Measuring the Opinion of Textile Industries of Punjab (India) towards the Reliability of their Connected Power Systems and its Effects on the Industrial Operations.

Harjit Singh Mangat[1*], Dr Harpuneet Singh[2]

[1] *PhD Research Scholar, Department of Mechanical Engineering, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India*

E-mail: mangat84@gmail.com

[2] *Assistant Professor, Department of Production Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab, India*

E-mail: prof.harpuneetsingh@gmail.com

Abstract: The purpose of this research was to measure the opinion of textile industries of Punjab (India) towards the reliability of their connected power systems of the sole public utility company- Punjab State Power Corporation Limited considering the period from 2010 to 2014. Out of the 400 randomly selected, 148 registered textile industrial units from Central, North and South Punjab, respectively, were responded successfully by conducting the interviews using a questionnaire schedule and dropping questionnaires with the responders, over a period of two years from April 2015-April 2017 which revealed that majority of the industries from the whole Punjab was discontented towards the occurrence of planned outages, unplanned outages and load shedding, work efficiency of staff, condition of infrastructure and tariff structure except the limited number of units from Central Punjab that have shown agreement towards the different aspects of power system reliability. An internal consistency and intra-rater reliability using Cronbach's alpha and Krippendorff's Alpha, respectively, calculated, was found very decent. A Kruskal Wallis test was applied and mean rank of Central Punjab was found considerably higher followed by South and North Punjab for the majority of the variables. Dunn's Bonferroni Post Hoc exposed that a Central Punjab is significantly different from both North and South Punjab but no statistical difference was found between the North and South Punjab. A Kruskal Wallis test statistic (H) and Mann Whitney test statistics (U) was used to calculate the overall effect sizes and the effect sizes between the groups for all the dependent variables, respectively. Out of the forty variables, thirty-three has shown the statistically significant difference from which twenty-eight, three and five were found in the zone of large, intermediate and small effect size, respectively.

Keywords: Reliability, Power Systems, Questionnaire Schedule, Cronbach's alpha, Krippendorff's Alpha, Kruskal Wallis Test, Bonferroni Post Hoc Test, Mann-Whitney U Test, Effect Size, Punjab (India)

1. INTRODUCTION

Electricity is one of the most important inventions that science has given to the humankind. The survival of the modern civilization is almost impossible in the absence of electric power. Electricity has been playing a foremost role in the growth and development of the entire world since the day it was commercialized. The economy of the whole world is driven by the electric power as almost every system needs an electricity as an input for its functioning. India is a densely populated developing country with a population of around 1.34 billion (2017), globally ranked second after China [8]. Such a big population is considered to be the prominent reason

---

* Corresponding author: mangat84@gmail.com

for the exponential increase in the demand for electric power supply. Additionally, more and more industries and commercial businesses are being established with a very fast pace which is adding burden to the already existing power systems. An electricity distributor can't promise for the continuous power supply because the power system can never be 100 per cent reliable.

A very bulk complex infrastructure is involved at all the three levels of electricity i.e. generation, transmission and distribution which not only includes just the electrical components but also have mechanical and electronic components too. Any failure of these components may occur due to natural calamities, ageing of the components or by any other cause can lead to an interruption of the electric power supply. Any disruption in electric power not only causes inconvenience but also have firm noticeable impacts. In the residential sector, it can impact the psychology and can become the major cause of discomfort and boredom which ultimately reduces the performance of individuals in other tasks. In other sectors such as commercial, industrial and agricultural, any interruption in electric power is equivalent to the loss of economy. The occurrence of outages of planned and unplanned nature has been a major concern for the industries since ages. In 2009, Zimbabwe lost US$1.8 billion which was 33% of their GDP [11]. Another study from Accra (Ghana) revealed that small and medium enterprises were incapable of producing improved quantities and quality indicating poor sales that resulted in low levels of profitability because of the power outages [4]. In Zimbabwe, about 10,000 jobs were gone and about 25% of businesses were closed due to power outages and load shedding, at the end of 2007. Over a period of 2010-2013, an average of 24 monthly power outages was recorded which had an unwanted effect on the production efficiency of industries in Africa [1]. A customer survey conducted in Nepal for the years 2008-10 revealed that electricity supply outage costs experienced by the customers were found significantly higher than current electricity rates [10]. The study presented here is the first ever effort in the region to measure the opinion of textile industries of Punjab for the period 2010-2014 towards the reliability aspects of their connected power systems of the sole public utility company, Punjab State Power Corporation Limited. All the definitions, terms and concepts that are relevant to the study are thoroughly discussed in the succeeding sections. The facets with supporting statistics pertaining to the utility company, power system reliability and textile industries, respectively, are discussed below:

1.1. Description of Utility Company

India lines sixth in terms of power generation. Around 65% of the electricity used in India is produced by thermal power, 22% by hydroelectric power , 3% by nuclear power and remaining by 10% from other alternative sources such as solar, wind, biomass etc. [9]. Punjab, one of the northernmost states of India has only two public utility companies: Punjab State Power Corporation Limited (POWERCOM) also called P.S.P.C.L allocated with the key functions of generation and distribution, and (b) Punjab State Transmission Corporation Limited (TRANSCO) also called P.S.T.C.L assigned with the main role of transmission. The Punjab State Power Corporation Limited serves residential, commercial, industrial and agriculture sector in South Zone, West Zone, Central Zone, North Zone, and Border Zone of Punjab with a total installed generation capacity of 11054 MW as on 31 March 2015. In Punjab, the electricity is primarily produced by thermal and hydropower. At the end of the financial year 2014-15, a total connected load of 31859 MW was evident from the official website of P.S.P.C.L. In terms of percentage share, the connected load of the general, industrial, agricultural and others sectors are 44.8, 26.6, 27.2 and 1.4 per cent, respectively [24].

1.2. Concepts of power system reliability

From the power system reliability point of view, the downtime may occur at industrial premises because of the broadly three reasons: (a) planned outages, (b) unplanned outages and (c) load shedding. The ability of a component or system to perform required functions under stated conditions for a stated period of time is called power system reliability. Power system

reliability has been categorized into system adequacy and operating reliability. "Adequacy" is the capability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers continuously, considering planned and reasonably expected unplanned outages of system components. "Operating reliability" is the capability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system components [19,22]. The total loss of electric power on, at least, one normally energized conductor to one or more customers connected to the distribution portion of the system is called an "outage". The time period from the initiation of an interruption until service has been restored to the affected customers is called outage duration.

A planned outage arises when electrical lines or equipment have to be temporarily taken out of service for repair or to allow network maintenance and alterations. A planned outage will be scheduled in advance and affected customers will be made alert of the outage before it arises. An unplanned outage is a consequence of the loss of a section of the network due to a fault, which can include: equipment failure, cable faults, damage by third parties, lightning strikes, high winds, pole fires, trees or branch interference, bird or animal interference etc. In these situations, there is no possibility of giving customers an early warning of an approaching outage [6]. Load shedding can be required when there is an inequality between electricity demand (customers' usage) and electricity supply (the ability of the electricity network to generate and transport the required amount of electricity to meet this demand). To relieve the burden on themselves and their consumers, providers may begin to share electricity. The flow of electricity is discontinued in one area for a predetermined amount of time. Then, supplies are reconnected in that region and disconnected somewhere else. In several cases, people in the affected regions, especially the businesses that are dependent on power are notified in advance. For firms in the manufacturing sector, this implies that they cannot run their machinery and therefore cannot produce [25].

1.3. Description of textile industries at the national and regional level

India positions second after China in the worldwide textile trade with 8 per cent of the total. It also lines second to China in the making of both cotton yarn and fabric and fifth in the creation of synthetic fibres and yarns [3]. It accounts for 14 per cent of total industry output and almost 5 per cent of Gross Domestic Product (GDP) [12]. Unlike other foremost textile-producing nations, India's textile industry is covered typically of small-scale, non-integrated spinning, weaving, finishing, and apparel-making enterprises. This sole industry structure is principally a inheritance of government strategies that have encouraged labour-intensive, small-scale operations and discriminated against larger scale industries. Punjab is amongst the major producers of cotton and blended yarn along with mill-made fabrics in India. Ludhiana is often referred to as the 'Manchester of India [7].

Punjab has arisen as a main center for textile-based industries including yarn, readymade garments and hosiery. The textile business accounts for 19% of the entire industrial production of Punjab and pays about 38% of the whole exports from the state. Amritsar, Ludhiana and Panipat- the three chief textile centres in North India- are strongholds in their corresponding areas of knitting, hosiery and carpets and industrial yarns. The joint problems faced by these industries are like the high tariff, power outages, deficiency of modernization and inconsistent policies of the State Governments [18]. As per the district wise reports of Ministry of micro, small and medium enterprises, the joint problem confronted by all type of industries was the unreliable power supply and costly tariff rate [16]. Comprising all types of industries, there were only 446 medium and large scale industries in Punjab against the huge count of 111743 micro and small scale industries in the state [15]. Based on the nationwide classification, the firms whose investment in plant and machinery does not increase 25 lakh rupees are called micro-scale enterprises, the firms with investment between 25 lakh and 05 crore rupees in plant

and machinery are termed as small-scale enterprises and the firms having investment in plant and machinery more than 05 crore rupees are known as medium scale enterprises [17].

2. METHODOLOGY

An extensive literature review was done before the commencement of the study and it has been found that a considerable research has been done on the impact of power outages on residential, commercial, industrial and agriculture sector throughout the world that involved the use of questionnaire containing a considerable number of questions related to cost patterns of industries. Most of the previous research studies were conducted at macro level using customer survey approach in which the sample is highly distributed over a large geographical region making the process expensive and also they consider the industrial sector as a whole without focussing on subsectors or categories of industries. This is evident from the studies contributed by big organizations by World Bank [2], Berkley Lab [13], Nexant SARI/Energy [20] considering both developing and developed countries.

Numerous calculations are needed to assess the cost of different duration of outages in hypothetical scenarios that are very helpful to understand the broad impact of power outages on different sectors but other aspects are not covered in these studies. This fact is evident from the studies [23,27,21]. Generally, the industries have very busy schedules and moreover majority of the time they are found not to disclose their confidential cost information which makes the response rate very poor. Therefore, it was decided to conduct a micro level regional study to make the state government aware of the situation of electric power by measuring the opinion of the textile consumers towards the different aspects of power system reliability by presenting the results in a simple and effective manner. A very limited number of studies related to the power system reliability and its impact on industrial sector were conducted in India. In order to cover this gap, a decision was made to perform the study at the regional state level by considering only the industrial textile sector of Punjab which is considered to be playing the major role in the economy of Punjab. Every industry depends on an interconnected network of generation, transmission and the distribution to run different processes of an industry. Even a high reliable power system sometimes can be hit by the natural disasters which outcomes in unplanned outages that are unavoidable. A duration of unplanned power outage because of the occurrence of the fault in a power system is not generally the same for industrial units but most of the times this length becomes prolonged because of the inability of the industry to bring back the production system to normal operation i.e. the power system may recover immediately say after 5 minutes of unplanned outage but the outage of this unannounced nature results in damage of in-process materials in the industries which requires cleanup adding additional restart costs. Depending on the type of industry, the recovery time may be as low as minutes or few hours but for some industries involving critical operations may last up to a considerable number of days. A database of 1756 registered textile industries of Punjab was created to form a population list which contains the name of the company, location and their postal addresses.

These companies were obtained from the following sources: Ministry of corporate affairs and Micro, Small and Medium Scale Enterprises (MSMEs). After removing the common industries and the industries falling in the districts with low concentration, a final sampling frame of 1163 registered textile consumers representing a population from Central Punjab (District-Ludhiana), North Punjab (Districts- Amritsar and Jalandhar) and South Punjab (Districts- Patiala and Mohali) was obtained. A total of 400 industries were randomly selected from a sampling frame of 1163 industries out of which 257 industries were from Central Punjab (District-Ludhiana), 86 from North Punjab (Districts- Amritsar and Jalandhar) and 55 from South Punjab (Districts-Patiala and Mohali). A questionnaire schedule was designed which contains the simple demographic questions and 7-point Likert scale questions. A pilot testing of the questionnaire schedule was performed which involved brainstorming sessions

and important discussions with the management and shop floor staff of textile consumers resulted in modifications, changes and deletion of some questions. Most of the responses (more than 90%) were achieved by conducting face to face interviews with shop floor and management staff by taking the appointments and few were accomplished through dropping the questionnaire schedule with the responder for a set period of time. Sometimes multiple visits were made to the different responders in order get the pending questions of the questionnaire schedule filled in a manner desired. During the survey process, it was observed that large and medium scale industries were marginally very less. Moreover, it is evident from the official website of MSME as mentioned above. Also, because of their busy schedules, they were not interested to take part in the questionnaire filling process. So, it was decided not to consider these industries in the sample. Only the completed questionnaire schedules are considered in the study. Over a period of 2 years from April 2015 to April 2017, a total of 169 textile industries were responded, however, a response of 148 industries was found complete and valid. Out of total 148 successful responders, 84 industries were found from Central Punjab (District-Ludhiana), 40 from North Punjab (Districts- Amritsar and Jalandhar) and 24 from South Punjab (Districts-Patiala and Mohali).

3. RESULTS AND ANALYSIS

A software package SPSS 24 was used for most of the data analysis however for calculating the Krippendorff's Alpha- an ordinal reliability measure, SPSS syntax (macro) was used which otherwise was absent in SPSS menu [5]. Further, as there was no provision of calculating effect sizes after Kruskal Wallis and Mann-Whitney U in SPSS, an online effect size calculator was used [14]. The formulas that are used for the calculation of effect size are thoroughly explained in the research article [26]. A Tableau Desktop 2018.1 software package was used to draw diverged 100 per cent stacked bar charts in order to visualize the data effectively. An internal consistency measure calculated using Cronbach's alpha was found very decent for all the variables. Moreover, an intra-rater reliability measure Krippendorff's Alpha for all the three independent groups was also calculated, separately, which was also found very good.

The results of reliability are shown in Table 3.1. A Kruskal Wallis test was applied to determine if there are statistically significant differences between three levels of an independent variable on a 7-point Likert scale ordinal dependent variables, separately, which are shown in the tables for the different categories of variables. Dunn's Bonferroni Post Hoc was applied to know further the statistically significant difference between the groups. A Kruskal Wallis test statistic (H) and Mann-Whitney test statistics (U) was used to calculate the overall effect sizes and the effect sizes between the groups for all the dependent variables, respectively. Figure 3.1 shows the overall orientation of textile industries of Punjab (India) towards the various aspects of power system reliability. In all the tables, the p-values are shown inside the round brackets together with the test statistics, with significant and insignificant values in the normal and italics bold font, respectively. In all the 100 per cent diverged stacked charts depicted as figures, only the Likert scale categories with maximum percentage are shown as labels on either side of the charts. In the tables, η_{1-2} and η_{3-1} depict the effect sizes for the group combinations 1-2 and 2-3 respectively. Also, LE, IE and IE stand for large effect, intermediate effect and small effect sizes, respectively. The legend shown below is showing the colour coding of the seven ordinal categories of the dependent variables used in the 100 per cent diverged stacked charts.
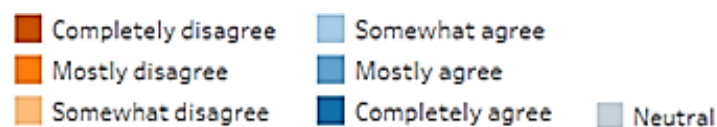

Completely disagree   Somewhat agree
Mostly disagree   Mostly agree
Somewhat disagree   Completely agree   Neutral

Table 3.1. Reliability measures of the survey responses

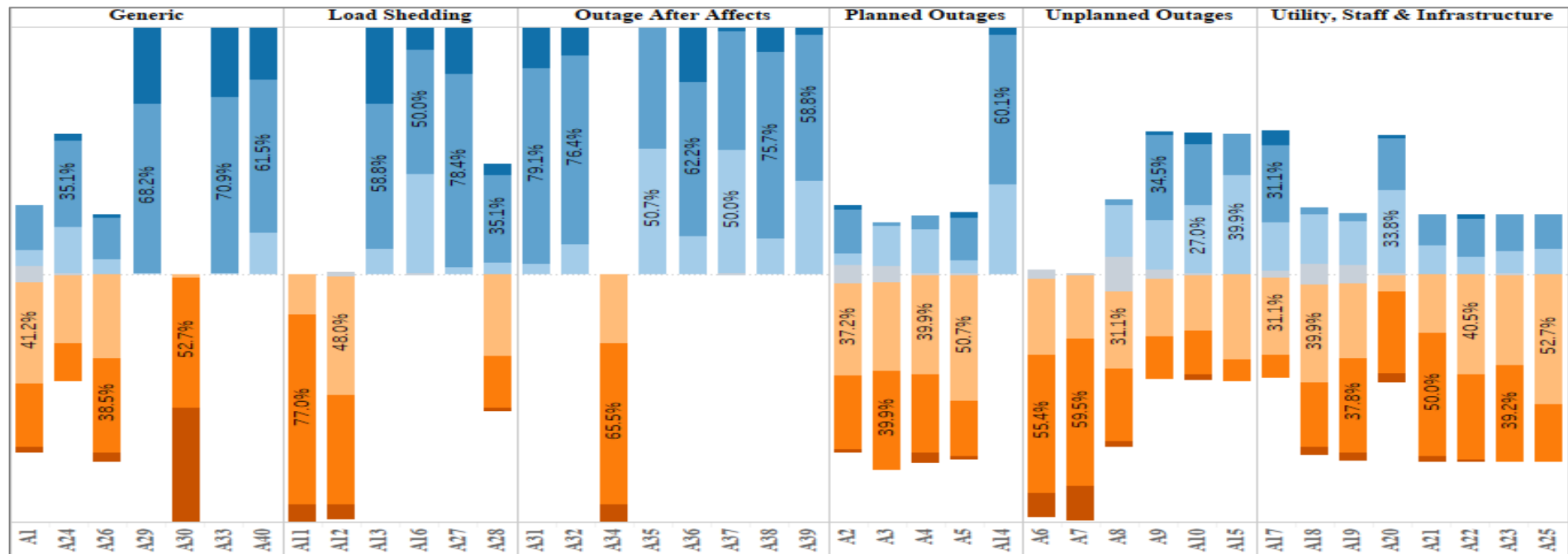| Opinion survey of textile industries towards power system reliability (2010 to 2014)						Time frame: April 2015-April 2017
CD = Completely Disagree (1)	MD = Mostly Disagree (2)	SD = Somewhat Disagree (3)	N = Neutral (4)	SA = Somewhat Agree (5)	MA = Mostly Agree (6)	CA = Completely Agree (7)
Independent Variable (Location)	Districts (Punjab)	Responders (Textile Industries)		Reliability (Krippendorff's Alpha)	Reliability (Cronbach's Alpha)	
1. Central Punjab	Ludhiana	84		0.63	0.95	
2. North Punjab	Amritsar & Jalandhar	40		0.79		
3. South Punjab	Patiala & Mohali	24		0.79	Confidence Level= 0.95	
Total		148		0.61	Significance Level= 0.05	

Figure 3.1. Overall percentage orientation of textile industries towards the different aspects of power system reliability.

A statistical analysis summary of the dependent variables related to planned outages is presented in Table 3.2. A Kruskal-Wallis test was conducted on the dependent variables A1-A5 and A14 that are shown in the Table 3.2 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" ($n = 84$), "North Punjab" ($n = 40$) and "South Punjab" ($n = 24$) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ^2 (Degree of Freedom) = Test Statistics Value, p-value. The H or χ^2 test statistics values for the variables A2, A3, A4, A5 and A14 are 87.363, 25.906, 37.206, 45.025 and 48.412, respectively. Thereafter, effect sizes (η_H^2) for all the variables were calculated using the online effect size calculator and were found in the zone of large effect. The effect sizes (η_H^2) calculated for the variables A2, A3, A4, A5 and A14 are 0.589, 0.165, 0.243, 0.297 and 0.320, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < .0167$ level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab ($p = 0.000$) and Central Punjab and South Punjab ($p = 0.000$) geographical location groups, but not between the North Punjab and South Punjab geographical location groups. For all the variables, mean rank was found higher for Central Punjab followed by South Punjab and North Punjab except for the variable A14 in which the mean rank for North Punjab is higher than South Punjab. Moreover, most of the effect sizes (η_U^2) for the statistical significant groups also came in the zone of large effect except for the group 1-3 (Central Punjab and South Punjab) under the variables A3 and A4 which were found in the zone of intermediate effect. The effect sizes were calculated from the U test statistics of Mann Whitney U test. The effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A2, A3, A4, A5 and A14 are 0.502, 0.153, 0.229, 0.252 and 0.158, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A2, A3, A4, A5 and A14 are 0.348, 0.084, 0.114, 0.150 and 0.233, respectively. The values of effect sizes, $\eta^2 \geq 0.0390$, are considered to be falling in the zone of the desired effect. The zone with values of effect sizes from 0.060-0.110 is called the zone of intermediate effect and values greater than 0.140 shows the large effect as per [14].

A statistical analysis summary of the dependent variables related to unplanned outages is presented in Table 3.3. A Kruskal-Wallis test was conducted on the dependent variables A6-A10 and A15 that are shown in the Table 3.3 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" ($n = 84$), "North Punjab" ($n = 40$) and "South Punjab" ($n = 24$) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ^2 (Degree of Freedom) = Test Statistics Value, p-value except for the variable A7 in which the score was not found significantly different. The H or χ^2 test statistics values for the variables A6, A8, A9, A10 and A15 are 57.627, 86.318, 116.024, 114.728 and 121.615, respectively however for the non-significant variable A7, the value was found 2.947. Thereafter, effect sizes (η_H^2) for all the variables, were calculated using the online effect size calculator and were found in the zone of large effect except for the variable A7 which were found in the zone of "no effect" effect. The effect sizes (η_H^2) calculated for the variables A6, A7, A8, A9, A10 and A15 are 0.384, 0.007, 0.582, 0.786, 0.777 and 0.825, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < 0.0167$ level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab ($p = 0.000$) and Central Punjab and South Punjab ($p = 0.000$) geographical location groups, but not between North Punjab and South

Table 3.2. Analysis summary of dependent variables related to planned outages

Dependent Variables	Levels of Independent Variable	Survey Response							Kruskal Wallis		Dunn's Bonferroni Post Hoc		Mann-Whitney U Post Hoc	
		CD	MD	SD	N	SA	MA	CA	Test Statistic	Mean Rank	Group	Test Statistics (p-values)	Test Statistic	η_U^2
A2- Number of planned electric power outages your firm has experienced annually were negligible	1. Central Punjab	0	1	36	11	7	26	3	87.363 (0.000)	101.95	1-2	66.221 (0.000)	204 (0.00)	0.502
	2. North Punjab	2	28	10	0	0	0	0		35.73	*2-3*	*-7.338 (1.000)*	*405 (0.204)*	*0.017*
	3. South Punjab	0	15	9	0	0	0	0		43.06	3-1	58.884 (0.000)	178.5 (0.00)	0.348
	Total Sample	2	44	55	11	7	26	3	Effect Size: η_H^2= 0.589 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A3- Average duration of planned power outages your firm has experienced was negligibly small	1. Central Punjab	0	24	24	10	24	2	0	25.906 (0.000)	89.07	1-2	36.671 (0.000)	864 (0.00)	0.153
	2. North Punjab	0	24	16	0	0	0	0		52.40	*2-3*	*-7.933 (1.000)*	*412 (0.274)*	*0.014*
	3. South Punjab	0	11	13	0	0	0	0		60.33	3-1	28.738 (0.006)	600 (0.002)	0.084
	Total Sample	0	59	53	10	24	2	0	Effect Size: η_H^2= 0.165 (Large Effect)				η_{1-2}= LE & η_{3-1}= IE	
A4- Advance notification was given well in advance in an event of planned outage	1. Central Punjab	0	18	30	2	26	8	0	37.206 (0.000)	92.00	1-2	44.775 (0.000)	684 (0.00)	0.229
	2. North Punjab	4	21	15	0	0	0	0		47.23	*2-3*	*-11.483 (0.822)*	*385 (0.144)*	*0.027*
	3. South Punjab	2	8	14	0	0	0	0		58.71	3-1	33.292 (0.001)	534 (0.00)	0.114
	Total Sample	6	47	59	2	26	8	0	Effect Size: η_H^2= 0.243 (Large Effect)				η_{1-2}= LE & η_{3-1}= IE	
A5- Electric power was restored within the stipulated time frame in an event of planned outage	1. Central Punjab	0	8	38	2	7	26	3	45.025 (0.000)	93.42	1-2	46.942 (0.000)	635 (0.00)	0.252
	2. North Punjab	2	17	21	0	0	0	0		46.48	*2-3*	*-8.525 (1.000)*	*404 (0.223)*	*0.017*
	3. South Punjab	0	8	16	0	0	0	0		55.00	3-1	38.417 (0.000)	464 (0.00)	0.150
	Total Sample	2	33	75	2	7	26	3	Effect Size: η_H^2= 0.297 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A14- Utility people keep record of every planned outage your firm has experienced	1. Central Punjab	0	0	0	0	11	68	5	48.412 (0.000)	92.43	1-2	36.335 (0.000)	852 (0.00)	0.158
	2. North Punjab	0	0	0	0	24	16	0		56.10	*2-3*	*13.704 (0.445)*	*388 (0.117)*	*0.025*
	3. South Punjab	0	0	0	0	19	5	0		42.40	3-1	50.039 (0.000)	329.5 (0.00)	0.233
	Total Sample	0	0	0	0	54	89	5	Effect Size: η_H^2= 0.320 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	

Table 3.3. Analysis summary of dependent variables related to unplanned outages

Dependent Variables	Levels of Independent Variable	Survey Response							Kruskal Wallis H		Dunn's Bonferroni Post Hoc		Mann-Whitney U Post Hoc	
		CD	MD	SD	N	SA	MA	CA	Test Statistic	Mean Rank	Group	Test Statistics (p-values)	Test Statistic	η_U^2
A6- Number of unplanned electric power outages your firm has experienced annually was negligible	1. Central Punjab	0	35	44	5	0	0	0	57.627 (0.000)	95.35	1-2	49.376 (0.000)	564 (0.00)	0.287
	2. North Punjab	10	29	1	0	0	0	0		45.98	*2-3*	*-3.087 (1.000)*	*454.5(0.646)*	*0.002*
	3. South Punjab	5	18	1	0	0	0	0		49.06	3-1	46.289 (0.000)	372 (0.00)	0.205
	Total Sample	15	82	46	5	0	0	0	Effect Size: η_H^2= 0.384 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A7- Average duration of unplanned power outages your firm has experienced was negligibly small	1. Central Punjab	11	47	25	1	0	0	0	*2.947 (0.229)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	9	23	8	0	0	0	0						
	3. South Punjab	1	18	5	0	0	0	0						
	Total Sample	21	88	38	1	0	0	0	Effect Size: η_H^2= 0.007 (No Effect)					
A8- Responsiveness of utility people was rapid in an event of unplanned outage	1. Central Punjab	0	2	28	20	31	3	0	86.318 (0.000)	102.11	1-2	64.207 (0.000)	227 (0.00)	0.486
	2. North Punjab	2	27	10	1	0	0	0		37.90	*2-3*	*-0.975 (1.000)*	*469 (0.857)*	*0.00*
	3. South Punjab	2	14	8	0	0	0	0		38.88	3-1	63.232 (0.000)	142 (0.00)	0.379
	Total Sample	4	43	46	21	31	3	0	Effect Size: η_H^2= 0.582 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A9- Utility always communicated with the cause of outage in an event of unplanned outage	1. Central Punjab	0	0	0	1	30	51	2	116.024 (0.000)	106.48	1-2	75.476 (0.000)	1.5 (0.00)	0.649
	2. North Punjab	0	18	19	3	0	0	0		31.00	*2-3*	*-4.083 (1.000)*	*418.5(0.333)*	*0.011*
	3. South Punjab	0	7	16	1	0	0	0		35.08	3-1	71.393 (0.000)	0.5 (0.00)	0.513
	Total Sample	0	25	35	5	30	51	2	Effect Size: η_H^2= 0.786 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A10- Restoration time taken by the utility people in an event of unplanned outage was rapid	1. Central Punjab	0	0	0	0	40	37	7	114.728 (0.000)	106.50	1-2	77.013 (0.000)	0.00(0.00)	0.650
	2. North Punjab	2	20	17	1	0	0	0		29.49	*2-3*	*-8.033 (1.000)*	*359.5(0.061)*	*0.044*
	3. South Punjab	1	6	16	1	0	0	0		37.52	3-1	68.979 (0.000)	0.00(0.00)	0.514
	Total Sample	3	26	33	2	40	37	7	Effect Size: η_H^2= 0.777 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A15- Utility people keep record of every unplanned outage your firm has experienced	1. Central Punjab	0	0	0	0	59	25	0	121.615 (0.000)	106.50	1-2	74.700 (0.000)	0.00 (0.00)	0.650
	2. North Punjab	0	9	31	0	0	0	0		31.80	*2-3*	*-1.867 (1.000)*	*452 (0.577)*	*0.002*
	3. South Punjab	0	4	20	0	0	0	0		33.67	3-1	72.833 (0.000)	0.00 (0.00)	0.514
	Total Sample	0	13	51	0	59	25	0	Effect Size: η_H^2= 0.825 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	

Punjab geographical location groups. For all the variables excluding the non-significant variable A7, mean rank was found higher for Central Punjab followed by South Punjab and North Punjab. Moreover, the effect sizes (η_U^2) for the statistical significant groups 1-2 (Central Punjab and North Punjab) and 1-3 (Central Punjab and South Punjab) also came in the zone of large effect. The effect sizes were calculated from the U test statistics of Mann Whitney U test. Except for the non-significant variable A7, the effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A6, A8, A9, A10 and A15 are 0.287, 0.486, 0.649, 0.650 and 0.650, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A6, A8, A9, A10 and A15 are 0.205, 0.379, 0.513, 0.514 and 0.514, respectively. A post hoc analysis was not performed for the non-significant variable A7. Figure 3.2 and Figure 3.3 depicts the GroupWise percentage orientation of textile industries towards the aspects related to "planned outages" and "unplanned outages", respectively.
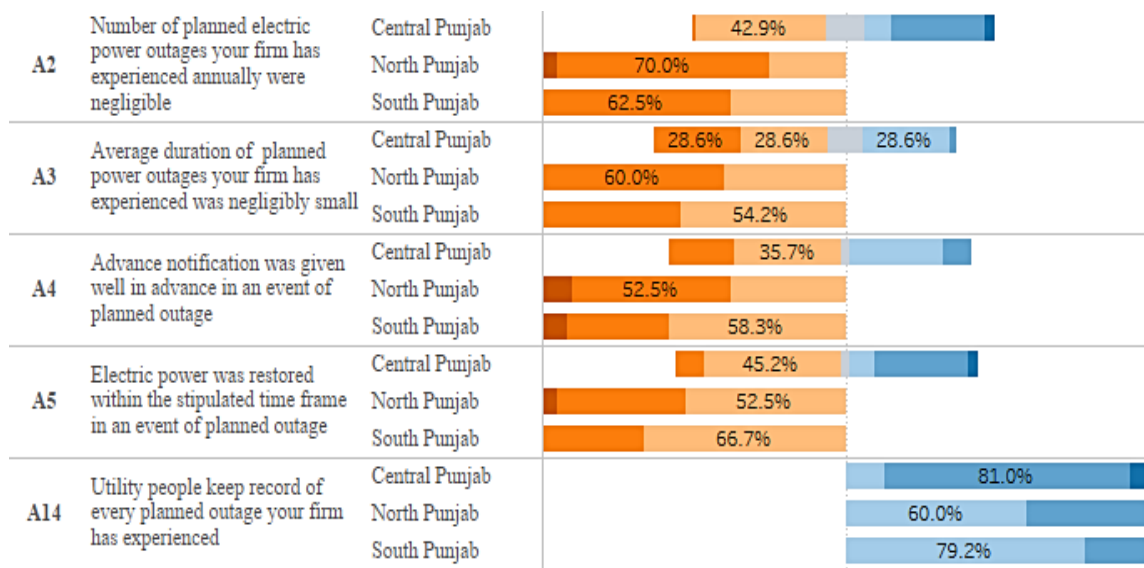

Fig. 3.2. GroupWise percentage orientation of textile industries towards the aspects related to planned outages
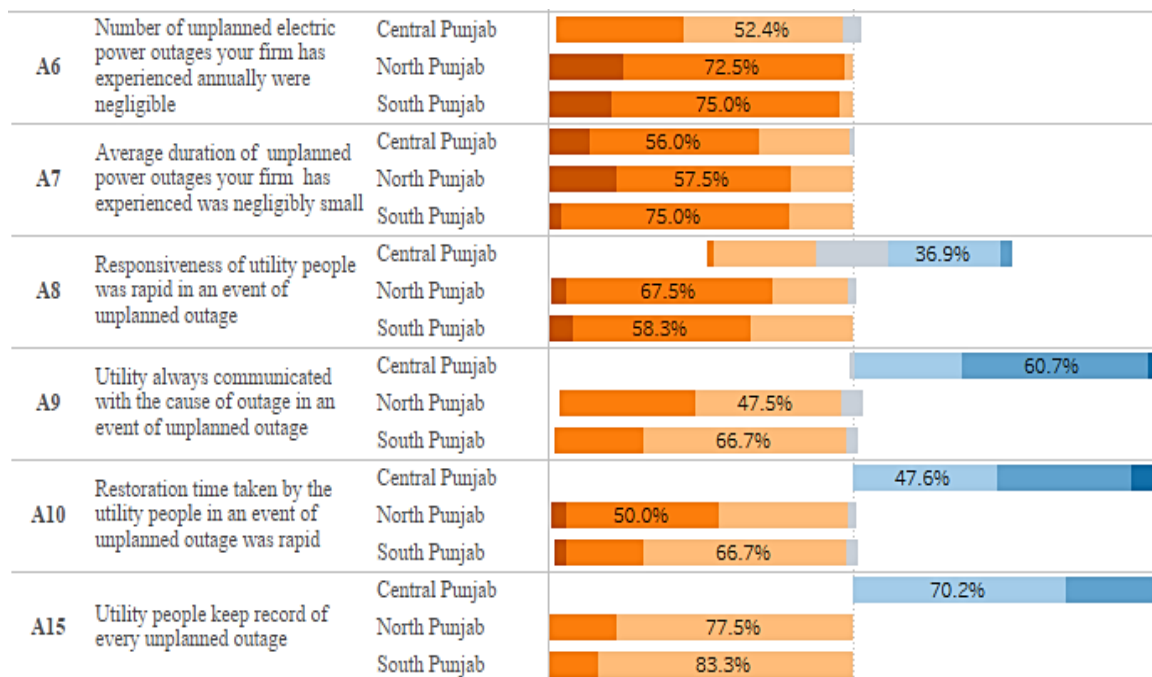

Fig. 3.3 GroupWise percentage orientation of textile industries towards the aspects related to unplanned outages

A statistical analysis summary of the dependent variables related to load shedding are presented in Table 3.4. A Kruskal-Wallis test was conducted on the dependent variables A11-

A13, A16, A27 and A28 that are shown in the Table 3.4 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" ($n = 84$), "North Punjab" ($n = 40$) and "South Punjab" ($n = 24$) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ^2 (Degree of Freedom) = Test Statistics Value, p-value except for the variable A11 in which the score was not found significantly different. The H or χ^2 test statistics values for the variables A12, A13, A16, A27 and A28 are 45.533, 33.570, 46.417, 13.475 and 8.210, respectively however for the non-significant variable A11, the value was found 5.107. Thereafter, effect sizes (η_H^2) calculated for the variables A11 and A28 were found in the zone of small effect. The effect sizes for the variable A27 were found in the zone of "intermediate effect" and for the variables A12, A13 and A16 the effect sizes were found in the zone of large effect. The effect sizes (η_H^2) calculated for the variables A11, A12, A13, A16, A27 and A28 are 0.021, 0.300, 0.218, 0.306, 0.079 and 0.043, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < 0.0167$ level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab geographical location group for the variables A12, A13, A16, A27 and A28 at p values of 0.000, 0.000, 0.000, 0.001 and 0.004, respectively. Further, for the geographical location group of Central Punjab and South Punjab, the level of agreement scores were also found statistically significantly different for the variables A12, A13 and A16 at p values of 0.000, 0.000 and 0.000, respectively, however, for the variables A27 and A28, the scores were not found statistically different at p values of 0.049 and 0.623 which were greater than a significant value of 0.0167. Furthermore, no statistical difference based on the level of agreement scores was observed between the North Punjab and South Punjab geographical location groups. For all the variables excluding the non-significant variable A11, mean rank was found higher for Central Punjab followed by South Punjab and North Punjab. Moreover, the effect sizes (η_U^2) considering the 1-2 (Central Punjab and North Punjab) groups for the variables A12, A13 and A16 were found in the zone of large effect, however, the effect sizes for the variables A27 and A28 were found in the zone of small and intermediate effect respectively. Furthermore, the effect sizes (η_U^2) considering the 1-3 (Central Punjab and South Punjab) groups for the variables A12 and A16 came in the zone of large effect, however, the effect size of the variable A13 was found in the zone of intermediate effect. The effect sizes considering the group 1-3 for the variables A27 and A28 were found in the zone of small effect and no effect, respectively. The effect sizes were calculated from the U test statistics of Mann Whitney U test. Except for the non-significant variable A11, the effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A12, A13, A16, A27 and A28 are 0.209, 0.182, 0.232, 0.049 and 0.062, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A12, A13, A16, A27 and A28 are 0.167, 0.080, 0.170, 0.023 and 0.002, respectively. A post hoc analysis was not performed for the insignificant variable A11.

A statistical analysis summary of the dependent variables related to utility, staff and infrastructure are presented in Table 3.5. A Kruskal-Wallis test was conducted on the dependent variables A17-A23 and A25 that are shown in the Table 3.5 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" ($n = 84$), "North Punjab" ($n = 40$) and "South Punjab" ($n = 24$) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ^2 (Degree of Freedom) = Test Statistics Value, p-

Table 3.4. Analysis summary of dependent variables related to load shedding

Dependent Variables	Levels of Independent Variable	Survey Response							Kruskal Wallis		Dunn's Bonferroni Post Hoc		Mann-Whitney U Post Hoc	
		CD	MD	SD	N	SA	MA	CA	Test Statistic	Mean Rank	Group	Test Statistics (p-values)	Test Statistic	η_U^2
A11- Load shedding (Weekly off days) your firm has experienced annually were negligible	1. Central Punjab	5	62	17	0	0	0	0	*5.107 (0.078)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	5	32	3	0	0	0	0						
	3. South Punjab	0	20	4	0	0	0	0						
	Total Sample	10	114	24	0	0	0	0	Effect Size: η_H^2= 0.021 (Small Effect)					
A12- Load shedding (peak load restriction hours/day) your firm has experienced were negligible	1. Central Punjab	0	23	58	3	0	0	0	45.533 (0.000)	92.70	1-2	41.727 (0.000)	726.5 (0.00)	0.209
	2. North Punjab	5	27	8	0	0	0	0		50.98	**2-3**	*0.975 (1.000)*	*467.5 (0.837)*	*0.00*
	3. South Punjab	4	15	5	0	0	0	0		50.00	3-1	42.702 (0.000)	432.5 (0.00)	0.167
	Total Sample	9	65	71	3	0	0	0	Effect Size: η_H^2= 0.300 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A13- Advance notification was given well in advance in an event of load shedding	1. Central Punjab	0	0	0	0	4	38	42	33.570 (0.000)	89.82	1-2	39.359 (0.000)	792 (0.00)	0.182
	2. North Punjab	0	0	0	0	8	31	1		50.46	**2-3**	*-10.475 (0.839)*	*406.5 (0.168)*	*0.016*
	3. South Punjab	0	0	0	0	3	18	3		60.94	3-1	28.884 (0.003)	609 (0.001)	0.08
	Total Sample	0	0	0	0	15	87	46	Effect Size: η_H^2= 0.218 (Large Effect)				η_{1-2}= LE & η_{3-1}= IE	
A16- Utility people keep record of load shedding your firm has experienced	1. Central Punjab	0	0	0	0	15	56	13	46.417 (0.000)	93.36	1-2	44.595 (0.000)	675.5 (0.00)	0.232
	2. North Punjab	0	0	0	2	27	11	0		48.76	**2-3**	*-2.633 (1.000)*	*455 (0.668)*	*0.002*
	3. South Punjab	0	0	0	0	17	7	0		51.40	3-1	41.961 (0.000)	428.5 (0.00)	0.170
	Total Sample	0	0	0	2	59	74	13	Effect Size: η_H^2= 0.306 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A.27. Labour was sent to home in an event of Load shedding (Weekly off Days)	1. Central Punjab	0	0	0	0	2	57	25	13.475 (0.001)	82.50	1-2	20.000 (0.002)	1220 (0.001)	0.049
	2. North Punjab	0	0	0	0	0	40	0		62.50	**2-3**	*-4.000 (1.000)*	*460 (0.551)*	*0.001*
	3. South Punjab	0	0	0	0	2	19	3		66.50	**3-1**	*16.000 (0.073)*	*796 (0.049)*	*0.023*
	Total Sample	0	0	0	0	4	116	28	Effect Size: η_H^2=0.079 (Intermediate Effect)				η_{1-2}= SE	
A.28. Labour was sent to home in an event of Load shedding (Peak Load)	1. Central Punjab	0	7	41	0	1	28	7	8.210 (0.016)	81.42	1-2	22.454 (0.013)	1161.5 (0.004)	0.062
	2. North Punjab	2	17	5	0	3	13	0		58.96	**2-3**	*-17.225 (0.309)*	*377 (0.130)*	*0.032*
	3. South Punjab	0	7	3	0	3	11	0		76.19	**3-1**	*5.229 (1.000)*	*945.5 (0.623)*	*0.002*
	Total Sample	2	31	49	0	7	52	7	Effect Size: η_H^2= 0.043 (Small Effect)				η_{1-2}= IE	

Table 3.5. Analysis summary of dependent variables related to utility, staff and infrastructure

Dependent Variables	Levels of Independent Variable	Survey Response							Kruskal Wallis		Bonferroni Post Hoc		Mann-Whitney U Post Hoc	
		CD	MD	SD	N	SA	MA	CA	Test Statistic	Mean Rank	Group	Test Statistics (p-values)	Test Statistic	η_U^2
A17- Utility people were skilled and reliable in their respective job areas	1. Central Punjab	0	0	0	0	29	46	9	116.927 (0.000)	106.50	1-2	77.375 (0.000)	0.00 (0.00)	0.65
	2. North Punjab	0	12	27	1	0	0	0		29.12	*2-3*	*-9.000 (1.000)*	*345 (0.017)*	*0.055*
	3. South Punjab	0	2	19	3	0	0	0		38.12	3-1	68.375 (0.000)	0.00 (0.00)	0.514
	Total Sample	0	14	46	4	29	46	9	Effect Size: η_H^2= 0.793 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A18- Utility people strongly followed preventive maintenance practice of electrical equipment	1. Central Punjab	0	3	37	10	30	4	0	70.676 (0.000)	99.17	1-2	57.748 (0.000)	377.5(0.00)	0.391
	2. North Punjab	4	21	14	1	0	0	0		41.42	*2-3*	*-1.846 (1.000)*	*459.5 (0.750)*	*0.001*
	3. South Punjab	1	14	8	1	0	0	0		43.27	3-1	55.902 (0.000)	238 (0.00)	0.300
	Total Sample	5	38	59	12	30	4	0	Effect Size: η_H^2= 0.474 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A19- Electric network was protected against lightning & storms	1. Central Punjab	0	10	33	10	26	5	0	72.327 (0.000)	99.40	1-2	60.180 (0.000)	347 (0.00)	0.409
	2. North Punjab	5	28	6	1	0	0	0		39.23	*2-3*	*-6.900 (1.000)*	*402 (0.170)*	*0.018*
	3. South Punjab	0	18	6	0	0	0	0		46.12	3-1	53.280 (0.000)	249 (0.00)	0.291
	Total Sample	5	56	45	11	26	5	0	Effect Size: η_H^2= 0.485 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A20- Reinforcement and upgradation of the network was effective to improve reliability	1. Central Punjab	0	0	0	1	50	31	2	118.257 (0.000)	106.50	1-2	74.838 (0.000)	0.00 (0.00)	0.65
	2. North Punjab	3	32	5	0	0	0	0		31.66	*2-3*	*-2.233 (1.000)*	*446.5 (0.530)*	*0.003*
	3. South Punjab	2	17	5	0	0	0	0		33.90	3-1	72.604 (0.000)	0.00 (0.00)	0.514
	Total Sample	5	49	10	1	50	31	2	Effect Size: η_H^2= 0.802 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A.21- Inspection and maintenance of the network were effective & in time by utility company	1. Central Punjab	0	17	31	0	17	19	0	75.138 (0.000)	99.18	1-2	55.960 (0.000)	388 (0.00)	0.385
	2. North Punjab	0	38	2	0	0	0	0		43.23	*2-3*	*2.996 (1.000)*	*439 (0.294)*	*0.005*
	3. South Punjab	3	19	2	0	0	0	0		40.23	3-1	58.955 (0.000)	226.5(0.00)	0.309
	Total Sample	3	74	35	0	17	19	0	Effect Size: η_H^2= 0.504 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A22- Ageing assets was always regularly monitored & replaced before their failure	1. Central Punjab	0	14	34	0	10	23	3	44.673 (0.000)	93.82	1-2	46.659 (0.000)	633 (0.00)	0.253
	2. North Punjab	1	24	15	0	0	0	0		47.16	*2-3*	*-5.275 (1.000)*	*433.5 (0.453)*	*0.006*
	3. South Punjab	0	13	11	0	0	0	0		52.44	3-1	41.384 (0.000)	432 (0.00)	0.168
	Total Sample	1	51	60	0	10	23	3	Effect Size: η_H^2= 0.294 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A23- Utility people adopted safe & standard techniques while performing inspection and maintenance work	1. Central Punjab	0	17	31	1	13	22	0	42.808 (0.000)	93.45	1-2	44.352 (0.000)	676 (0.00)	0.232
	2. North Punjab	0	26	14	0	0	0	0		49.10	*2-3*	*-1.400 (1.000)*	*468 (0.841)*	*0.00*
	3. South Punjab	0	15	9	0	0	0	0		50.50	3-1	42.952 (0.000)	420 (0.00)	0.175
	Total Sample	0	58	54	1	13	22	0	Effect Size: η_H^2= 0.281 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A25- Condition of electrical infrastructure from the feeder to your industry premises was sophisticated	1. Central Punjab	0	3	45	0	15	21	0	58.203 (0.000)	95.93	1-2	47.629 (0.000)	588 (0.00)	0.275
	2. North Punjab	0	18	22	0	0	0	0		48.30	*2-3*	*5.133 (1.000)*	*436 (0.481)*	*0.006*
	3. South Punjab	0	13	11	0	0	0	0		43.17	3-1	52.762 (0.000)	300 (0.00)	0.253
	Total Sample	0	34	78	0	15	21	0	Effect Size: η_H^2= 0.388 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	

value. The H or χ^2 test statistics values for the variables A17, A18, A19, A20, A21, A22, A23 and A25 are 116.927, 70.676, 72.327, 118.257, 75.138, 44.673, 42.808 and 58.203, respectively. Thereafter, effect sizes (η_H^2) for all the variables from A17-A23 and A25 were calculated using the online effect size calculator and were found in the zone of large effect. The effect sizes (η_H^2) calculated for the variables A17, A18, A19, A20, A21, A22, A23 and A25 are 0.793, 0.474, 0.485, 0.802, 0.504, 0.294, 0.281 and 0.388, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p <$ 0.0167 level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab ($p = 0.000$) and Central Punjab and South Punjab ($p = 0.000$) geographical location groups, but not between the North Punjab and South Punjab geographical location groups. For all the variables, mean rank was found higher for Central Punjab followed by South Punjab and North Punjab except for the variables A21 and A25 in which the mean ranks for North Punjab are higher than South Punjab. Moreover, the effect sizes (η_U^2) considering the statistical significant groups for all the variables A17-A23 and A25 were found in the zone of large effect. The effect sizes were calculated from the U test statistics of Mann Whitney U test. The effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A17, A18, A19, A20, A21, A22, A23 and A25 are 0.650, 0.391, 0.409, 0.650, 0.385, 0.253, 0.232 and 0.275, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A17, A18, A19, A20, A21, A22, A23 and A25 are 0.514, 0.300, 0.291, 0.514, 0.309, 0.168, 0.175 and 0.253, respectively. Figure 4 & Figure 5 shows the GroupWise percentage orientation of textile industries towards the aspects related to "load shedding" and "utility, staff & infrastructure", respectively.
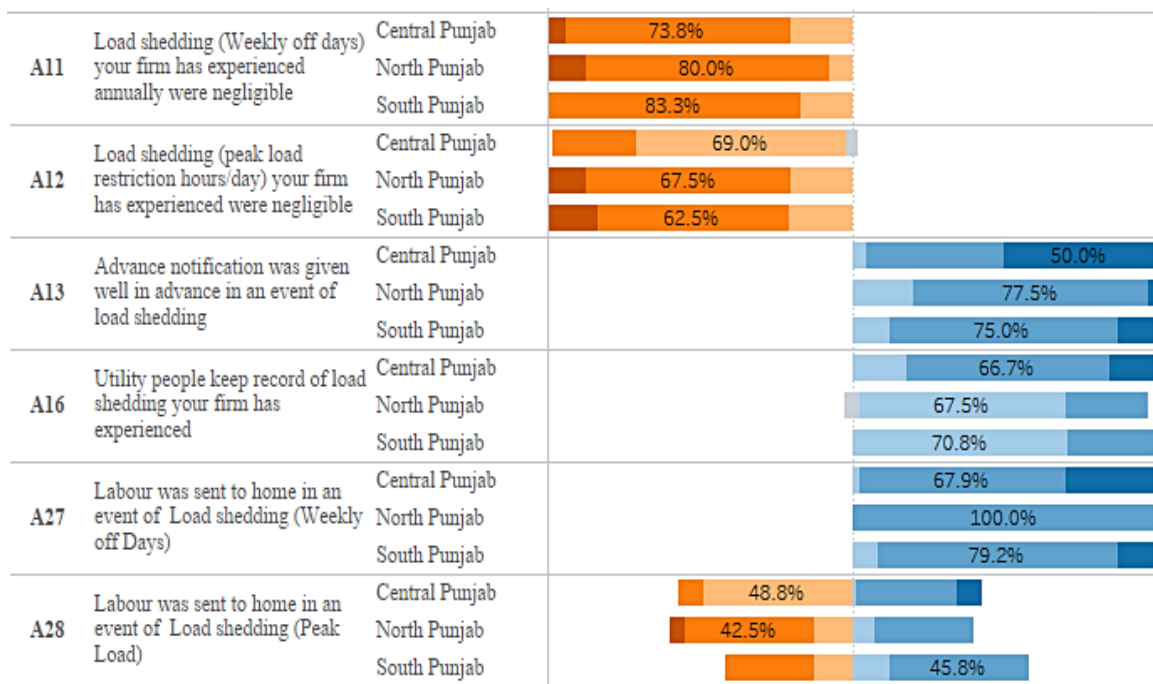

Fig. 3.4. GroupWise percentage orientation of textile industries towards the aspects related to load shedding
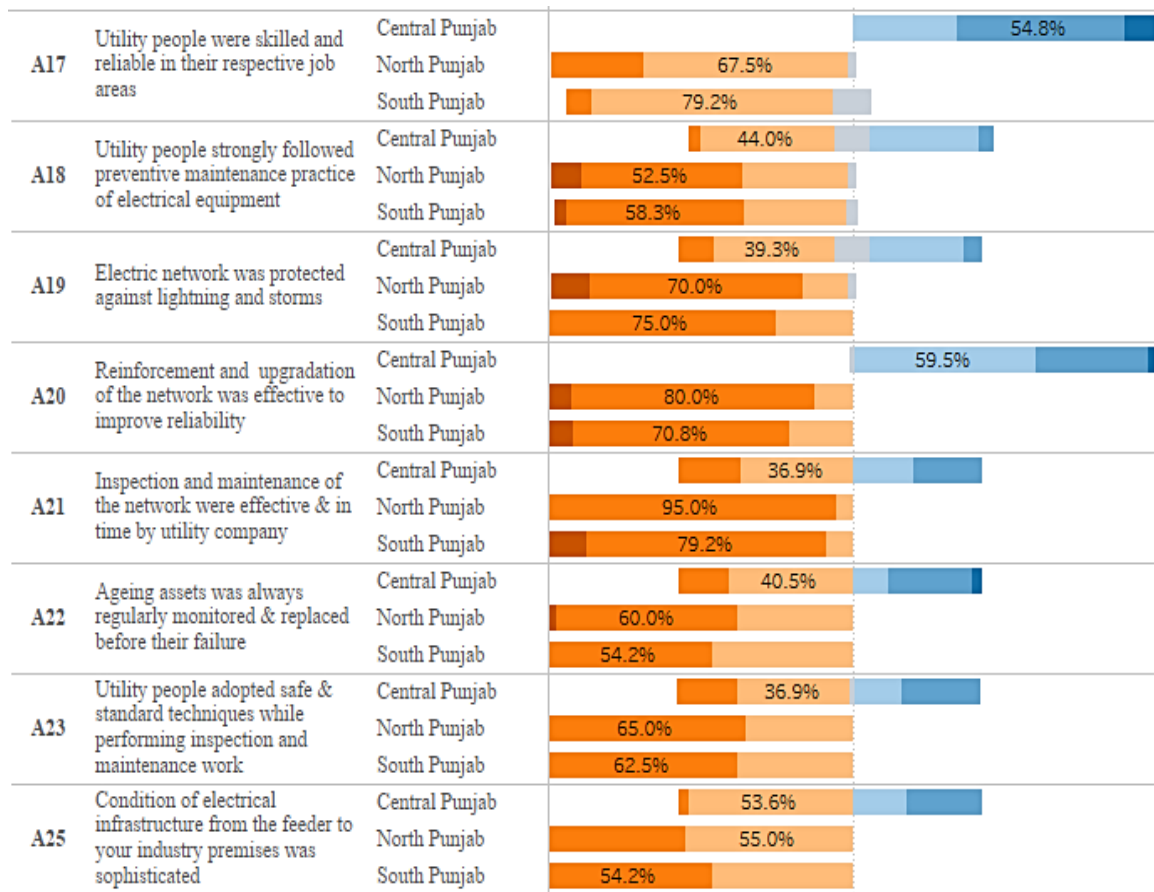
Fig. 3.5. GroupWise percentage orientation of textile industries towards the aspects related to utility, staff and infrastructure

A statistical analysis summary of the dependent variables related to generic nature is presented in Table 3.6. A Kruskal-Wallis test was conducted on the dependent variables A1, A24, A26, A29, A30, A33 and A40 that are shown in the Table 3.6 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" (n = 84), "North Punjab" (n = 40) and "South Punjab" (n = 24) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ2 (Degree of Freedom) = Test Statistics Value, p-value except for the variable A40 in which the score was not found significantly different. The H or χ2 test statistics values for the variables A1, A24, A26, A29, A30 and A33 are 70.495, 116.727, 63.948, 11.364, 6.303 and 16.484, respectively however for the non-significant variable A40, the value was found 1.259. Thereafter, effect sizes (ηH2) calculated for the variables A29 and A33 were found in the zone of intermediate effect. The effect sizes for the variables A30 and A40 were found in the zone of "small effect" and "no effect", respectively and for the variables A1, A24 and A26 the effect sizes were found in the zone of large effect. The effect sizes (ηH2) calculated for the variables A1, A24, A26, A29, A30, A33 and A40 are 0.472, 0.791, 0.427, 0.065, 0.030, 0.100 and 0.005, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the p < 0.0167 level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab geographical location groups for the variables A1, A24, A26, A29 and A33 at p values of 0.000, 0.000, 0.000, 0.008 and 0.011, respectively, however, for the variable A30, the scores were not found statistically different at p-value of 0.018 which was greater than a significant value of 0.0167. Further, for the geographical location group of Central Punjab and South Punjab, the level of agreement scores were also found statistically significantly different for

the variables A1, A24, A26, A29 and A33 at p values of 0.000, 0.000, 0.000, 0.004 and 0.000, respectively, however, for the variable A30, the scores were not found statistically different at p-value of 0.897 which was greater than a significant value of 0.0167. Furthermore, no statistical difference based on the level of agreement scores was observed between the North Punjab and South Punjab geographical location groups. For the variables A1, A26, A29 and A30, mean rank was found higher for Central Punjab followed by South Punjab and North Punjab, however, for the variables A24 and A33, mean rank of North Punjab was found to be greater than South Punjab. Moreover, the effect sizes (η_U^2) considering the 1-2 (Central Punjab and North Punjab) groups for the variables A1, A24 and A26 were found in the zone of large effect, however, the effect sizes for the variables A29, A30 and A33 were found in the zone of small effect. Furthermore, the effect sizes (η_U^2) considering the 1-3 (Central Punjab and South Punjab) groups for the variables A1, A24 and A26 were found in the zone of large effect, however, the effect sizes for the variables A29, A30 and A33 were found in the zone of small effect, no effect and intermediate effect, respectively. The effect sizes were calculated from the U test statistics of Mann Whitney U test. Except for the non-significant variable A40, the effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A1, A24, A26, A29, A30 and A33 are 0.412, 0.650, 0.376, 0.034, 0.034 and 0.034, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A1, A24, A26, A29, A30 and A33 are 0.258, 0.514, 0.225, 0.047, 0.00 and 0.077, respectively. A post hoc analysis was not performed for the non-significant variable A40.

A statistical analysis summary of the dependent variables related to outage after affects are presented in Table 3.7. A Kruskal-Wallis test was conducted on the dependent variables A31, A32 and A34-A39 that are shown in the Table 3.7 to determine if there were differences in level of agreement scores between groups that differed in their geographical location: the "Central Punjab" ($n = 84$), "North Punjab" ($n = 40$) and "South Punjab" ($n = 24$) geographical location level groups. A level of agreement scores was statistically significantly different between the different levels of geographical location group based on the H (Degree of Freedom) or χ^2 (Degree of Freedom) = Test Statistics Value, p-value except for the variables A31, A32, A34 and A35 in which the score was not found significantly different. The H or χ^2 test statistics values for the variables A36, A37, A38 and A39 are 29.711, 31.037, 31.124 and 34.960, respectively however for the non-significant variables A31, A32, A34 and A35, the values were found 1.359, 0.980, 5.479 and 0.285, respectively. Thereafter, effect sizes (η_H^2) calculated for the variables A31 and A32 were found in the zone of no effect, the effect sizes for the variables A34 and A35 were found in the zone of "small effect" and "no effect", respectively and for the variables A36-A39, the effect sizes were found in the zone of large effect. The effect sizes (η_H^2) calculated for the variables A31, A32, A34, A35, A36, A37, A38 and A49 are 0.004, 0.007, 0.024, 0.012, 0.191, 0.200, 0.201 and 0.227, respectively. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < 0.0167$ level. This post hoc analysis revealed statistically significant differences in the level of agreement scores between Central Punjab and North Punjab geographical location groups for the variables A36, A37, A38 and A39 at p values of 0.000. Further, for the geographical location group of Central Punjab and South Punjab, the level of agreement scores were also found statistically significantly different for the variables A36, A37, A38 and A39 at p values of 0.002, 0.000, 0.000 and 0.001, respectively. Furthermore, no statistical difference based on the level of agreement scores was observed between the North Punjab and South Punjab geographical location groups. For the variables A36, A37, A38 and A39, mean rank was found higher for North Punjab followed by South Punjab and Central Punjab. Moreover, the effect sizes (η_U^2) considering the 1-2 (Central Punjab and North Punjab) groups for the variables A36, A37 and A39 were found in the zone of large effect, however,

Table 3.6. Analysis summary of dependent variables related to generic nature

Dependent Variables	Levels of Independent Variable	Survey Response							Kruskal Wallis		Bonferroni Post Hoc		Mann-Whitney U Post Hoc	
		CD	MD	SD	N	SA	MA	CA	Test Statistic	Mean Rank	Group	Test Statistics (p-values)	Test Statistic	η_U^2
A1- Supply of electric power from the utility has been reliable	1. Central Punjab	0	4	34	9	10	27	0	70.495 (0.000)	98.94	1-2	60.140 (0.000)	342 (0.00)	0.412
	2. North Punjab	2	24	14	0	0	0	0		38.80	*2-3*	*-9.658 (1.000)*	*390 (0.156)*	*0.024*
	3. South Punjab	1	10	13	0	0	0	0		48.46	3-1	50.482 (0.000)	293 (0.00)	0.258
	Total Sample	3	38	61	9	10	27	0	Effect Size: η_H^2= 0.472 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A24- Overall behaviour of utility people towards your firm in an event of outages was courteous	1. Central Punjab	0	0	0	1	27	52	4	116.727 (0.000)	106.49	1-2	73.494 (0.000)	0.5 (0.00)	0.65
	2. North Punjab	0	14	25	1	0	0	0		33.00	*2-3*	*1.312 (1.000)*	*460.5 (0.748)*	*0.001*
	3. South Punjab	0	9	15	0	0	0	0		31.69	3-1	74.807 (0.000)	0.00 (0.00)	0.514
	Total Sample	0	23	40	2	27	52	4	Effect Size: η_H^2= 0.791 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A26- Tariff structure provided by the utility company was economical	1. Central Punjab	0	13	35	0	9	25	2	63.948 (0.000)	97.65	1-2	57.386 (0.000)	402 (0.00)	0.376
	2. North Punjab	4	29	7	0	0	0	0		40.26	*2-3*	*-10.279 (0.982)*	*388.5 (0.119)*	*0.025*
	3. South Punjab	1	15	8	0	0	0	0		50.54	3-1	47.107 (0.000)	341.5 (0.00)	0.225
	Total Sample	5	57	50	0	9	25	2	Effect Size: η_H^2= 0.427 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A29- Workers were found losing their interest in an event of sustained power outages	1. Central Punjab	0	0	0	0	1	66	17	11.364 (0.000)	66.27	1-2	-16.970 (0.032)	1294.5(.008)	0.034
	2. North Punjab	0	0	0	0	0	23	17		83.24	*2-3*	*-5.513 (1.000)*	*444 (0.563)*	*0.004*
	3. South Punjab	0	0	0	0	0	12	12		88.75	3-1	-22.482 (0.015)	702 (0.004)	0.047
	Total Sample	0	0	0	0	1	101	46	Effect Size: η_H^2= 0.065 (Intermediate Effect)				η_{1-2}= SE & η_{3-1}= SE	
A30- Utility company gave compensation if it took more time to restore power than stipulated time	1. Central Punjab	34	48	2	0	0	0	0	6.303 (0.043)	78.90	1-2	17.030 (0.052)	1295 (0.018)	0.034
	2. North Punjab	25	15	0	0	0	0	0		61.88	*2-3*	*-18.250 (0.174)*	*360 (0.054)*	*0.043*
	3. South Punjab	9	15	0	0	0	0	0		80.12	*3-1*	*-1.220 (1.000)*	*993 (0.897)*	*0.00*
	Total Sample	68	78	2	0	0	0	0	Effect Size: η_H^2= 0.03 (Small Effect)				η_{1-2}= LE	
A33- Your business has been heavily dependent on stable and secure power supply	1. Central Punjab	0	0	0	0	0	50	34	16.484 (0.000)	83.75	1-2	16.887 (0.028)	1294 (0.011)	0.034
	2. North Punjab	0	0	0	0	0	33	7		66.86	*2-3*	*12.008 (0.505)*	*399.5 (0.064)*	*0.019*
	3. South Punjab	0	0	0	0	1	22	1		54.85	3-1	28.896 (0.001)	617 (0.00)	0.077
	Total Sample	0	0	0	0	1	105	42	Effect Size: η_H^2= 0.1 (Intermediate Effect)				η_{1-2}= SE & η_{3-1}= IE	
A40- Alternative power supplies are expensive comparing with that of electricity	1. Central Punjab	0	0	0	0	23	38	23	*1.259 (0.533)*	*There is no statistical significant difference between the groups.*				
	2. North Punjab	0	0	0	0	1	35	4						
	3. South Punjab	0	0	0	0	1	18	5						
	Total Sample	0	0	0	0	25	91	32	Effect Size: η_H^2= 0.005 (No Effect)					

Table 3.7. Analysis summary of dependant variables related to outage after affects

Dependent Variables	Levels of Independent Variable	CD	MD	SD	N	SA	MA	CA	Test Statistic (Kruskal Wallis)	Mean rank	Group	Test Statistics (p-values) (Bonferroni Post Hoc)	Test Statistic (Mann-Whitney U)	η_U^2
A31- Electric power outages have led to a decrease in your profit margin	1. Central Punjab	0	0	0	0	2	70	12	*1.359 (0.507)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	0	0	0	0	1	34	5						
	3. South Punjab	0	0	0	0	3	13	8						
	Total Sample	0	0	0	0	6	117	25	Effect Size: η_H^2= 0.004 (No Effect)					
A32- Electric power outages have led to closed down part of your branch operations	1. Central Punjab	0	0	0	0	8	66	10	*0.980 (0.613)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	0	0	0	0	6	29	5						
	3. South Punjab	0	0	0	0	4	18	2						
	Total Sample	0	0	0	0	18	113	17	Effect Size: η_H^2= 0.007 (No Effect)					
A34- Electric power outages have led to increasing in the cost of preserving your products	1. Central Punjab	4	51	29	0	0	0	0	*5.479 (0.065)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	4	27	9	0	0	0	0						
	3. South Punjab	2	19	3	0	0	0	0						
	Total Sample	10	97	41	0	0	0	0	Effect Size: η_H^2= 0.024 (Small Effect)					
A35- Electric power outages have led to increase in maintenance & replacement cost	1. Central Punjab	0	0	0	0	41	43	0	*0.285 (0.867)*	*There is no statistically significant difference between the groups.*				
	2. North Punjab	0	0	0	0	21	19	0						
	3. South Punjab	0	0	0	0	13	11	0						
	Total Sample	0	0	0	0	75	73	0	Effect Size: η_H^2= 0.012 (Small Effect)					
A36- Electric power outages have led to decrease in sales	1. Central Punjab	0	0	0	0	23	52	9	29.711 (0.000)	60.45	1-2	-37.173 (0.000)	851 (0.00)	0.158
	2. North Punjab	0	0	0	0	0	22	18		97.62	*2-3*	*12.500 (0.572)*	*384 (0.112)*	*0.028*
	3. South Punjab	0	0	0	0	0	18	6		85.12	3-1	-24.673 (0.012)	657 (0.002)	0.062
	Total Sample	0	0	0	0	23	92	33	Effect Size: η_H^2= 0.191 (Large Effect)				η_{1-2}= LE & η_{3-1}= IE	
A37- Electric power outages have led to disposed of some of your assets	1. Central Punjab	0	0	0	1	58	25	0	31.037 (0.000)	59.63	1-2	-36.882 (0.000)	848.5 (0.00)	0.159
	2. North Punjab	0	0	0	0	9	29	2		96.51	*2-3*	*6.658 (1.000)*	*431 (0.386)*	*0.007*
	3. South Punjab	0	0	0	0	7	17	0		89.85	3-1	-30.223 (0.001)	590.5 (0.00)	0.088
	Total Sample	0	0	0	1	74	71	2	Effect Size: η_H^2= 0.2 (Large Effect)				η_{1-2}= LE & η_{3-1}= LE	
A38- Electric power outages have led to reduction in your product lines	1. Central Punjab	0	0	0	0	21	62	1	31.124 (0.000)	61.63	1-2	-30.157 (0.000)	996.5 (0.00)	0.108
	2. North Punjab	0	0	0	0	0	31	9		91.79	*2-3*	*1.058 (1.000)*	*472 (0.877)*	*0.00*
	3. South Punjab	0	0	0	0	0	19	5		90.73	3-1	-29.098 (0.000)	610.5 (0.00)	0.08
	Total Sample	0	0	0	0	21	112	15	Effect Size: η_H^2= 0.201 (Large Effect)				η_{1-2}= IE & η_{3-1}= IE	
A39- Electric power outages have led to decrease in purchasing of your products by existing customers	1. Central Punjab	0	0	0	0	0	48	36	34.960 (0.000)	59.14	1-2	-39.582 (0.000)	768 (0.00)	0.192
	2. North Punjab	0	0	0	0	2	36	2		98.72	*2-3*	*10.850 (0.766)*	*423 (0.260)*	*0.01*
	3. South Punjab	0	0	0	0	6	15	3		87.88	3-1	-28.732 (0.002)	630 (0.001)	0.072
	Total Sample	0	0	0	0	56	87	5	Effect Size: η_H^2= 0.227 (Large Effect)				η_{1-2}= LE & η_{3-1}= IE	

the effect sizes for the variable A38 was found in the zone of intermediate effect. Furthermore, the effect sizes (η_U^2) considering the 1-3 (Central Punjab and South Punjab) groups for all the significant variables A36-A39 were found in the zone of intermediate effect. The effect sizes were calculated from the U test statistics of Mann Whitney U test. Except for the non-significant variables A31, A32, A34 and A35, the effect sizes considering the group 1-2 (Central Punjab and North Punjab) for the variables A36, A37, A38 and A39 are 0.158, 0.159, 0.108 and 0.192, respectively. Similarly, the effect sizes considering the group 1-3 (Central Punjab and South Punjab) for the variables A36, A37, A38 and A39 are 0.062, 0.088, 0.080 and 0.072, respectively. A post hoc analysis was not performed for the non-significant variables A31, A32, A34 and A35. Figure 3.6 and Figure 3.7 depicts the GroupWise percentage orientation of textile industries towards the aspects related to "generic nature" and "outage after affects", respectively.
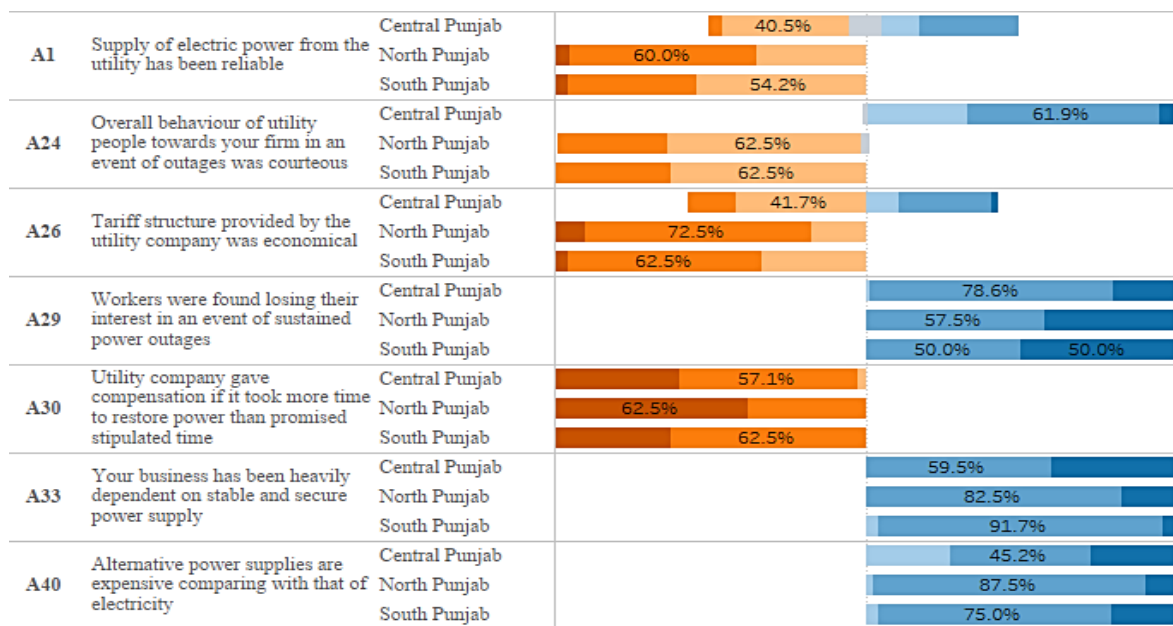
Fig. 3.6. GroupWise percentage orientation of textile industries towards the aspects related to generic nature.
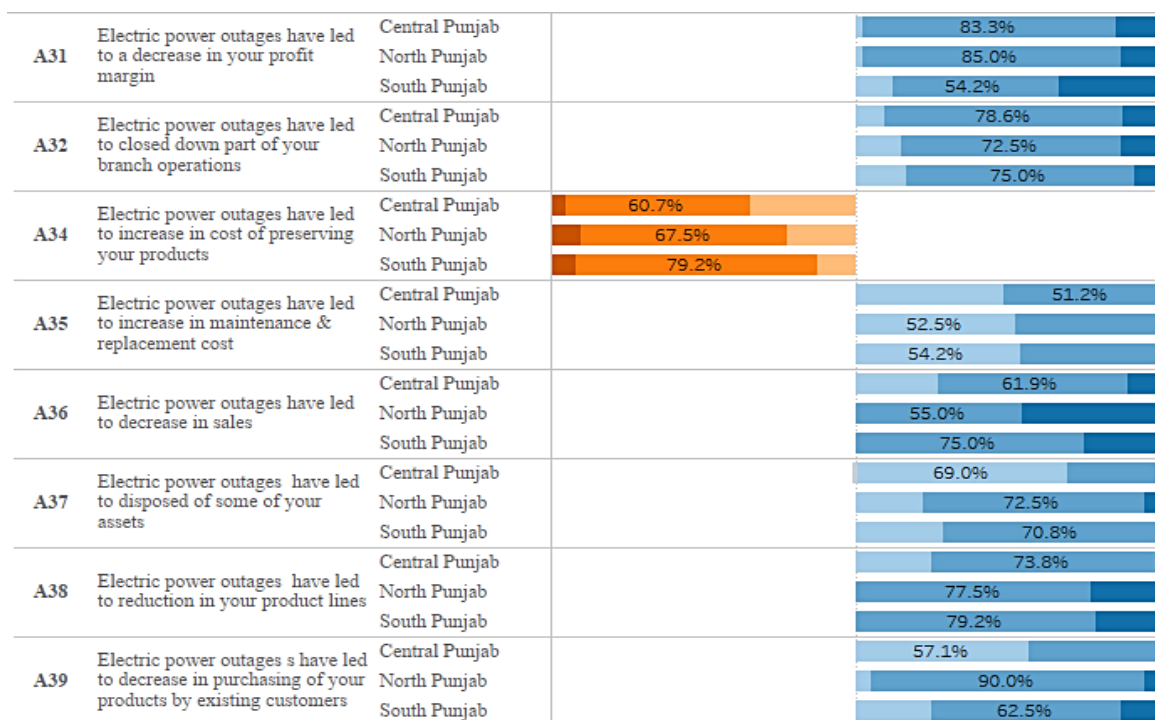
Fig. 3.6. GroupWise percentage orientation of textile industries towards the aspects related to outage after affects

4. CONCLUSION AND DISCUSSION

The results from the analysis reveal that the majority of the textile industries, especially from North and South Punjab, were shown a high level of disagreement towards the reliability of their connected power systems of the public utility company- Punjab State Power Corporation Limited (P.S.P.C.L) for the period 2010 to 2014. It has been observed that the textile industries falling in the region of Central Punjab are somewhat agreed on various aspects of power system reliability but overall this effect is not dominant and opinions are partially oriented on either side. The outcomes of the conducted study for the different categories of dependent variables are highlighted below:

Planned Outages- Only 24.3% of the sampled textile industries, all of them belong to the subgroup Central Punjab, were found agreed towards the occurrence of planned outages annually and rest of the industries from North and South Punjab have shown the very high level of disagreement. Similarly, merely 17.6% of the total industries, again all of them from Central Punjab, thought that average duration of the planned outages they experienced was negligible, against the rest who stated very high level of disagreement. Almost 23% of the total industries were agreed with the advance notification practice of the utility company and 77% of the total from North and South Punjab believed that they were not notified well in advance before the occurrence of the planned outages. Following the same trend, more than 76% sampled industries from North and South Punjab exposed that the utility company failed to restore the electric power in a promised time, however, rest of the 24% from Central Punjab were found satisfied with the restoration time. Though the whole of the sampled industries from Punjab was found agreed towards the record keeping habit of the utility company however high mean ranks and effect sizes revealed that Central Punjab was more fulfilled than the North and South Punjab. Above discussion revealed the condition of network and infrastructure in the state.

Unplanned Outages- Though the whole of the sampled industries was found disagree towards the occurrence of unplanned outages but mean ranks and effect sizes revealed that Central Punjab opted the lower order category of agreement making its mean rank higher than North and South Punjab. Further, all the industries were found dissatisfied towards the average duration of unplanned outages they experienced. Moreover, 23% of the industries, all of them from Central Punjab, believed that response of the utility was rapid in an event of an unplanned outage. More than 56% of the sampled industries, again all of them from Central Punjab was confident that the utility responds faster in an event of unplanned outages against the rest of the industries from North and South Punjab. Following the same trend, the group Central Punjab was also found high on agreement than other groups on the restoration time and record keeping practice as far as the unplanned outages are concerned. Above discussion exposed the protection of power systems and infrastructure against the natural disasters.

Load Shedding- As far as the load shedding (weekly off days) is concerned whole of the sampled industries were found oriented towards the disagreement which is indicating the inability of industries to use electric power because of the demand surpassing supply. Based on the load shedding (peak load) experienced by the industries, all of them have shown orientation towards the disagreement, however, a group Central Punjab selected high order of agreement category making its mean rank higher than the other groups. Further, all the sampled industries were found agreed on the advance notification and record keeping practice in an event of load shedding, however, Central Punjab have shown higher mean rank than the North and South Punjab. When it was asked from the industries that labour should be sent to a home in an event of a load shedding (weekly off days), all of them responded towards the high level of agreement and only one combination i.e. Central Punjab and North Punjab has shown the statistically significant difference. Similarly, when thought was taken on that the labour should be sent to a home in an event of a load shedding (peak load), again only one group combination i.e. Central Punjab and North Punjab have shown the statistically significant difference with Central Punjab showing the higher mean rank.

Utility, Staff and Infrastructure- About 56% of the total sampled industries, all of them from Central Punjab revealed that utility people were skilled and reliable in their respective job areas, and reinforcement and upgradation of the network were effective to improve the reliability against the thinking of industries from North and South Punjab. Moreover, more than 20% of the total industries, again from Central Punjab believed that utility people strongly followed preventive maintenance practice of the electrical equipment and electric network was protected against lightning & storms as compared to North and South Punjab. Around 24% industries of the total, whole of them from Central Punjab thought that inspection and maintenance of the network were effective and in time by utility company, ageing assets was always regularly monitored and replaced before their failure, utility people adopted safe and standard techniques while performing inspection and maintenance work, condition of electrical infrastructure from the feeder to your industry premises was sophisticated, respectively, against the North and South Punjab. This discussion has revealed that the overall the maintenance and upgradation practices of the networks by the utility are not effective in North and South Punjab, however, Central Punjab have shown considerable agreement.

Generic- From the whole Punjab, just 25% of the sampled industries from Central Punjab have shown agreement towards the reliability of supply of electric power from the utility against North and South Punjab which have shown the very high level of disagreement. Further, almost whole of the industries from Central Punjab was agreed that the overall behaviour of the utility people towards their firms in an event of outages was courteous against rest of the industries from North and South Punjab. More than 24% of the total industries, all of them from Central Punjab were found agreed on that the tariff structure provided by the utility company was economical against the North and South Punjab which have shown the very high level of disagreement. Further, the whole of the industries from Punjab believed that workers lose their interest in an event of sustained power outages. Though the statistically significant difference is evident from the analysis, the effect sizes are falling in the zones of intermediate and small effect showing the smaller overall difference and difference between the groups. Furthermore, it has also been observed that almost whole of the industries was shown a high level of disagreement that utility company gave compensation if it took more time to restore power than stipulated time. Also, all the sampled industries believed that businesses are heavily dependent on the stable and secure power supply. It has been observed from the results of a survey that almost whole of the sample have the same thinking that the cost of choosing alternative power supply is quite high.

Outage After Affects- When it was asked from the industries about the impact of power outages on their different industrial operations, all the industries throughout Punjab was found almost having the same opinion of high negative affect. No statistically significant difference was found and almost whole of the sample believed that electric power outages led to a decrease in their profit margin, closing down part of their branch operations and increase in maintenance & replacement cost. It has also been observed that sampled industries from North and South Punjab have the strong belief as compared to Central Punjab that the power outages led to decrease in their sales, disposed of some of their assets, reduction in the product lines, decrease in the purchasing of their products by the existing customers.

Overall, the conducted survey at the regional state level revealed the standing of the utility company. This kind of surveys considering the specific industrial sector at a local state level can be very helpful to draw the attention of the government towards the reliability of utility company without the use of any calculations. The results of the survey demand large scale modifications in order to improve the power systems of the utility company. The outcomes revealed that the textile industries had faced major power system reliability issues from 2010 to 2014 which not only affected their operations but also the goodwill among their customers. A high level of disagreement towards the power system reliability stresses the direct intervention of the state government in order to avoid the negative impact of power outages.

ACKNOWLEDGMENTS

REFERENCES

[1]   Abotsi, A. K. (2016). Power outages and production efficiency of firms in Africa. *International Journal of Energy Economics and Policy, 6*(1), 98-104.

[2]   Arlet, J. (2017). *Electricity Tariffs, Power Outages and Firm Performance: A Comparative Analysis.* Global Indicators Group, Development Economics. The World Bank.

[3]   Dhanabhakyam, M., & Shanti, A. (2018). Retrieved May 29, 2018, from www.fibre2fashion.com: www.fibre2fashion.com/industry-article/2363/indian-textile-industry-an-overview?page=1

[4]   Frederick, D., & Selase, A. E. (2014, September). The Effect of Electric Power Fluctuations on the Profitability and Competitiveness of SMEs: A Study of SMEs within the Accra Business District of Ghana. *Journal of Competitiveness, 6*(3), 32-48.

[5]   Hayes, A. F. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures, 1*, 77-89.

[6]   *IEEE Std 762™.* (2006). U.S.A: Power System Analysis, Computing and Economics Committee of the IEEE Power Engineering Society, Institute of Electrical and Electronics Engineers, Inc. (IEEE).

[7]   *India Brand Equity Foundation.* (2018). Retrieved 30 2018, 2018, from www.ibef.org: https://www.ibef.org/states/punjab.aspx

[8]   *India Online Pages.* (2018). Retrieved June 14, 2018, from www.indiaonlinepages.com: www.indiaonlinepages.com/population/india-current-population.html.

[9]   *Indian Power Sector.* (2018). Retrieved June 04, 2018, from www.indianpowersector.com: http://indianpowersector.com/home/about/

[10]   Karki, N. R., Karki, R., & Verma, A. K. (2010, June). Estimation of Cost of Unserved Energy A Customer Survey. *International Journal of Systems Assurance Engineering and Management, 1*(2), 157-162.

[11]   Kaseke, N. (2014, April). A Comparative Cost Assessment of Electricity Outages and Generation Expansion in Zimbabwe. *International Journal of Advanced Research in Management and Social Sciences, 3*(4), 1-20.

[12]   KPMG, & I.B.E.F. (2018). *Textiles and Apparel- Market and Opportunities.* India Brand Equity Foundation (IBEF)-public-private partnership between the Ministry of Commerce & Industry, Government of India and the Confederation of Indian Industry. India: KPMG-Consultancy Firm. Retrieved May 30, 2018, from https://www.ibef.org/download/Textiles_Apparel_220708.pdf

[13] LaCommare, K. H., & Eto, J. H. (2004). *Understanding the Cost of Power Interruptions to U.S. Electricity Consumers.* Berkeley, California: Energy Analysis Department, Ernest Orlando Lawrence Berkeley National Laboratory, University of California Berkeley.

[14] Lenhard, W., & Lenhard, A. (2016). *Calculation of Effect Sizes*. (Dettelbach, Germany: Psychometrica) doi:10.13140/RG.2.1.3478.4245. Retrieved from https://www.psychometrica.de/effect_size.html

[15] M.S.M.E. (2016). *State Industrial Profile of Punjab.* MSME - Development Institute, Government of India, Ministry of micro, small and medium enterprises. Punjab: MSME - Development Institute, Government of India. Retrieved from http://www.msmedildh.gov.in/State%20Profile%20of%20Punjab%2015-16.pdf

[16] *Ministry of Micro, Small and Medium Enterprises*. (2018)a. (Micro, Small & Medium Enterprises Development Institute-Government of India, Ministry of MSME) Retrieved May 30, 2018, from www.msmedildh.gov.in: http://www.msmedildh.gov.in/report_msme.html

[17] *Ministry of Micro, Small and Meduim Enterprises*. (2018, June 05)b. Retrieved from www.msme.gov.in: https://msme.gov.in/faqs/q1-what-definition-msme

[18] Mittal, M., & Johari, R. (2016). *Textile centres in North: Strength Vs Weakness.* The Indian Textile Journal. Retrieved from www.indiantextilejournal.com/News.aspx?news=Textile-centres-in-North-Strength-Vs-Weakness&nid=0+Hc9IrqxMtIQA4MQ3/sZg==

[19] N.E.R.C. (2009). *2009 Long-Term Reliability Assessment-2009-2018.* New Jersey: North American Electric Reliability Corporation (NERC). Retrieved June 14, 2018, from https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2009_LTRA_v1_1_errata.pdf

[20] NEXANT/SARI Energy. (2003). Economic Impact of Poor Power Quality on Industry: Review of Studies. United States Agency for International Development under South Asia Regional Initiative for Energy, USA.

[21] Nooij, M. d., Koopmans, C., & Bijvoet, C. (2007, March). The Value of Supply Security: The Costs of Power Interruptions: Economic Input for Damage Reduction and Investment in Networks. *Energy Economics, 29*(2), 277-295.

[22] *North American Electric Reliability Corporation.* (2007, January 18). Retrieved June 14, 2018, from www.nerc.com: https://www.nerc.com/docs/pc/Definition-of-ALR-approved-at-Dec-07-OC-PC-mtgs.pdf

[23] Pepermans, G. (2011, December). The value of continuous power supply for Flemish households. *Energy Policy, 39*(12), 7853-7864.

[24] *Punjab State Power Corporation Limited*. (2018). Retrieved May 29, 2018, from www.pspcl.in: www.pspcl.in/about-us/statistics/

[25] Sing'andu, N. (2009). An Assessment of Impact of ZESSCO's Power Rationing on Firm Productivity and Profitability: A Case of Selected Luaska Based Manufacturing Firms. http://dspace.cbu.ac.zm:8080/jspui/handle/123456789/214. Retrieved June 14, 2018, from www.dspace.cbu.ac.zm: http://dspace.cbu.ac.zm:8080/jspui/handle/123456789/214

[26] Tomczak, M., & Tomczak, E. (2014). The need to report effect size estimates Revisited-An overview of some recommended measures of effect size. *TRENDS in Sports Science, 1*(21), 19-25.

[27] Wijayatunga, P. D., & Jayalath, M. (2004, January). Assessment of Economic Impact of Electricity Supply Interruptions in the Sri Lanka Industrial Sector. *Energy Conservation and Management, 45*(2), 235-247.