ORIGINAL RESEARCH PAPER

Statistics

A STATISTICAL ANALYSIS OF CONSUMER SATISFACTION IN RURAL WATER SUPPLY SCHEMES: A CASE STUDY OF SOME VILLAGES OF BIJNOR DISTRICT (UTTAR PRADESH), INDIA.

KEY WORDS: Water Supply System, Rural background, Developing Nations, User satisfaction, Water demand, Factor Analysis tool.

Deepak Chauhan* Department of Civil Engineering, BIET Jhansi, Jhansi-284128, India *Corresponding Author

Naveen Patel Department of Civil Engineering, NIT Agartala, Agartala-799046, India

Amitabh Kumar Srivastava Department of Civil Engineering, BIET Jhansi, Jhansi-284128, India

ABSTRACT

Today inadequate water is main threat to whole world, rural area of developing nations are more vulnerable to be its victim because of the lack of proper planning and implementation of programs related to water and sanitation. In the last few decades, United Nation, World Bank and WHO are working in collaboration with certain organizations to handle this critical issue, due to which many programs have been started by Indian Government. The present study will help in demonstrating the real scenario of the water system in Bijnor district of Uttar Pradesh state of India. It will help in manifesting the level of user satisfaction with the water system and along with that it will consider the issue related to both quality and quantity of the water resources from the villages in which; (1) water is used as a conventional source and (2) water is provided by Government agencies. Data is collected through surveys and processed by Statistical Package for the Social Sciences (SPSS) software and other Factor Analysis tool to figure out the main concern regarding the correlation between water supply, demand and quality of water. Results of the study will help in designing new water schemes along with desired modifications in the present system.

1. INTRODUCTION

The basic need of one's life is Water. Every organism including human being, plants, and animals need this resource to survive. Apart from water need for various domestic purposes like drinking, cooking, washing etc. it has many other essential usages like in agricultural purposes, industrial purposes, hydropower generation and maintenance of healthy ecosystem [1]. But disappointingly developing countries are failing to provide clean potable water to a majority of the population, resulting in severe health ailments or even death, approximately 3.1 % death are related to contaminated water consumption [2]. Some health impacts are immediate, while others are noticed over time, these include illness related to stomach, intestines, vomiting, diarrhea, cramps and various other harmful effects [3]. World Health Organization indicates that nearly 80% diseases are somewhere and somehow related to water contamination and many countries are not able to fulfill the water quality standards set by WHO for drinking water [4]. The most important need of present time is to provide potable water, sanitation, neat and clean environment to the rural population as they suffer from a lot of water-related health issues [5]. People belonging to rural areas are deprived of proper water supply system hence mostly hinge on an unconventional system of water sources such as dug wells, hand pump etc. and lack of awareness further leads to making the problem more critical. Provision of clean water is crucial to enhance the health of individuals and to lower down the cases of diseases due to contaminated water. The problem is not only limited to water quality but also related to its quantity. Rural habitants tend to extract water from the ground for satisfying their domestic and agricultural needs which often causes deterioration of groundwater table. There are mainly two reasons provided by experts on the water problem, one is the natural mode and the other one is artificial. The natural mode consists of disasters in form of flood, earthquake, landslides, Tsunami etc. whereas artificial mode is created by humans and is considered as the major cause of water pollution. It includes industrialization, urbanization, and entry of waste particle generated by human activities into water sources which pollute both surface and groundwater [6]. Water-related problems including both quality and quantity is the biggest threat to the world and unfortunately, India is also among one of its victims. A report published by Water Aid in 2016 ranked India as one of the worst nations in the world with a large population of people without potable water. According to a report, about 76 million people in India do not have any proper/reliable source of safe water and this condition is getting worst day by day [7]. In another article on water scarcity, it has been founded that 4 billion people approximately two- third of world population faces severe water scarcity at least one month of the year, out of this 4 billion people 1 billion lives in India only, this shows the actual condition of our nation [8].

In this context, the first step taken by Indian Government in 1972-1973 by Accelerated Rural Water Supply Program (ARWSP) for their active participation in rural drinking water supply, with having main aim to assist States/Union Territories so that coverage of drinking water supply can be accelerated. During 1972-1986, main focus was to provide safe and secure water to rural community with the help of Public Health Engineering system [9]. In 1986, government has started second generation program and launched Technology Mission on Drinking Water and Related Water Management, which was renamed in 1991-1992 as Rajiv Gandhi National Drinking Water Mission (RGNDWM). The main focus of this program was related to the water quality, new technology intervention, along with human resource development and various other means so that supply of water can be maintained in rural areas. Ministry of Rural Development (MoRD) in 1999, established a Department of Drinking Water Supply (DDWS), with main goal to emphasize not only proper water supply but sanitation also. The third Generation program started in 1999-2000 where new initiatives and reforms in the water sector projects has been started, which includes community participation in planning, implementation, and management of water supply projects. In continuation of these schemes, new interventions scaled up as Swajaldhara in 2002 [12]. In the subsequent fourth phase of Rural Water Supply Program, the main focus was drawn on ensuring sustainability in the availability of water with respect to convenience, adequacy, portability, equity, and affordability (India water portal). Ministry of Drinking Water and Sanitation Department of Drinking Water and Sanitation (formerly, Department of Drinking Water and Sanitation) launched a program named National Rural Drinking Water Program (NRDWP) in April 2009, with main aim to assist states in providing drinking water to a rural population of India [11]. Subsequently, a program is initiated under Bharat Nirman UPA Government (which aimed at addressing water quality problem in all the affected habitation by 2009). The main aim of this program was to provide adequate and clean drinking water by means of hand pumps, piped water supply etc. to rural areas. This program came into existence after merging three program namely Accelerated Rural Water Supply Program (ARWSP); Swajaldhara and National Rural Water Quality Monitoring & Surveillance (Ministry of rural development).

Now, one important question arises that whether the policies made under the above-mentioned programs are implemented

properly or not, if implemented then people of rural areas are satisfied with them or not. In the present study, we tried to figure out the satisfaction level of rural habitants about the source of water they are using along with the water demand and issues related to the water. In this study a sensible relation among the various factors were developed by using Principal Component Analysis and was further studied by rotation method in order to develop user's satisfaction regarding the water supply and management system.

2. BACKGROUND

This study is conducted in the world's seventh largest country with regard to area [12], second most populous nation [13] and considered to be the largest democratic country in the world i.e. India. It is a part of South Asia and located situated between 8°4' and 37°6' north latitude and 68°7' and 97°25' east longitude north of the equator [12]. Now, in terms of state, the present study is related to an area of a state which is the most populous having a population of 227,920,005 as per 2011 census of India [14]. The state is divided in to 18 divisions and 75 districts with Lucknow as capital and is the fourth largest area among Indian states with an area of 243,290 km_2. The present study is Bijnor which is one of the 75 districts present in Uttar Pradesh state. Location wise its latitude and longitude are 29.372442 and 78.135849 respectively and is a part of the Indo-Gangetic alluvial plain. Its maximum length from east to west is about 90 km and north to south is about 102 km and having Moradabad as Administrative division. General data about district Bijnor- Area in Sq.km- 4,561, Density/km_2- 807, Population-3,682,713, Population growth- 17.60%, Proportion to Uttar Pradesh Population- 1.84%, Sex Ratio (Per 1000)- 917, Average Literacy- 68.48%, Male Literacy- 76.56%, Female Literacy- 59.72%, Bijnor District Urban/Rural 2011- Out of total population, 25.13 percent lives in urban areas. Approximately, 925,312 people live in the urban region having and rest 74.87% population which is nearly 2757401 live in rural area. Religional aspect of Bijnor- There are mainly two religions Hindu (55.18%) and Muslims (43.04%) and rest include Sikh, Christian, Jain, and Buddhist [15]. Assembly Constituencies-Najibabad, Chandpur, Noorpur, Dhampur, Nagina, Bijnor, Barhapur and Nehtaur, total villages- 2,984 and a total number of household- 631075. It is clear from above census report that majority of the population live in rural areas of the district. Agriculture is the main source of income for this area and sugarcane is major crop along with Wheat, Paddy, Potato, Cereals etc. The main river of the district is Ganga and next river comes is East Ramganga river. Some rivers of the district include Ban, Khoh, Gangan, Karula, Malin, Chhoiya, Ekra, Pili, Dhara, Panili, and Phika. In Bijnor- most of the irrigation practices are done by private tube well which means groundwater is the main irrigation source and other sources include wells, ponds etc. Irrigation by canals is relatively lesser as compared to other parts of the state. About 1008 mm of precipitation falls in district annually with a monthly precipitation index of 43.074. Climate is sub-humid with June as the hottest month and January being the coldest. Characteristic vegetation is grassland, having a normal annual wind speed of 6.7 Km/hr [16].

The political map of Uttar Pradesh with district Bijnor as study area is highlighted in Fig.1 Total of 11 villages was selected, namely Akbrabad, Mohd. Ashiqpur Bhure 1, Larpur, Rajpura, Alha Heri, Mehsanpur, Shahpur Jamal Bila Ahatmali, Binjaheri, Puraini, Shahpur Jamal Ahatmali, and Siriawali as rural areas are considered to be main concern of the present study and were surveyed.

3. METHODOLOGY USED

3.1. DATA COLLECTION

In this study, the data is collected by conducting a survey in various villages of Bijnor District. For this purpose, first of all two categories were made, they are; (1) first category of villages in which there is supply of water by the Government agencies like UP Jal Board and (2) second category in which there is still no water supply by Government. In second category people are dependent on the groundwater sources like manually operated hand pumps and in some cases extracting water by means of electricity based hand pumps or submersible, which impart a huge burden on the groundwater of the region and is the main reason for depleting groundwater table. The survey consists of a set of open-ended questionnaire distributed to both category people, elected head of the village called as Gram Pradhan and other members of gram panchayat. Gram Pradhan gave basic necessary information about village like total population, the total number of households, distance from the main city, number of water connection, cost of water supply, a mechanism to store or treat water, electricity supply and cost of electricity along with information regarding members of water committee and water system operator. A survey from villagers consists of questions related to gender, the source of water, distance of the source from household, number of members in the household, water required by family in summer, winter and rainy season, water quality and quantity satisfaction along with issue related to water. Survey also consists of questions which cover Government approaches implemented for the betterment of the villages and a string of questions in order to find out the main problems of villages in terms of water and sanitation. The survey (data collection) was done in 25. In order to get authentic results, only those houses were interviewed which were residing in the village before the water supply was introduced in that village so that a clear vision of peoples towards water supply can be examined. Random sampling was done irrespective of gender, religion or age which includes both males, as well as female but emphasis, was given to the head of the individual houses along with other people, in order to analyze the maximum views about the water system. In this process, 11 villages were covered and data of 10 households from each village was taken into consideration, i.e. data was collected from total 110 houses of the study area.

3.2. PROCESSING OF DATA

Processing of data is performed by Factor Analysis tool, i.e. IBM's "Statistical Package for the Social Sciences" (SPSS) Software [17]. It is a widely used software which found great importance in the large number of fields including educational, health, market, government organizations, data mines, survey companies and others. Original manual of SPSS describes it as one of "sociology's most influential books" which allows researchers to do statistical analysis along data documentation and management as basic features of the software [18]. This software has great importance as it have the capability to analyze data of almost every format (e.g., binary, dollar, numeric, alphanumeric, time, date formats) and further it is able to generate charts, tabulated reports and plots of trends and distribution, complex and descriptive statistical analysis. It is highly used for iterative and non-iterative uses and has excellent data manipulation capability [16]. Factor Analysis tool was used for data processing in the present study and is one of the multivariate statistical methods of data reduction which leads to a clear understanding of correlation among the observed variables, by determining the nature and number of common factors needed to establish a relationship among variables [19]. Factor analysis is really helpful to process a large sample size data as it removes duplication and redundancy among correlated variables and represents correlated variables along with derived variables. This tool is really helpful in describing many variables and beneficial in regression analysis using only a few factors. In this study, we have used factor analysis for which Principal Component Analysis is used as the Extraction method, and Rotation method -Varimax with Kaiser Normalization is used for analysis of extracted data. Table 1 is Descriptive Statistics, which gives us basic information about variables in regard to their mean and standard deviation, it further shows maximum mean and standard deviation associated with B i.e.; number of family members in the household and minimum in case of quantity issue.

Where various alphabets can be denoted as follows:-

A= Gender of respondent, B= number of members in family, C= summer water requirement, D= rainy water requirement, E= winter water requirement, F= source of water, G= distance of source from house, H= water quality satisfaction, I= water quantity satisfaction, J= water quality issue, K= water quantity issue.

4. RESULTS AND DISCUSSION

After analyzing the above variables using Factor Analysis tool in

IBM SPSS following results were obtained. Table 2, is a correlation matrix, which is used to show relationship among the variables. The upper half of table contains Pearson correlation coefficient among all pair of variables and lowers half consists of the one-tailed significance of these coefficient, determinant value at bottom of the table is greater than 0.00001 signifies that multicollinearity issue is not associated with these data [20]. Correlation matrix is showing various relations but most important relation is that the number of family members (B) is directly related to water requirement, which is maximum in summer (C), followed by rainy (D) and winter (E), not satisfied with water quality (H) as well as quantity (I) and having issues related to both quality (J) and quantity (K). Source of water is showing a negative relation with water required in summer which means that the source is not satisfying the need of people of people whereas little satisfaction was founded in rainy and winter. Both, quality as well as quantity wise, people are mostly unsatisfied with the water which they are using.

Table 3- is very important, it gives an idea about the adequacy of the sample given by Kaiser-Meyer-Olkin Measure, a value greater than 0.5 is acceptable and our value 0.76 is more than 0.5 so, we can say factor analysis is appropriate for the sample [21]. Another test i.e. Bartlett's test which gives measures whether the original correlation matrix is an identity matrix or not, but in present study significance value (0.000) is obtained which was founded to be less than 0.05, which suggests that the correlation matrix is not an identity matrix. Further, this test is considered to highly significant for carrying out the factor analysis [22]. Table 4 or output gives the Eigen values of each and every component before & after extraction i.e. principal component analysis and rotation method. Eigen value basically represents the variance associated with that particular component and also representing Eigen value in terms of percentage of variance explained, the second column in each stage. Before extraction there are 11 components in the dataset (as same as total components), it is clear that the first few factors are showing more variance with respect to the subsequent factors. In extraction stage, 3 factors have been extracted having initial Eigen value greater than one, variance associated with these extracted factors are shown in Extraction Sums of Squared Loading. In Rotation Sums of Squared Loading, Eigen value associated with extracted factor after rotation is displayed. Rotation is done in order to equalize the relative importance of extracted factor. Table 5 shows communalities. Communalities denotes variance explained by the factors, in initial all variance are assumed to be common hence communalities are same before extraction. In extraction column values are showing common variance in data structure it interprets that 16.5% of variance associated with A (gender) is common or shared variance or it is showing the individual variable's variance explained by factors retained after extraction. Fig.2 is Scree Plot graph and plotted between Eigen value and Component number and it shows inflexion point on the curve, it is another way to figure out how many factors has to be extracted, in this case three factors are retained after extraction as subsequent factors variance proportion is quite less as compared to the first three factors. Table 6 is Rotated Component Matrix or Rotated Factor Matrix showing the correlation among factor and variables as well as variables weightage for each factor. This is the most important result in interpreting the factor analysis. We may observe that factor 1 is highly correlated with variable C, B, D, and E we can say factor 1 is associated with domestic water demand, factor 2 is related to K and J somewhere showing water problem and in the same way factor, 3 is correlated with G and F indicating water source using.

5. CONCLUSIONS

By making a sensible relation among 3 factors discussed in Rotated Component Matrix, it can be concluded that most of the people are not satisfied with the water provided to them in terms of both quality as well as quantity. Existing sources whether authorized agencies for water supply or other conventional sources are not fulfilling the water requirement of rural communities, challenges are not limited to provide water supply to those rural areas which still lacking supply system but it is also associated with the dissatisfaction reported among the people with the supply system provided. Authorities involved in the management of rural water supply should be flexible enough so that they may find the issues related with the water supply like inappropriate hours of supply as well as fall in pressure of water after some distance. Numerous issues related to quality in areas using hand pumps placed at shallow depth including colour, taste, odour, smell etc. Policies should be made to resolve them as soon as possible- as the most important thing is user's satisfaction as they are the ones for which supply system is designed and better way of life to a large population residing in rural area should be provided.

ACKNOWLEDGMENT

The authors wish to acknowledge Department of Civil Engineering, Bundelkhand Institute of Engineering & Technology, Jhansi. Special thanks to people of villages along with elected head and members of gram panchayat for providing necessary information about the water supply system. This research did not received any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

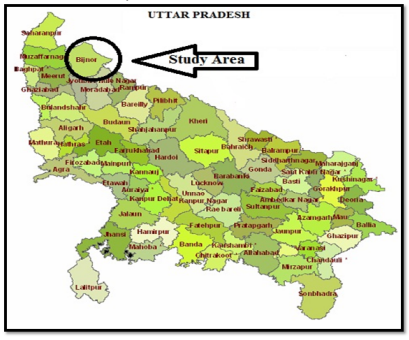

Fig.1- Political map of Uttar Pradesh.

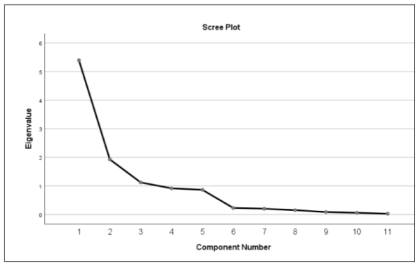

Fig.2- Scree Plot graph.

Table 1- Descriptive Statistics

	Mean	Std. Deviation	Analysis N
A	1.45	.500	110
B	8.718	2.60251	110
C	4.25	.840	110
D	3.81	.796	110
E	2.93	.673	110
F	2.16	.862	110
G	1.95	1.214	110
H	1.63	.486	110
I	1.75	.438	110
J	1.39	.490	110
k	1.27	.447	110

Table 2- Correlation matrix

		A	B	C	D	E	F	G	H	I	J	K
Correlation	A	1.000	0.283	0.203	0.220	0.262	0.102	0.095	-0.240	-0.179	0.242	0.179
	B	0.283	1.000	0.915	0.851	0.810	0.049	0.013	-0.556	-0.547	0.540	0.524
	C	0.203	0.915	1.000	0.801	0.812	-0.033	0.002	-0.440	-0.446	0.425	0.424
	D	0.220	0.851	0.801	1.000	0.779	0.046	0.010	-0.518	-0.562	0.499	0.508

	E	0.262	0.810	0.812	0.779	1.000	0.179	0.097	-0.532	-0.562	0.504	0.523
	F	0.102	0.049	-0.033	0.046	0.179	1.000	0.769	-0.379	-0.229	0.346	0.169
	G	0.095	0.013	0.002	0.010	0.097	0.769	1.000	-0.184	0.030	0.153	-0.061
	H	-0.240	-0.556	-0.440	-0.518	-0.532	-0.379	-0.184	1.000	0.499	-0.962	-0.457
	I	-0.179	-0.547	-0.446	-0.562	-0.562	-0.229	0.030	0.499	1.000	-0.473	-0.907
	J	0.242	0.540	0.425	0.499	0.504	0.346	0.153	-0.962	-0.473	1.000	0.472
	K	0.179	0.524	0.424	0.508	0.523	0.169	-0.061	-0.457	-0.907	0.472	1.000
Sig.(1-tale)	A		0.001	0.017	0.010	0.003	0.143	0.162	0.006	0.031	0.006	0.031
	B	0.001		0.000	0.000	0.000	0.304	0.445	0.000	0.000	0.000	0.000
	C	0.017	0.000		0.000	0.000	0.367	0.490	0.000	0.000	0.000	0.000
	D	0.010	0.000	0.000		0.000	0.317	0.459	0.000	0.000	0.000	0.000
	E	0.003	0.000	0.000	0.000		0.031	0.157	0.000	0.000	0.000	0.000
	F	0.143	0.304	0.367	0.317	0.031		0.000	0.000	0.008	0.000	0.039
	G	0.162	0.445	0.490	0.459	0.157	0.000		0.027	0.379	0.055	0.262
	H	0.006	0.000	0.000	0.000	0.000	0.000	0.027		0.000	0.000	0.000
	I	0.031	0.000	0.000	0.000	0.000	0.008	0.379	0.000		0.000	0.000
	J	0.006	0.000	0.000	0.000	0.000	0.000	0.055	0.000	0.000		0.000
	K	0.031	0.000	0.000	0.000	0.000	0.039	0.262	0.000	0.000	0.000	

Table 3- KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.760
Bartlett's Test of Sphericity	Approx. Chi-Square	1190.799
1	df	55
2	Sig.	00

Table 4- Total Variance Explained

	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.395	49.044	49.044	5.395	49.044	49.044	3.669	33.355	33.355
2	1.931	17.550	66.594	1.931	17.550	66.594	2.774	25.223	58.577
3	1.124	10.215	76.809	1.124	10.215	76.809	2.005	18.231	76.809
4	.916	8.329	85.137						
5	.865	7.866	93.004						
6	.229	2.084	95.088						
7	.204	1.857	96.945						
8	.154	1.401	98.346						
9	.090	.815	99.161						
10	.062	.564	99.726						
11	.030	.274	100.000						

Table 5- Communalities

	Initial	Extraction
A	1.000	.165
B	1.000	.921
C	1.000	.901
D	1.000	.827
E	1.000	.814
F	1.000	.865
G	1.000	.839
H	1.000	.719
I	1.000	.855
J	1.000	.689
K	1.000	.853

Table 6- Rotated Component Matrix

	Component		
	1	2	3
A	.351	.063	.194
B	.902	.327	-.009
C	.928	.186	-.071
D	.841	.344	-.025
E	.829	.342	.097
F	-.040	.225	.901
G	.057	-.134	.904
H	-.417	-.612	-.413
I	-.281	-.881	.016
J	.397	.619	.385
K	.243	.889	-.064

REFERENCES

[1] Bibi, S.; Khan, R. U.; Nazir, R.; Khan, P.; Rehman, H. U.; Shakir, S. K.; Jan, R. Heavy Metals Analysis in Drinking Water of Lakki Marwat District, KPK, Pakistan. 2016, World applied sciences journal, 34(1), 15-19.

[2] Pawari, M. J.; Gawande, S. A. Ground water pollution & its consequence. 2015, International journal of engineering research and general science, 3(4), 773-76.

[3] Montgomery, M.A.; Elimelech M. Water and sanitation in developing countries: including health in the equation. 2007, Environmental Science & Technology 41:17–24.

[4] Khan, N.; Hussain, S. T.; Saboor, A.; Jamila, N.; Kim, K. S. Physicochemical investigation of the drinking water sources from Mardan, Khyber Pakhtunkhwa, Pakistan. 2013, International journal of physical sciences, 8(33), 1661-1671.

[5] Schweitzer, R. W.; Mihelcic, J. R. Assessing sustainability of community management of rural water systems in the developing world. 2012, Journal of Water Sanitation and Hygiene for Development, 2(1), 20-30.

[6] Kamble, S. M. Water pollution and public health issues in Kolhapur city in Maharashtra. 2014, International journal of scientific and research publications, 4(1), 1-6.

[7] WaterAid India, WaterAid India Brochure. http://wateraidindia.in/our-impact/publications/page/7/

[8] Mekonnen, M. M.; Hoekstra, A. Y. Four billion people facing severe water scarcity. 2016, Science advances, 2(2), e1500323.

[9] Department of water supply and sanitation, Government of Punjab http://www.pbdwss.gov.in/dwss/left_menu/major_schemes_projects.html

[10] India water portal, http://www.indiawaterportal.org/articles/national-rural-drinking-water-programme-framework-implementation-mord-2010.

[11] Ministry of Drinking Water and Sanitation. https://swachhindia.ndtv.com/76-million-dont-have-safe-drinking-water-indias-looming-water-crisis-5606/.

[12] Geography of India, https://en.wikipedia.org/wiki/Geography_of_India.

[13] Demographics of India, https://en.wikipedia.org/wiki/Demographics_of_India.

[14] Demographics of Uttar Pradesh,https://en.wikipedia.org/wiki/Demographics_of_Uttar_ Pradesh.

[15] Bijnor District: Census data. 2011, http://www.census2011.co.in/census/district/505-bijnor.html.

[16] Budhauliya, A.K., 2012-2013. Ground water brochure of Bijnor district, Uttar Pradesh.

[17] Quintero, D.; Ancel, T.; Cassie, G.; Ceron, R.; Darwish, A.; Felix, G.; & Pal, S. Workload optimized systems: Tuning POWER7 for analytics. 2013, IBM Redbooks.

[18] Wellman, M. P., & Hu, J. (1998). Conjectural equilibrium in multiagent learning. Machine Learning, 33(2-3), 179-200.

[19] Arkkelin, D. 2014, Using SPSS to understand research and data analysis.

[18] Conway, J. M.; Huffcutt, A. I. A review and evaluation of exploratory factor analysis practices in organizational research. 2003, Organizational research methods, 6(2), 147-168.

[20] Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. Tutorials in quantitative methods for psychology, 9(2), 79-94.

[21] Kaiser, M. O. Kaiser-Meyer-Olkin measure for identity correlation matrix. 1974, Journal of the Royal Statistical Society, 52, 296-298.

[22] Williams, B.; Onsman, A.; Brown, T. Exploratory factor analysis: A five-step guide for novices. 2010, Australasian Journal of Paramedicine, 8(3).