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Ergonomic Workplace: An analysis based on Gender and Employee Wellbeing

Dr. Rajini.G[1] and . Gomathi.K [2]

[1] *Professor & Head- MBA (Integrated), School of Management Studies, Vels Institute of Science Technology and Advanced Studies, (Deemed to be University) Chennai, India.*
dr.rajini.g@gmail.com, rajini.sms@velsuniv.ac.in

[2] *Ph.D Research Scholar, School of Management Studies, Vels Institute of Science and Technology & Advanced Studies, Pallavaram, Chennai. Gomathi8301@gmail.com*

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Abstract

Garment production industry is often characterized by long working hours and overtime, putting an extra burden on women who serve as main caregivers in their families and societies. Thepurpose of this research paper is to investigate the organisational ergonomics involved in designing physical workplace Environment, Task, Machines and Psychosocial factors at the industry .The employee resilience and wellbeing of employees are to be probed based on gender. The methodology is by administering questionnaire with seven variables to various garment industry employees at Tirupur (India's Knitwear Capital) a place in Tamilnadu .The sample size is 453 in which , 268 (59.2%) are Men and 185(40.8) are Women .The reliability test , test of significance using analysis of variance and a Path model is done by SPSS 21.0 and AMOS software .The findings narrates there is significant difference in their perception based on gender on the variables Physical workplace environment, Machines, Task, Psychosocial factors , Organisational ergonomics, Resilience, and Well-being. Though the education level and employee retention is the same across gender there is still discrimination as per their view regarding workplace ergonomics. As the expectation of Women at the garment industry is different, it is high time to reframe the Human resource policies at Workplace.

Keywords: *Workplace gender based Discrimination, Ergonomics, Physical workplace Environment, Task, Well-being, organisational ergonomics.*

I. Introduction

Working conditions in garment factories are particularly degrading for all workers, nevertheless of gender. Men and women typically work long hours for very low pay. They are often exposed to dust and toxic chemicals in noisy, crowded rooms with poor ventilation and lighting. Due to poor ergonomics, job design and overwork, men and women garment workers are both at risk of strain and overuse injuries. These and other risks, however, are not gender equal. Women garment workers face different and often greater health risks than men in the same workplace due to differences in gender-based roles and expectations.

In spite of our success in improving working conditions and empowering women in the workplace, several fundamental challenges to gender equality remain in factories participating in the Better Work programme. This reflects trends identified in the garment industry at large as well

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

as more broadly in the countries where we operate.

II. Review of Literature

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimize human well-being and overall system performance (definition International Ergonomics Association (IEA) .Within this discipline or profession, physical ergonomics is regarded as one of the domains of specialization, beside organizational ergonomics and cognitive ergonomics.

OSHAS(2018), Organizational ergonomics is concerned with the optimization of socio-technical systems, including their organizational structures, policies, and processes.

Relevant topics include:

- communication,
- crew resource management,
- work design,
- work systems,
- design of working times,
- teamwork,
- participatory design,
- community ergonomics,
- cooperative work,
- new work programs,
- virtual organizations,
- telework, and quality management)

Professionals who use ergonomics principles adapt work tasks to the physical and mental capabilities of the workers. Implementing ergonomics principles in an occupational environment can directly benefit the worker and the organisation by reducing physical and mental strain, lowering the risk of occupational related injuries and illnesses and improving work performance (Sanderrs and Mccormick, 1993). An ergonomically design workplace was very important in making the human-machine-environment interface as efficient, safe and comfortable, the effective application of ergonomics in workplace design can accomplish a balance between worker characteristics and task demands.

This fill lead to improve worker productivity and to decrease health problems of employees. According to (Tarcan et al. 2004), if the organisation provides a good working environment and taking ergonomics consideration in designing workplace, it will increase the employees loyalty level. (Gallagher and Callaghan, 2015) suggests the postural movements play a role in decreasing eventual pain. Sit, Stand workstations are more common to interact in a specific task. Job rotation, sequencing and decentralization aid to reduce pain and comfort the employee (Ramkumar.A, and Dr.Rajini.G, 2018). In (2018), verdicts the inferences of job rotation. More research needs to be carried on to fully assess a variety of tasks to recommend the cognitive tasks. These skill set acquired can help maintain the postural movements.

The mechanical factors of importance in illness and injury in industry are definitive design of machinery, defective procedures, unguarded machinery, protruding and moving parts, falling heavy objects and poor ergonomics. The health effects are such as cuts, wounds, loss of fingers, hands, bruises, sprains, fractures and in extreme cases, death (Trajkovic, 2000).Another important health problem the workers face in garment industries is strain on their eyes. As they are to work for long time and need a keen concentration to their work, an extra pressure is created on their eyes which also effect on the visual comfort (Ahmed and Raihan, 2014).Berberoğlu and Tokuç, (2013) stated that Ergonomic hazards are common throughout the garment industry. Obsolete machinery, inadequate seating and

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

standing arrangements for workers and the improper lifting/movement of heavy loads all lead to stresses and strains on the body with a result that workers are often off sick or their productivity is drastically reduced.

Importantly, recent research suggests that an organisation's capacity to build resilience, and indeed to successfully manage crises and transitions, is largely contingent on its ability to capitalise on, and skilfully integrate, core practices and procedures with employee contributions (Lengnick-Hall, Beck, &Lengnick-Hall, 2011; Shin, Taylor, &Seo, 2012).(Brad Shuck, 2013) the author says Psychological Workplace climate was associated with Personal accomplishment, depersonalization, emotional exhaustion, and psychological Well- Being and whether employee engagement moderated these relations. (OyaErdil,2011) In this study the author used two main approaches; The Subjective approach (Subjective Well- Being) and objective approach(Psychological Well-Being).

III. Objectives of the study

- To investigate the organisational ergonomics involved in designing physical workplace Environment, Task, Machines and Psychosocial factors at the industry based on gender and other demographic variables
- To examine employee resilience and wellbeing based on gender and other demographic variables
- To develop and test a model on Ergonomics factors influencing Employee Wellbeing

IV. Research Methodology

The plan for the study is to carry out a data collection from garment industry employees, Tirupur through structured questionnaire. The Sample size is 453 respondents. The questionnaire contained closed end questions consisting of 118 items with five point Likert like scale with intensities varying through Strongly Agree, Agree, Partially Agree, Disagree, Strongly Agree, and To a great extent, To some extent, To little extent, To very Little extent, Not at all and Always, Very Often, Sometimes, Rarely and Never.

Seven variables were generated namely Working environment (11 items) , Machines (6 items) , Task (8 Items), Prevention of hazards (21 Items), Organisational Ergonomics (16 items), Resilience(15 Items) and Employee Well-being (29 Items). The data were analysed with SPSS 21.0 where Reliability, multiple Regression (Enter Method), were used in addition to descriptive statistics.(Rajini and M. Krithika, 2016) .

Findings

Reliability and validity test

The reliability is the ability of an instrument to measure the variables used in the study consistently. The reliability of a research instrument can be defined as the extent to which the research produces same results on repeated measurements. The Cronbach's co efficient alpha test is conducted to measure the consistency of the attributes used in the study. The higher value of cronbach alpha indicates a greater consistency between the measures.

Table 1.Reliability Test

Dimensions	Cronbach Alpha Value	Items
Physical Workplace Environment	.792	26
Machines	.770	10
Task	.858	14
Psychosocial factor	.676	6
Organizational Ergonomics	.783	17
Resilience	.800	15
Well-Being	.806	29
Total	**.912**	**118**

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Table 1 shows the results of scale reliability test. The Cronbach value for all the items used in the study is .912 which is greater than the threshold value of 0.7 and so is considered to be adequate. The Cronbach alpha value is tested for each construct and the results are .792,.770,.858,.676,.783,.800,and .806 for the construct name is Physical Workplace environment, Machines, Task, Psychosocial Factor, Organizational Ergonomics, Resilience, Well-being respectively. The alpha value for all constructs are greater than 0.6 and thus seems to be adequate for the study.

KMO and Bartlett's Test

KMO & Bartlett's test of sphericity is recommended to check the ratio variances. It is a measure to check the sample adequacy hence KMO plays a crucial role in accepting the sample adequacy. The KMO range is from 0 to 1 and the world follows an index that is over 0.5. this value is suitable for factor analysis. Bartlett's test shows the suitability and validity of the responses that has been collected. If factor analysis needs to be recommended, the Bartlett's test of sphericity should show <0.05.

Table 2 KMO & Bartlett's test of sphericity

Dimensions	KMO-Sampling Adequacy	Bartlett's test of Sphericity
Physical Workplace Environment	.624	.000
Machines	.686	.000
Task	.772	.000
Psychosocial factor	.626	.000
Organizational Ergonomics	.653	.000
Resilience	.752	.000
Well-Being	.689	.000

Hypotheses based on the Ergonomics related Variables with Gender

Hypothesis 1: There is no significant difference in the opinion about workplace environment based on gender.

Hypothesis 2: There is no significant difference in the perception about machines based on gender.

Hypothesis 3: There is no significant difference in the opinion about task and gender.

Hypothesis 4: There is no significant difference in the opinion about psychosocial factor based on the gender.

Hypothesis 5: There is no significant difference in the opinion about Organisational Ergonomics based on the gender.

Hypothesis 6: There is no significant difference in the opinion about Resilience based on the gender.

Hypothesis 7: There is no significant difference in the opinion about Well-being based on the gender.

Hypothesis 8: There is no significant difference in the type of family based on gender.

Hypothesis 9: There is no significant difference in the education level based on gender.

Hypothesis 10: There is no significant difference in Blue collar vs White collar job based on gender.

Hypothesis 11: There is no significant difference in the Monthly income based on gender.

Hypothesis 12: There is no significant difference in the nature of job based on gender.

Hypothesis 13: There is no significant difference in the overtime pattern based on gender.

Hypothesis 14: There is no significant difference in the employee retention based on gender.

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Table-3 ANOVA

Gender Vs Physical Workplace Environment						
	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig**	**Results**
Between Groups	19.106	31	.616	2.872	.000	Rejected
Within Groups	90.342	421	.215			
Total	109.448	452				
Gender Vs Machines						
Between Groups	12.130	16	.758	3.396	.000	Rejected
Within Groups	97.319	436	.223			
Total	109.448	452				
Gender Vs Task						
Between Groups	29.196	26	1.008	5.156	.000	Rejected
Within Groups	83.252	426	.195			
Total	109.448	452				
Gender Vs Psychosocial Factors						
Between Groups	13.949	17	.821	3.737	.000	Rejected
Within Groups	95.499	435	.220			
Total	109.448	452				
Gender Vs Organizational Ergonomics						
Between Groups	22.576	24	.941	4.634	.000	Rejected
Within Groups	86.873	428	.203			
Total	109.448	452				
Gender Vs Resilience						
Between Groups	17.214	20	.861	4.031	.000	Rejected
Within Groups	92.234	432				
Total	109.448	452	.214			
Gender Vs Well-Being						
Between Groups	20.932	41	.511	2.371	.000	Rejected
Within Groups	88.516	411	.215			
Total	109.448	452				

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

The above table 3 shows the outline of Anova table. The sum of squares of each item is calculated between group effects and within group effects. The between group effects are the experimental effects and within group effects is unsystematic data variations. The sum of squares for the between groups is 19.106, 12.130, 29.196, 13.946, 22.576, 17.214, 20.932 and the degree of freedom is 31, 16, 26, 17, 24, 20, 41. The mean squares given in the above table is .616, .758, 1.008,.821,.941,861,.511.the experimental effect of the group is given usually by the sum of squres and mean squares.

The F-ratio provides information as to whether the group means are the same or different. The F-ratio value in this case is 2.872, 3.396, 5.156, 3.737, 4.634, 4.031, 2.371 and its associated p-value is .000, .000, .000, .000, .000, .000, .000, since the p-value is <0.05 the test concludes that there is a significant difference in the opinion about physical workplace environment based on gender. There is a significant difference in the opinion about Machines, Task, Psychosocial factor, Organisational ergonomics, Resilence and Well-being based on gender.

Table-4 ANOVA on other demographic variables based on Gender

Gender Vs Type of Family						
Between Groups	1.958	1	1.958	10.025	.002	Rejected
Within Groups	88.099	451	.195			
Total	90.057	452				
Gender Vs Education						
Between Groups	.750	1	.750	.505	.478	Accepted
Within Groups	669.612	451	1.485			
Total	670.362	452				
Gender Vs Blue collar vs White collar job						
Between Groups	.873	1	.873	3.576	.059	Accepted
Within Groups	110.046	451	.244			
Total	110.918	452				
Gender Vs Monthly Income						
Between Groups	61.435	1	61.436	43.941	.000	Rejected
Within Groups	630.565	451	1.398			
Total	692.000	452				
Gender Vs Nature of job						
Between Groups	15.787	1	15.787	7.977	.005	Rejected
Within Groups	892.562	451	1.979			

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Total	908.349	452				
Gender Vs Over time Pattern						
Between Groups	21.912	1	21.912	23.802	.000	Rejected
Within Groups	415.179	451	.921			
Total	437.091	452				
Gender Vs Employee retention						
Between Groups	.513	1	.513	.441	.507	Accepted
Within Groups	525.539	451	1.165			
Total	526.053	452				

The above table 4 shows the outline of Anova table. The sum of squares of each item is calculated between group effects and within group effects. The between group effects are the experimental effects and within group effects is unsystematic data variations. The sum of squares for the between groups is 2.380, .049, 1.958, .750, .873, 61.436, 15.787, 21.912, .513 and the degree of freedom is 1. The mean squares given in the above table is 2.380,.049,1.958, .750, .873, 61.436,15.787, 21.912, .513. The experimental effect of the group is given usually by the sum of squres and mean squares.

The F-ratio provides information as to whether the group means are the same or different. The F-ratio value in this case is 2.821, .197, 10.025, .505, 3.576, 43.941, 7.977, 23.802, .441 and its associated p-value is .002, .000, .005, .000 since the p-value is <0.05 the test concludes that there is a significant difference in the type of family, Monthly income, Nature of job, Over time pattern based on gender. Associated p- value is .094, .657, .478, .059, .507 Since the p –value is >0.05 the test concludes that there is no significant difference in the Education, Blue collar vs White collars job, employee retention based on gender.

Table 5 .Gender * Nature of job Cross tabulation

Count

		Nature of job						Total
		Pattern making	Cutting	Stitching	Checking	Ironing	Packing	
Gender	Male	25	37	110	21	29	46	268
	Female	10	5	46	90	7	27	185
Total		35	42	156	111	36	73	453

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Table 6 Gender * Age Cross tabulation

Count

		Age				Total
		21Yrs-30Yrs	31Yrs-40Yrs	41Yrs-50Yrs	>50Yrs	
Gender	Male	101	93	59	15	268
	Female	54	76	37	18	185
Total		155	169	96	33	453

Table 7 Gender * Marital status Cross tabulation

Count

		Marital status			Total
		Married	Single	Others	
Gender	Male	196	70	2	268
	Female	138	39	8	185
Total		334	109	10	453

Table 8 Gender * Type of family Cross tabulation

Count

		Type of family		Total
		Nuclear	Joint	
Gender	Male	180	88	268
	Female	149	36	185
Total		329	124	453

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Table 9 Gender * Education Cross tabulation

Count

		Education					Total
		<SSLC	SSLC	HSC	Diploma	UG	
Gender	Male	128	61	50	10	19	268
	Female	105	22	40	5	13	185
Total		233	83	90	15	32	453

Table 10 Gender * Monthly income Cross tabulation

Count

		Monthly income					Total
		9000-10500	10501-12500	12501-15000	15001-17500	>17000	
Gender	Male	98	78	29	38	25	268
	Female	118	45	11	8	3	185
Total		216	123	40	46	28	453

Table 11 Gender * How do you get the salary Cross tabulation

Count

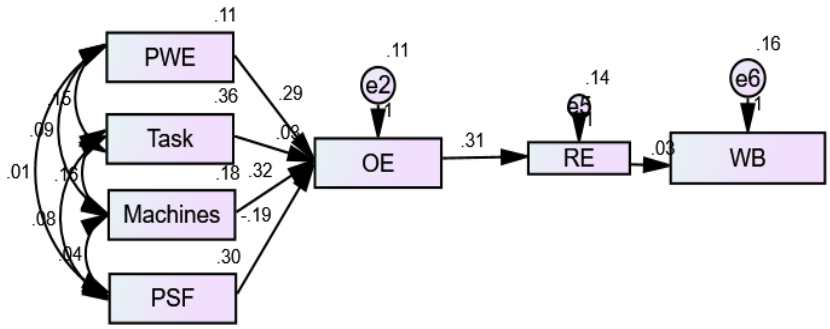
		How do you get the salary		Total
		Monthly	Weekly	
Gender	Male	105	163	268
	Female	89	96	185
Total		194	259	453

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Consolidated Table

Description	PWE	Machines	Task	Psychosocial Factors	Organisational Ergonomics	Resilience	Employee Wellbeing
Gender	S	S	S	S	S	S	S
Marital Status	S	S	S	S	S	S	S
Type of family	S	S	S	S	S	S	S
Education Level	S	S	S	S	S	S	S
Blue Collar Vs White Collar Job	S	S	S	S	S	S	S
Monthly Income	S	S	S	**NS**	S	S	S
Nature of Job	**NS**	**NS**	S	S	**NS**	S	S
Over time pattern	S	S	S	S	S	S	S
Employee Retention	S	S	S	S	S	S	S

Fig.1 Structural Equation Model



January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

Table .12 Model fit summary

Fit indices	Results	Suggested values
CMIN/DF	20.383	Significant <5.00
Chi square	0.112	Significant >0.05
GFI	.911	Significant >0.90
AGFI	.823	Significant >0.90
NFI	1.000	Significant >0.90
CFI	1.000	Significant >0.90
TLI	.925	Significant >0.90
RMSEA	0.054	Significant <0.08

V. Conclusion

The study has opened up dialogues on the factors influencing ergonomic work place .They are perceived similarly based on gender, age ,marital status ,type of family ,Monthly income ,White and blue collar jobs, Nature of job, Over time pattern .But the finding is that the ergonomics differs based on monthly income and nature of job .But based on the gender the education ,blue collar and white collar job and employee retention differs in a significant level.

Lena Karlqvist and Gunvor Gard(2012). The author said significant differences in working conditions between men and women both in female and male dominated workplaces. Most differences concerned physical work environment factors at workplaces. However, the level of low control and strain were more prevalent among women in male dominated workplaces. A significantly greater share of women, compared to men, reported symptoms in all body parts except in low back and knees at both workplaces. Good general health was reported by 80% of both men and women but men in male dominated workplaces perceived significantly better psychological well-being than the others.

Being a female is often described as a "risk factor" for many musculoskeletal disorders because prevalence in the general population and in large groups of employees has reported to be twice as high among women compared to men.

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Reference

1. B. Sarder, N. Imrhan, and NabeelMandahawi,(2006), Ergonomic Workplace Evaluation of An Asian Garment Factory.
2. Badrinarayan Shankar Pawer. (2016). Workplace spirituality and employee well-being: an empirical examination, The international journal, 38(6), 1-43.

January - February 2020
ISSN: 0193 - 4120 Page No. 272 – 283

3. Dubey,A,D. (2014). Role of ergonomics to improve productivity in textile industries, International Journal of engineering research & Technology, 3(2),2105-2010.
4. Emmanuel MajekodunmiAjala. (2012). The Influence of workplace Environment on Workers' Welfare, Performance and Productivity. The African Symposium: An Online Journal of the African Educational Research.
5. Faruk Ahmed. (2017). Ergonomics to design and safe and comfort work stations for garment workers: Bangaladesh perspective, International conference on Business & Management, ISBN 978-984-34-2360-3, 95-100.
6. Gayatri, G., Patil, Randhiryadav.,Viney G., et al. (2017). Ergonomics Textile apparel :A responsibility towards manpower,38-46.
7. Goamthi,K., Rajini, G.(2018). A preliminary study on organisational ergonomics and prevention of hazards in garment industry, International journal mechanical and production engineering research and development, 8(4), 963-968.
8. KemRamadass. The implementation of ergonomics as a sustainable competitive advantage in the clothing industry.
9. Lamb,S., Kwok, K.C.S. (2016). A longitudinal investigation of work environment stressors on the performance and wellbeing of office workers, Applied Ergonomics, 52, 104-111.http://dx.doi.org/10.1016/j.apergo.2015.07.010.
10. Laura Costa Mala, AnabelaCarvalhoAlves, Celina Pinto Leao. (2013). Preparation of a Textile and Clothing Company to Lean Implementation by Identifying Ergonomic and Environmental Risks. Integrity, Reliability and Failure of Mechanical Systems.
11. Lena Karlqvist, GunvorGard. (2012) Ergonomic Conditions and Health at Gender Segregated Workplaces. *The Ergonomics Open Journal*, 2012, *5*, 19-27.
12. Matthew J. Grawitch, Melanie Gottschalk, David C. Munz. (2006). The Path to a Healthy Workplace A Critical Review Linking Healthy Workplace Practices, Employee Well-Being, and Organizational Improvements. Psychology Journal.
13. Metgud,D.C., Mokashi , M.G., &Saha, P.N. (2008). An Ergonomics study of Women workers in a woollen textile factory for identification of health- related problems, Indian Journal of Occupational and and Environmental Medicine ,12(1), 14-19.
14. Mukund, A.,Amanprasath, B,H., RajeswaraRaoKvs., et al. (2014). Ergonomics evaluation of the work stations in garment manufacturing industry- An exploratory study, International journal of mechanical and production engineering ,2(4), 54-57.
15. Neelamsaini. (2015). Ergonomics for improving productivity in clothing industry,Global journal for research analysis,4(6), 239-240.
16. OyaErdil., Oznurgulen. (2011). The relationship between social climate and loneliness in the workplace and effects on employee well-being. Procedia Social and Behavioural sciences, 24, 505-525.
17. Ramkumar,A. And Dr.Rajini,G.(2018) Innovative Human Resource Practices and selected HR outcomes in software Firms, International Journal of Innovation,Creativity and Change, 4(2), 134-157. ISSN 22011323.
18. RohanGade., PranjaliChandurkar., Harshadaupasani., et al. (2015). Ergonomics intervention to improve safety and productivity, International journal on textile engineering and processes,1(3), 79-88.
19. SaritPrava Das. (2015). Ergonomics and Its Impact on Workplace Productivity with Special Reference to Employees of Various Sectors in Mumbai. The International Journal Of Business & Management (ISSN 2321 –8916).
20. ZafirMohdMakhbul. (2013).Workplace Environment towards Emotional Health. *International Journal of Academic Research in Business and Social Sciences January 2013, Vol. 3, No. 1 ISSN: 2222-6990.*