographical spreads due to time & resource constraint. But such a study is required to exclude cultural biases etc. to arrive at a better conclusion.

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**T. Nandakumar** is currently working as a Senior Manager in GAIL India, Noida. He has vast professional experience in the Natural gas value chain in Operation, Project management, R&D and Technology management. He is an M.Tech in Chemical Engineering and a professional member of American Society of Chemical Engineers.

He also holds an MBA from Indian Institute of Technology, Delhi in Technology and Strategy management. His research interests include Energy studies, sustainable strategies and general management.



**Akhil Damodaran** (b. 1986) He has experience in IT service industry in diverse disciplines ranging from service operation, ISO- 27K auditing, and six sigma project management. He holds an MBA (Technology management) majoring in strategy from Indian Institute of Technology, New Delhi and bachelor of engineering in Electronics and Instrumentation from Rajeev Gandhi Technical University, Bhopal.