Service Quality of Electric Utilities in Haryana – A Comparison of North and South Haryana

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Abstract - In today's time, electricity distribution utilities in every corner of the world are grappling with severe aggregate technical and commercial losses. The scenario is more worsening in the State of Haryana. This is mainly due to the fact that customers' belief and satisfaction level towards electric distribution utilities is rapidly declining which results into different types of losses to the company and customers as well. Behind this situation, service quality of the utility plays a major role. Therefore, this paper is aimed at the analysis of service quality of two utilities serving the State of Haryana. For service quality measurement, SERVQUAL model has been adopted. Based on the SERVQUAL model, customers' expectations and perceptions towards utility services are collected from Sonepat and Palwal district using a well-designed questionnaire. Sonepat, i.e., a northern district, is served by UHBVNL and Palwal, i.e., a southern district, is served by DHBVNL. Service quality gap has been measured using the empirical analysis of the data collected from respondents' from both districts. The results of this study show that both utilities do not meet customer expectations due to unsatisfactory services on different dimensions of service quality. From comparative point of view, DHBVNL has better service quality as compared to UHBVNL. Outcomes of this paper may give the reflection of the weak-points of the utility companies where they need to upgrade their service quality.

Keywords —Service quality, gap analysis, SERVQUAL, Haryana.

I. INTRODUCTION

Service quality has become main parameter to sustain in the competitive market of service sector. Competition in the service sector is constantly increasing as it is one of the major contributors of the economic development of the country [4, 23]. Same thing is applicable to India also as a large share of GDP comes from service sector. Service sector needs to provide good service quality to flourish itself irrespective of whether it is public or private sector. Before service quality, question arises about how to define a service. Services can be understood as dead, processes and performance provided or coproduced by one entity or person for another entity or person [3, 5]. Service quality is also defined by [6] as excellence, value, conformance to specifications and meeting or exceeding customers' expectations. Though, the services are intangible, non-heterogenous and inperishable, the quality of services can be judged/analysed depending on different criterion [7]. This paper covers the measurement of service quality of two electricity distribution utilities serving the State of Haryana. One is UHBVNL (Uttar Haryana Bijli Vitran Nigam Limited) and another is DHBVNL (Dakshin Haryana Bijli Vitran Nigam Limited). Southern areas of State of

Haryana come under the jurisdiction of DHBVNL and northern areas come under the jurisdiction of UHBVNL. Both the utilities are public sector companies governed by the State of Haryana. There is no as such competition between two utilities, but still service quality is a major paradigm for both utilities. Good service quality brings the customer satisfaction and their loyalty [19]. This will consequently result into financial gains of utilities as higher customers' perceptions towards utility will result into reduction of electricity theft, higher bill collection and other positive impacts [14-15, 18]. Therefore, analysis of service quality is a critical issue for both the utilities. This paper studies the service quality of both utilities and compares their performances on ten dimensions of SERVQUAL model.

II. LITERATURE REVIEW

Literature abounds the research works in the field of service quality analysis [20-22, 24, 25]. In power sector, quality of electricity supply has gained equal importance as that of electricity supply in terms of quantity [26-36]. Seth et al. [7] have proposed different models for service quality measurement in different sectors. Gunatilake et.al [8] performs an experiment in Madhya Pradesh, India and shows

that if the service quality in terms of hours of supply, power quality and other services' quality drops, then willingness of the customers to pay bill also decreases. Likewise, good service quality in all terms enhances their willingness to pay. Thus, good service quality indirectly also guarantees about minimum losses to the electricity utilities [16, 17]. Daniel et.al [9] uses SERVQUAL model for studying the customer satisfaction in grocery stores. Authors show some gap in SERVQUAL performance and show the necessary improvements for good quality of service.

Achchuthan et al. [10] uses the SERVQUAL model having five dimensions (tangibility, empathy, responsiveness, reliability and assurance) with 21 items in total for the measurement of service quality of Ceylon Electricity Board in Sri Lanka. Andaleeb et al. [11] examines the impact of service quality on the post-complaint satisfaction of electricity customers. Manjunath et al. [12] show that service quality of the services offered by the electricity company decides the consumer behaviour towards electricity consumption and the company. Hemant Sharma [13] proposes a reliable tool having seven dimensions for assessment of quality of services provided by DHBVNL to South Haryana. Still, there is no study available in the literature comparing the service quality of UHBVNL and DHBVNL. Addressing this gap, the present study has been undertaken.

III. OBJECTIVE OF THE STUDY

This paper presents the scenario of service quality of electricity distribution companies serving the State of Haryana which are UHBVNL and DHBVNL. For the measurement of service quality, SERVQUAL model has been employed. Focusing on the main purpose of this paper, following objectives have been set for this study:

1. To measure the service quality of UHBVNL supplying electricity to northern Haryana.

2. To measure the service quality of DHBVNL supplying electricity to southern Haryana.

3. To compare the service quality of UHBVNL and DHBVNL on different dimensions of SERVQUAL model.

IV. RESEARCH HYPOTHESIS

Since, this study focuses on the comparative analysis of service qualities of two electric utility companies; one is serving northern districts of Haryana and another is serving southern districts of Haryana. Therefore, keeping the main objectives of this study in mind, following hypotheses have been designed for this comparative study:

H_0: There is no difference between service quality of electric utility companies in north and south Haryana.

H_1: There is significant difference between service quality of

electric utility companies in north and south Haryana.

H_0 refers to null hypothesis and H_1 gives alternative hypothesis. For hypothesis testing, t-test has been employed to compare the performance of electric utilities, i.e., UHBVNL and DHBVNL. Testing of these hypotheses will give the confirmatory results of the present study.

V. RESEARCH METHODOLOGY

Exploratory cum descriptive research design has been followed in this study. This study undertakes the sample survey in one district each served by UHBVNL and DHBVNL. Stratified random sampling is followed in this study for selection of sample population. UHBVNL undertakes power distribution business in northern districts of Haryana; where DHBVNL undertakes power distribution business in southern districts of Haryana. All the northern and southern districts covered under the jurisdiction of UHBVNL and DHBVNL are considered as different strata. For measuring the service quality of UHBVNL and DHBVNL, Sonepat district and Palwal district are randomly chosen respectively for collecting the sample survey. Using the stratified random sampling, the sample population size for both the districts is computed as 150 each. Here, population means electricity connections. As population comprises electricity connections, 150 electricity customers are asked to fill the questionnaire in each district.

For data collection, a SERVQUAL based questionnaire has been designed with proper structure and ease of understanding for the respondents. Questionnaire first asks about the demographic profile of the respondents. There are two parts of questionnaire according to SERVQUAL model; one is for collecting customer expectations and other is for collecting customer perceptions of different attributes of utility's services: tangibility, empathy, responsiveness, reliability, communication, security, courtesy, credibility, competence and accessibility. Customers' responses against expectations and perceptions are collected on 5-point Likert Scale which varies from 1 (highly disagree) to 5 (highly agree). The primary data collected through survey is empirically analysed with SPSS (version 20.0) software.

VI. DATA ANALYSIS

Customers' demographic profile governs their expectations and perceptions of services offered by electricity distribution utility. Educated and highly earning people have more expectations from the utility company. They demand both quantity and quality of electricity supply; whereas, poor people and less educated persons become satisfied only with sufficient quantity of electricity. Therefore, firstly, demographic profile of the respondents is collected for both

UHBVNL and DHBVNL. Different characteristics like gender, monthly income, age, education, type of employment, and reservation category (if any), are recorded for each respondent. Table 1 shows the demographic profile of respondents from both districts in terms of their age, gender, reservation category, education, monthly income, locality and type of employment. Figure 1 and Figure 2 show graphically the demographic profile of UHBVNL and DHBVNL customers respectively.

A. Reliability Analysis

Reliability of the survey instrument is checked to judge the reliability of collected data through survey instrument. For checking the reliability, Cronbach coefficient alpha is computed [2]. This coefficient analyses the internal consistency of the items. For the instrument to be considered valid for survey, Cronbach alpha should be more than 0.70 [1]. In this work, Cronbach alpha has been computed for all ten dimensions of SERVQUAL model having both expectations and perceptions towards each distribution company. The reliability analysis for DHBVNL and UHBVNL of all dimensions is shown in Table 2. Table 2 shows that all the items under expectations and perceptions have value of Cronbach alpha greater than 0.7 in case of both UHBVNL and DHBVNL. The value of reliability coefficients show that collected data has high overall reliability coefficient, thus proving the reliability of the survey instrument. Hence, the collected data can be regarded as reliable for further analysis.

B. Descriptive Analysis

Empirical analysis of the data is carried out in SPSS (version 20.0) software. The mean value of all the responses is calculated, as shown in Table 3 for both UHBVNL and DHBVNL. Table 3 shows that all the customers of UHBVNL and DHBVNL have high expectations from the utility but the performance of the utilities is not meeting their expectations. Consequently, customers' perceptions about the utility's service quality are lower than their expectations on all dimensions of service quality, as showcased by the analysis in Table 3. Though, there is difference in the customers' perceptions about different dimensions of utility services.

The gap between the customer expectations and perceptions gives the reflection of how much the utility's services are lagging behind the customer's expectations. Table 4 gives the gap values between expectations and perceptions about different dimensions of UHBVNL and DHBVNL service quality. The services of UHBVNL have large difference from customer expectations on tangibility, security, courtesy and accessibility dimensions. There is minimum gap in case of communication front of UHBVNL's services. Customers are most satisfied with communication services of UHBVNL.

In case of DHBVNL also, customers get the best services with respect to communication dimension of utility's services as observed from the gap analysis in Table 4. They are offered worst services towards tangibility, accessibility and courtesy dimension of utility's services, as gap is maximum in these dimensions.

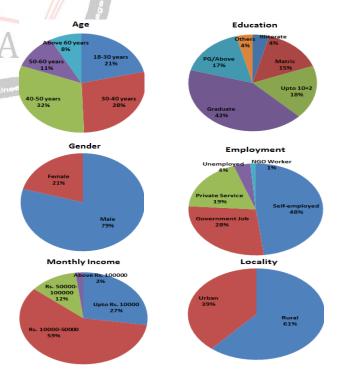**Figure 1. Demographic profile of respondents served by UHBVNL**

Figure 2. Demographic profile of respondents served by DHBVNL

Variable	Category	UHDVN		DHBVN	
		Freq.	Percent	Freq.	Percent
Age	18-30 years	29	19.3	32	21.3
	30-40 years	43	28.7	42	28.0
	40-50 years	49	32.7	47	31.3
	50-60 years	19	12.7	17	11.3
	Above 60 years	10	6.7	12	8.0
Gender	Male	129	86.0	119	79.3
	Female	21	14.0	31	20.6
Category	General	87	58.0	91	60.6
	OBC	49	32.7	44	29.3
	SC/ST	14	9.3	15	10.0
Education	Illiterate	5	3.3	6	4.0
	Matric	17	11.3	22	14.6
	Upto 10+2	39	26.0	30	17.3
	Graduate	56	37.3	61	40.6
	Post Graduate/Above	28	18.7	24	16.0
	Others	5	3.3	7	4.0
Monthly Income	Upto Rs. 10000	38	25.3	41	27.3
	Rs. 10000-50000	80	53.3	88	58.6
	Rs. 50000-100000	26	17.3	18	12.0
	Above Rs.100000	6	4.0	3	2.0
Locality	Rural	81	54.0	92	61.3
	Urban	69	46.0	58	38.6
Employment	Self-employed	69	46.0	72	48.0
	Government Job	45	30.0	42	28.0
	Private Service	26	17.3	28	18.6
	Unemployed	7	4.7	6	4.0
	NGO Worker	3	2.0	2	1.3
	Others	0	0.0	0	0.0

Table 1. Demographic profile of respondents

Between UHBVNL and DHBVNL, services offered by DHBVNL are comparatively good with respect to every dimension of service quality. This can be inferred from gap values given in Table 4. On each dimension, DHBVNL performs higher than UHBVNL producing lesser gap between customers' expectations and customers' perceptions. These observations prove that DHBVNL offers higher service quality than UHBVNL. This conclusion is also corroborated by performing the t-test.

C. Hypothesis Testing

The performance of UHBVNL and DHBVNL is compared using paired sample t-test. Paired sample t-test is used to compare the mean values of gap between customer expectation and perceptions towards the service quality of UHBVNL and DHBVNL. Table 4 gives *t-value*, *df* and *significance value* for UHBVNL and DHBVNL on all dimensions. The significance level of 0.05 has been considered while performing the t-test. As there is significance value is below 0.05 for all dimensions except competence, this shows that there is significant difference between the performance of UHBVNL and DHBVNL corresponding to nine dimensions of service quality. There is only one dimension, i.e., competence, on which the service quality of both UHBVNL and DHBVNL are almost similar. Otherwise, DHBVNL performs better than UHBVNL with large difference in performance. Thus, alternative hypothesis has been accepted.

Table 2. Value of Cronbach alpha

Dimensions	No. of Items	UHBVNL		DHBVNL	
		Expectation	Perception	Expectation	Perception
Tangibility	5	0.880	0.852	0.899	0.883
Empathy	5	0.722	0.781	0.786	0.755
Responsiveness	5	0.734	0.751	0.789	0.793
Reliability	5	0.784	0.798	0.789	0.799
Communication	5	0.763	0.746	0.775	0.739
Security	5	0.723	0.838	0.710	0.759
Courtesy	5	0.779	0.828	0.793	0.767
Credibility	5	0.731	0.89	0.734	0.736
Competence	5	0.741	0.828	0.728	0.745
Accessibility	5	0.822	0.783	0.798	0.810
Overall	50	0.884	0.841	0.856	0.861

Table 3. Descriptive statistics of expectation and perception values for SERVQUAL dimensions

Statements	UHBVNL		DHBVNL	
	Expectation	Perception	Expectation	Perception
Tangibility				
The company has modern tools and technology.	4.560	2.273	4.647	2.720
The company has well managed offices.	4.607	2.280	4.647	2.633
Forms (for new connections, load change etc.) are simply written in regional languages.	4.620	2.393	4.660	2.560
The records (of electricity connection, bills and meter, etc.) are maintained properly.	4.640	2.453	4.667	2.853
Wires are well organized on electric poles.	4.500	2.133	4.433	2.793

Empathy				
Employees personally attend the customers for their queries and complaints.	4.547	2.427	4.653	2.767
Company staff has operating hours suitable to customer's needs.	4.467	2.507	4.573	2.707
Rural customers get subsidies in electricity bill.	4.327	2.853	4.420	3.153
Company motivates the customers to use energy saving bulbs, fans and other products.	4.580	2.940	4.647	3.193
The bill collection centers are near to the customer's residence.	4.440	2.773	4.587	2.967
Responsiveness				
There are not long queues at bill collection centers.	4.680	2.687	4.553	2.873
Employees quickly respond to customers' complaints.	4.793	2.607	4.673	2.760
Every electricity office has helpdesk for enquiry.	4.713	3.860	4.633	3.920
Company gives information in advance for power cuts.	4.713	3.673	4.640	3.693
Customers get the satisfactory service in the first visit to the company office.	4.680	3.900	4.607	4
Reliability				
Employees give reliable answers to customers' enquiries.	4.480	2.453	4.627	2.833
The company provides correct electricity bills.	4.480	2.740	4.580	2.927
Customers get full voltage all the time.	4.467	2.613	4.547	2.927
Company gives 24 hours supply.	4.207	2.507	4.373	2.913
Meter reader honestly notes correct reading from the meter.	4.567	2.887	4.640	3.227
Communication				
Prior information about due date of bill is given to customers through phone.	4.400	3.627	4.333	3.827
Company provides toll-free numbers for enquiries.	4.527	3.820	4.433	3.920
Employees communicate with customers in regional language.	4.393	3.887	4.327	3.960
Company runs awareness programs through advertisement, social media and newspapers.	4.353	3.693	4.300	3.833
Company gives notice before disconnection of meter.	4.440	3.853	4.400	3.980
Security				
Customers are secured in all financial transactions.	4.460	2.547	4.527	2.887
Employees show ID proof while visiting to customer premises (for meter reading etc.).	4.427	2.247	4.580	2.687
Company does timely maintenance of transformers.	4.440	2.293	4.520	2.767
Supply lines are far from the reach of customers.	4.433	2.240	4.587	2.773
Company properly seals the electricity meters.	4.480	2.580	4.560	2.953
Courtesy				
Employees behave respectfully with the customers.	4.460	2.560	4.513	2.640
Behavior of the employees is same with all the customers.	4.440	2.713	4.520	2.940
At the entrance of electricity office, ramps are available for the physically challenged customers.	4.480	2.347	4.560	2.680
Expertise staff is available to properly deal with physically challenged (deaf, dumb, blind) customers.	4.520	2.433	4.553	2.813
Customers get new connection with less formalities.	4.440	2.167	4.573	2.520
Credibility				
Company does repairing of equipments without charging money from customers.	4.327	3.320	4.320	3.560
The supply is restored within the minimum time.	4.440	3.293	4.407	3.560
Electricity bills are provided by the company at the time of meter reading.	4.413	3.227	4.347	3.473
Customers have secured toll free number/online facility to report against employees.	4.320	3.260	4.300	3.540
Electricity meter runs at normal speed.	4.453	3.353	4.340	3.607
Competence				
Billing is done on monthly basis.	4.340	3.493	4.427	3.607
Employees ensure the safety of customers after repairing and maintenance work.	4.467	3.280	4.833	3.533

Customers get the electricity bill at least 7 days before due date.	4.513	3.373	4.627	3.747
Major equipments (like transformer) are replaced without any delay.	4.467	3.080	4.467	3.260
Company takes strict actions for theft complaints.	4.487	3.327	4.580	3.453
Accessibility				
Employees are available in any emergency conditions.	4.427	2.093	4.493	2.420
Bill correction procedures are easy for customers.	4.427	2.180	4.513	2.573
Customers have facility of online complaint registration.	4.447	2.620	4.500	2.867
Customers get the online facility to apply for new connections.	4.447	2.313	4.540	2.553
Company provides facility to pay the bill through various modes (cash, cheques, online and drafts).	4.407	2.860	4.540	3.120

Table 4. Paired t-test for SERVQUAL dimensions

Dimensions	Gap (P-E)		t-value	df	Sig.
	UHBVN	**DHBVN**			
Tangibility	-2.279	-1.899	8.853	149	.000
Empathy	-1.772	-1.619	4.045	149	.000
Responsiveness	-1.370	-1.172	8.341	149	.000
Reliability	-1.800	-1.588	5.608	149	.000
Communication	-0.647	-0.455	7.609	149	.000
Security	-2.067	-1.741	6.656	149	.000
Courtesy	-2.024	-1.825	5.314	149	.000
Credibility	-1.100	-0.795	9.040	149	.000
Competence	-1.144	-1.067	1.061	149	.290
Accessibility	-2.018	-1.811	6.210	149	.000

VII. CONCLUSION

This study compares the service quality of two utilities serving northern Haryana and southern Haryana, i.e., UHBVNL and DHBVNL respectively. The customers' expectations and perceptions are collected through a well-structured questionnaire filled from Sonepat and Palwal district. Though, the data analysis shows that both utilities are not performing much as compared to customers' expectations from them. There is large gap between their services and customers' expectations. Both utilities have worst services with respect to tangibility and best services with respect to communication. But, between UHBVNL and DHBVNL, DHBVNL offers higher service quality with respect to all dimensions of service quality.

VIII. PRACTICAL IMPLICATIONS

This study facilitates both distribution utilities in Haryana with the analysis of expectations and perceptions of their customers towards their services. This analysis highlights the weaker fronts of their services so that they can focus their management strategies towards improvement on those weaker fronts with high priority. Both utilities can also seek for the servicing strategies of each other to sustain in the competition.

IX. LIMITATIONS OF THE STUDY

This study undertakes the sample survey from only one district each for UHBVNL and DHBVNL. More concrete results can be collected if the survey covers all the districts served by both utilities. This work can also be extended by collecting the views of utility's employees to better understand the gap between customers' expectations and utility's performance.

REFERENCES

[1] J. C. Nunnally, *Psychometric Theory*, McGraw-Hill, New York, 1978.

[2] L. J. Cronbach, Coefficient Alpha and the Internal Structures of Tests, *Psychometrika,* vol.16, no. 3, pp. 297-333, 1951.

[3] P. W. Daniel, J. W. Harrington, *Services and Economic Development in the AsiaPacific: Ashgate*. 2007.

[4] Zeithaml, Valarie A., Bitner, Mary Jo and Dwayne D. Gremler *Services Marketing. Integrating Customer Focus across the Firm,* 6th Edition, New York: McGraw-Hill Irwin, 2013.

[5] C. Reeves and D. Bednar, "Defining quality: alternatives and implications‖," *The Academy of Management Review*, vol. 19, no. 3, pp. 419-445, 1994.

[6] A. Parasuraman, V. A. Zeithaml, and L. L. Berry, "A Conceptual Model of Service Quality and Its Implications for Future Research," *Journal of Marketing (fall)*, pp. 41-50, 1985.

[7] N. Seth and S. G. Deshmukh, "Service quality models: a review," *International Journal Quality Reliability Management*, vol. 22, no. 9, pp. 913-949, 2004.

[8] H. Gunatilake, N. Maddipati and S. Patail, "Willingness to Pay for Good Quality Uninterrupted Power Supply in Madhya Pradesh, India," *South Asia Working Paper Series, No. 13*, Asian Development Bank. Nov. 2012.

[9] Chingang Nde Daniel and Lukong Paul Berinyuy, "Using the SERVQUAL Model to assess Service Quality and Customer Satisfaction, An Empirical study of grocery stores in Umea," Master Thesis, Umea School of Business, 2010.

[10] S. Achchuthan, N. Sivathaasan and J. M. R. S. Jayasundara, "Service Quality Dimensions of Electricity Services: Evidence from Electricity Board in Sri Lanka," *Asian Social Science,* vol. 10, no. 17, pp. 194-203, 2014.

[11] S. S. Andaleeb, S. S. M. Sadrul Huda, A. Akhtar, S. Dilshad, "Customer Satisfaction with Complaint Resolution in the Power Sector in a Developing Economy," *Journal of Nonprofit & Public Sector Marketing*, vol. 24, no. 3, pp. 181-201, 2012.

[12] M. Manjunath, P. Singh, A. Mandal, G. S. Parihar, "Consumer Behaviour towards Electricity – a field study," *Energy Procedia*, vol. 54, pp. 541-548, 2014.

[13] H. Sharma, "Modeling Customer Perceived Service Quality for Electricity Supply in South Haryana," *International Journal of Business and Management Science,* vol. 3, no. 1, pp. 73-91, 2010.

[14] S. Saini, "Social and behavioral aspects of electricity theft: An explorative review," *International Journal of Research in Economics and Social Sciences,* vol. 7, no. 6, pp. 26-37, 2017.

[15] S. Saini, "Scenario of Distribution Losses – A Case Study from Haryana", *International Journal of Research in Economics and Social Science*, vol. 8, no. 1, pp. 163-175, 2018.

[16] S. Saini, "Malpractice of Electricity Theft: A major cause of distribution losses in Haryana," *International Research Journal of Management and Commerce*, vol. 5, no. 1, pp. 284-313, 2018.

[17] S. Saini, "Expectancy-disconfirmation based assessment of customer Satisfaction with electric utility in Haryana," *International Research Journal of Human Resources and Social Sciences*, vol. 5, no. 1, pp. 320-335, 2018.

[18] S. Saini, "Electricity Theft – A primary cause of high distribution losses in Indian State", *International Research Journal of Management and Commerce*, vol. 8, no. 1, pp. 163-175, 2018.

[19] S. Saini, "Rationale behind developing awareness among electricity consumers," *International Journal of Research in Engineering Application & Management*, Accepted, 2018.

[20] S. Saini, "Analysis of service quality of power utilities," *International Journal of Research in Engineering Application & Management*, Accepted, 2018.

[21] S. Saini, "Difference in Customer Expectations and Perceptions towards Electric Utility Company", *National Journal of multidisciplinary research and management*, vol. 3, no. 1, pp. 264-269, 2018.

[22] S. Saini, "Appraisal of Service Quality in Power Sector of NCR", *National Journal of multidisciplinary research and management*, vol. 3, no. 1, pp. 270-274, 2018.

[23] S. Saini, "Evolution of Indian Power Sector at a Glance", *National Journal of multidisciplinary research and management*, vol. 3, no. 1, pp. 275-278, 2018.

[24] S. Saini, R. Singh and Satpal, "Service quality assessment of utility company in Haryana using SERVQUAL model", *Asian Journal of Management*, Accepted, 2018.

[25] S. Saini, "Influence of gender on service quality perceptions", *International Journal of Economics, Commerce & Business Management - A Peer Review Quarterly Journal*, Accepted, 2018.

[26] R. K. Beniwal, A. Aggarwal, R. Saini and S. Saini, "Analysis of electricity supply in the distribution network of power sector", *International Journal of Engineering Sciences & Research Technology*, Accepted, 2018.

[27] R. Kumar, A. Aggarwal, R. K. Beniwal, Sumit, R. Paul and S. Saini, "Review of voltage management in local power generation network", *International Journal of Engineering Sciences & Research Technology*, Accepted, 2018.

[28] Sumit, R. K. Beniwal, R. Kumar, R. Paul and S. Saini, "Modelling for improved cyber security in Smart distribution system", *International Journal on Future Revolution in Computer Science & Communication Engineering*, vol. 4, no. 2, pp. 56-59, 2018.

[29] R. Kumar, Sumit, A. Aggarwal, R. Paul, R. Saini and S. Saini, "Complete management of smart distribution system", *International Journal of Engineering Sciences & Research Technology*, Accepted, 2018.

[30] R. K. Beniwal, A. Aggarwal, R. Saini and S. Saini, "Detection of anomalies in the quality of electricity supply", *International Journal on Future Revolution in Computer Science & Communication Engineering*, vol. 4, no. 2, pp. 6-10, 2018.

[31] M. K. Saini, R. Dhiman, A. N. Prasad, R. Kumar and S. Saini, "Frequency management strategies for local power generation network", *International Journal on Future Revolution in Computer Science & Communication Engineering*, vol. 4, no. 2, pp. 49-55, 2018.

[32] R. Kapoor and M. K. Saini, "Detection and tracking of short duration variations of power system disturbances using modified potential function", *International Journal of Electrical Power and Energy Systems,* vol. 47, pp. 394-401.

[33] M. K. Saini and R. K. Beniwal, "Optimum fractionally delayed wavelet design for PQ event detection and classification", *International Transactions on Electrical Energy Systems*, vol. 27, no. 10, pp. 1-15.

[34] S. Dahiya, D. K. Jain, A. Kumar, R. Kapoor and M. Kumar, "Detection and Classification of power quality events using multiwavelets", *International Journal of Energy Technology and Policy*, vol. 5, no. 6, pp. 673-683.

[35] M. K. Saini and R. K. Beniwal, "Recognition of Multiple PQ issues using Modified EMD and Neural Network Classifier", *Iranian Journal of Electrical and Electronics Engineering*, In Press, 2018.

[36] R. Kapoor, M. K. Saini and P. Pramod, "Detection of PQ Events Using Demodulation Concepts: A Case Study", *International Journal of Nonlinear Science*, vol. 13, no. 1, pp. 64-77.