

A Comprehensive Analysis of The Ergonomics Factor Affecting The Working Environment By Implementing The Concept of Cognitive Ergonomics

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Abstract- *The usefulness of benefits work in India cannot be over emphasized. Benefits activities influence the sentiments of the workers. When the workers feel that the employers and the state are interested in their happiness, his tendency to grouse and grumble will steadily disappear. The main objective is to study about the benefits measures provided by company to its employees. For this purpose a sample of 120 was collected and percentage analysis, Descriptive statistics, Kruskal Wallis test, one-way Anova and rank correlation were used as tool to analyse the study and the conclusion is that the company may include more feedback sessions for the employees to give than chance to express their views and tell their needs and wants to the management.*

Keywords- Ergonomics, Working environment and Cognitive ergonomics

I. INTRODUCTION

Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them.

Most people have heard of ergonomics and think it is something to do with seating or with the design of car controls and instruments – and it is... but it is so much more. Ergonomics applies to the design of anything that involves people – workspaces, sports and leisure, health and safety. Ergonomics (or ‘human factors’ as it is referred to in North America) is a branch of science that aims to learn about human abilities and limitations, and then apply this learning to improve people’s interaction with products, systems and environments.

Ergonomics aims to improve workspaces and environments to minimise risk of injury or harm. So as technologies change, so too does the need to ensure that the tools we access for work, rest and play are designed for our body’s requirements.

Definition and Scope

Ergonomics means literally the study or measurement of work. In this context, the term work signifies purposeful human function; it extends beyond the more restricted concept of work as labour for monetary gain to incorporate all activities whereby a rational human operator systematically pursues an objective. Thus it includes sports and other leisure activities, domestic work such as child care and home maintenance, education and training, health and social service, and either controlling engineered systems or adapting to them, for example, as a passenger in a vehicle.

The human operator, the focus of study, may be a skilled professional operating a complex machine in an artificial environment, a customer who has casually purchased a new piece of equipment for personal use, a child sitting in a classroom or a disabled person in a wheelchair. The human being is highly adaptable but not infinitely so. There are ranges of optimum conditions for any activity. One of the tasks of ergonomics is to define what these ranges are and to explore the undesirable effects which occur if the limits are transgressed—for example if a person is expected to work in conditions of excessive heat, noise or vibration, or if the physical or mental workload is too high or too low.

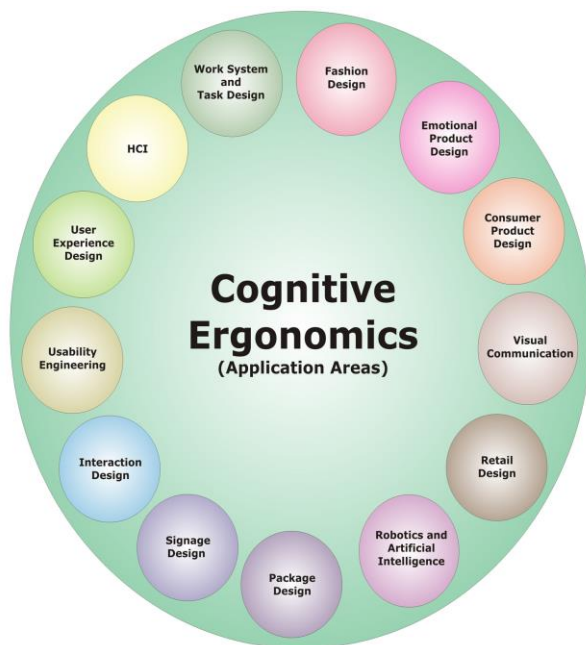
Ergonomics examines not only the passive ambient situation but also the unique advantages of the human operator and the contributions that can be made if a work situation is designed to permit and encourage the person to make the best use of his or her abilities. Human abilities may be characterized not only with reference to the generic human operator but also with respect to those more particular abilities that are called upon in specific situations where high performance is essential. For example, an automobile manufacturer will consider the range of physical size and strength of the population of drivers who are expected to use a particular model to ensure that the seats are comfortable, that the controls are readily identifiable and within reach, that there is clear visibility to the front and the rear, and that the internal

instruments are easy to read. Ease of entry and egress will also be taken into account. By contrast, the designer of a racing car will assume that the driver is athletic so that ease of getting in and out, for example, is not important and, in fact, design features as a whole as they relate to the driver may well be tailored to the dimensions and preferences of a particular driver to ensure that he or she can exercise his or her full potential and skill as a driver.

In all situations, activities and tasks the focus is the person or persons involved. It is assumed that the structure, the engineering and any other technology is there to serve the operator, not the other way round.

Factors related to Cognitive ergonomics

Cognitive ergonomics is the field of study that focuses on how well the use of a product matches the cognitive capabilities of users. It draws on knowledge of human perception, mental processing, and memory. Rather than being a design discipline, it is a source of knowledge for designers to use as guidelines for ensuring good usability.



Cognitive ergonomics mainly focuses on work activities which have an emphasized cognitive component (e.g., calculation, decision-making) are in safety-critical environments are in a complex, changeable environment (i.e., where tasks cannot be predetermined) The first domains investigated by cognitive ergonomics were nuclear power plants, air traffic control systems, and medical anesthetics. Those situations feature complex environments (e.g., where there are many controls and switches—or many factors—

coming into play) and where exceptional focus is needed so as to make decisions in potentially life-threatening situations. In the years following, many studies were conducted in “softer” domains such as banking, office work and leisure activities. The principles proved transferable between such environments.

Central to cognitive ergonomics is the notion of domain: the larger environment in which the system must operate, presenting both constraints and opportunities for the system. The field also studies the competencies and limitations of users in their interaction with the system in general (e.g., attention, perception errors, strategies, cognitive workload). In particular, it studies the cognitive artifacts they use to achieve their goals, as well as their co-operation with other actors. As a result, each cognitive ergonomic study operates with two underlying theories (implicit or explicit): a theory about the domain and a theory about human cognition. Since cognitive ergonomics covers both realms with such immediacy and addresses the interconnectivity of factors involved in use scenarios, designing with these considerations in mind helps ensure the usability of a product.

II. STATEMENT OF PROBLEM

Ergonomics is a sub domain of the scientific discipline ergonomics/human factors engineering. ‘Cognitive ergonomics focuses on mental processes, such as perception, memory, information processing, reasoning and motor response, as they affect interactions among humans and other elements of a system’. The study is to analyse the factors related to ergonomics with SME industry were the following factors are taken as problem towards the study,

- Whether the employees working in SME sector receive welfare benefits from their companies?
- What are the statutory welfare facilities provided by the company?
- Do the employees accept towards human operator factors and work place factors?

OBJECTIVES OF THE STUDY

- To analyse the welfare of employees working in SME sector.
- To evaluate the statutory welfare facilities provided by the company.
- To analyse the acceptance of employees based on human operator factors and work place factors.

SCOPE OF THE STUDY

Ergonomics is the study of comfort of the human body at work by adjusting tools and chains to fit the worker. Ergonomics is important because when you are doing a job and your body is stressed by an awkward posture, extreme temperature or repeated movement your musculoskeletal system is affected. The main scope of the study is that it will improve workspaces and environments to minimize risk of injury or harm and it can lead to the best ergonomic solutions will often improve productivity with the companies.

III. RESEARCH METHODOLOGY

Research design

Descriptive research design is been adopted with the study.

Sampling universe

The universe of the study comprises of employees working in SME in Coimbatore city.

Sampling design

The researcher adopted the stratified random sampling technique for selecting the sample of the study and following the sampling design of the study,

Data collection method

Primary data collection

Primary data has been collected through the well framed questionnaire from the selected 120 respondents which formed the data for the study and the following are the data collection tools used with primary data,

- Level of satisfaction of employees.
- Statutory Welfare facilities of the employees.
- Human operator and Work Place factors.

Secondary data

The secondary data was collected from articles, journals, books and magazines. And also, the secondary data were collected from various websites of Government of Tamil Nadu and Coimbatore, websites containing details about Ergonomics. The unpublished sources like a Ph.D., thesis, Project works, Dissertations, etc., contributed significantly to the data source.

Tools used for the study

The data collected from the respondents were analyzed by statistical tools like Percentage analysis, Descriptive statistics, Kruskal Wallis test, one way analysis of variance, Factor analysis.

LIMITATIONS OF THE STUDY

- There may be a bias in primary data collection because there is a chance for the omission of some of the information from the respondents.
- The study is limited only to Coimbatore district and the results may vary in other demographic regions.
- The standard limitations of the statistical tools applied in the study may also affect the findings of the study.

Demographic variables	Particulars	Frequency	Percent
Gender	Male	60	50
	Female	60	50
	Total	120	100
Age	Below 18 years	39	32.5
	18-25 years	72	60
	26-35 years	3	2.5
	Above 35 years	6	5
	Total	120	100
Qualification	Higher	45	37.5
	Secondary		
	Diploma	48	40.0
	UG	27	22.5
	Total	120	100
Department	Production	36	30
	HR	78	65
	Marketing	6	5
	Total	120	100

IV. ANALYSIS AND INTERPRETATION

Out of 120 respondents 50.0% are Male, 50.0% are Female. 32.5% are below 18 years of age, 60.0% are between 18-25 years, 2.5% are between 26-35years, 5.0% are above 35 years. 40.0% have completed their Diploma, 22.5% have completed their UG, 37.5% have completed their Higher Secondary. 30.0% are in production department, 65.0% are in HR department, 5.0% are in marketing.

Machine Operator

Factor analysis

KMO and Bartlett's Test for acceptance of employees towards machine operator

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.579
Bartlett's Test of Sphericity	Approx. Chi-Square	57.242
	df	36
	Sig.	.014

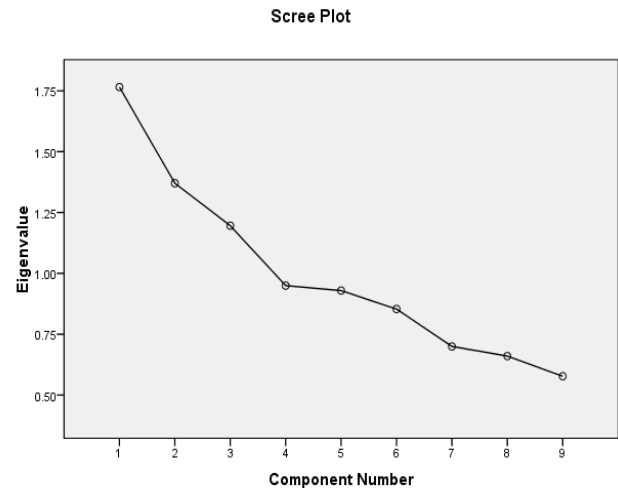
It reveals that the score for KMO test was high at 0.579, indicating 'Good' reliability among the items in the scale. Therefore, all 9 items in the scale which were used to measure the the acceptance of Machine Operator. As the data is highly reliable and internally consistent, it was further subjected to principal component method of factor analysis with 'varimax rotation'. The result of the factor analysis is presented and the following table shows Eigen value of 'varimax rotation' for all the statements.

Total Variance Explained for acceptance of employees towards machine operator

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.765	19.615	19.615	1.765	19.615	19.615	1.574	17.494	17.494
2	1.370	15.225	34.840	1.370	15.225	34.840	1.545	17.167	34.661
3	1.196	13.286	48.125	1.196	13.286	48.125	1.212	13.464	48.125
4	.950	10.550	58.676						
5	.929	10.324	69.000						
6	.853	9.481	78.481						
7	.700	7.773	86.254						
8	.660	7.334	93.588						
9	.577	6.412	100.00						

Out of 9 components, eigen value more than 1 are taken for factor rotation. With the study 3 components were taken were the first component contributes 19.615%, the second component contributes 15.225% and the third component contributes 13.286%.

Scree plot for acceptance of employees towards machine operator



Rotated Component Matrix for acceptance of employees towards machine operator

Particulars	Component		
	1	2	3
Conducting job training within the company	.060	.254	.648
Conducting safety training within the company	.623	.120	.469
Considering skills of the employees	.009	.659	-.216
Considering knowledge of the employees	.166	.251	.568
Giving importance to posture of the employees	.772	.036	.147
Company concentrating on stress related factors	.144	.621	.082
Using personal protective equipment with the company	.558	.041	-.014
Company looking after fatigue of the employees	-.222	.626	.318
The company concentrating a lot on employees job satisfaction	.423	-.435	.270

Extraction Method: Principal Component Analysis.
 Rotation Method: Quartimax with Kaiser Normalization.
 a. Rotation converged in 3 iterations.

It shows the factor loadings produced by the factor analysis. It is understood that each statement corresponding to the highlighted factor loading is correlated with the factor corresponding to that factor loading. It is understood that Eigen value is more than one for first three factors. Higher the factor loading, stronger is the correlation between the factors and the statements. In the rotated component matrix, only those common variables that had a factor loading which is greater than 0.5 for all 9 statements were grouped under their respective derived factors for further analysis.

The factors are conducting job training within the company (0.648), conducting safety training within the company (0.623), considering skills of the employees (0.659), company concentrating on stress related factors (0.621) and company looking after fatigue of the employees (0.626).

Descriptive Statistics for acceptance of employees towards machine operator

	N	Mean	SD
Conducting job training within the company	110	2.06	1.343
Conducting safety training within the company	110	2.51	1.232
Considering skills of the employees	110	2.33	1.279
Company concentrating on stress related factors	110	2.84	1.443
Company looking after fatigue of the employees	110	3.20	1.326
Valid N (listwise)	110		

The employees agree towards conducting job training within the company (2.06), conducting safety training within the company (2.51), considering skills of the employees (2.33), company concentrating on stress related factors (2.84). Meanwhile, the companies disagree towards company looking after fatigue of the employees (3.20)

Comparison between gender and acceptance of employees towards machine operator

Ho1: There is no relationship between gender and acceptance of employees towards machine operator

Demo graphic variables	Particulars	N	Mean Rank	Chi-Square	Asymp. Sig.
Gender	Male	55	57.50	0.439	0.508
	Female	55	53.50		
	Total	110			

There is no relationship between gender (0.508) and acceptance of employees towards machine operator.

Comparison between age, education qualification, department and acceptance of employees towards machine operator

Ho2: There is a significant difference between gender and acceptance of employees towards machine operator

Demographic variables	Particulars	N	Mean	SD	F	Sig
Age	Below 18 Years	35	2.57	0.696	0.721	0.541
	18-25 Years	67	2.63	0.717		
	26-35 Years	2	2.70	0.141		
	Above 35 Years	6	2.20	0.310		
	Total	110	2.59	0.690		
Qualification	Higher Secondary	42	2.59	0.686	0.100	0.905
	Diploma	43	2.61	0.741		
	UG	25	2.54	0.629		
	Total	110	2.59	0.690		
Department	Production	35	2.57	0.725	2.086	0.008
	HR	70	2.60	0.700		
	Marketing	5	2.48	0.228		
	Total	110	2.59	0.690		

There is a significant difference between age (0.541), qualification (0.905) and acceptance of employees towards machine operator. There is no significant difference between department of the respondents (0.008) and acceptance of employees towards machine operator.

Department

The respondents who are working production department (2.57), doing HR department (2.60) and doing marketing department (2.48) agree towards machine operator factors.

Acceptance of employees towards equipment’s of the company

Descriptive Statistics for acceptance of employees towards equipment’s of the company

Particulars	N	Mean	SD
Design of equipment’s inside the premises	110	2.85	1.441
Availability of emergency safety features inside the company	110	2.05	1.432
Availability of guards	110	2.34	1.206
Easy access towards the equipment	110	2.24	1.219
Easy access towards controls and displays of equipment’s	110	2.63	.947
Installation of equipment’s inside the company	110	2.93	1.346
Condition of equipment’s	110	2.65	1.224
Maintenance of equipment’s	110	2.95	1.248
Valid N (listwise)	110		

The employees agree towards design of equipment’s inside the premises (2.85), availability of emergency safety

features inside the company (2.05), availability of guards (2.34), easy access towards the equipment (2.24), easy access towards controls and displays of equipment's (2.63), installation of equipment's inside the company (2.93), condition of equipment's (2.65), and maintenance of equipment's (2.95).

Acceptance of employees towards environmental factors of the company

Descriptive Statistics					
	N	Minimum	Maximum	Mean	SD
Noise inside the company	110	1	5	2.78	1.350
Avoiding pollution inside the premises as much as possible	110	1	5	2.36	1.139
ValidN (listwise)	110				

The employees agree towards noise inside the company (2.78), avoiding pollution inside the premises as much as possible (2.36).

Managerial Factors

Descriptive Statistics for acceptance of employees towards managerial factors of the company

Descriptive Statistics					
	N	Minimum	Maximum	Mean	SD
Satisfactory plant layout	110	1	5	2.75	1.376
Hazard recognition by the company	110	1	5	2.37	1.319
Availability of ergonomics and safety programs inside the company	110	1	5	2.66	1.258
Standard setting of operational activities given by the company	110	1	5	2.33	1.271
OHS compliance inside the company	110	1	5	2.77	1.246
Standard setting of operational activities by the company	110	1	5	2.62	1.368
Getting regular feedback from employees by the management	110	1	5	2.59	1.350
Good attitude of management towards the employees	110	1	5	2.49	1.247

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The employees agree towards satisfactory plant layout (2.75), hazard recognition by the company (2.37), availability of ergonomics and safety programs inside the company (2.66), standard setting of operational activities given by the company (2.33), ohs compliance inside the company (2.77), standard setting of operational activities by the company (2.62), getting regular feedback from employees by the management (2.59), and good attitude of management towards the employees (2.49).

FINDINGS

- Both male and female respondents are equal in numbers.
- Majority of the respondents are in the age group between 18-25years.
- Most of the respondents have completed their diploma.
- Majority of the respondents are in HR department.

Machine Operator

The employees agree towards conducting job training within the company (2.06), conducting safety training within the company (2.51), considering skills of the employees (2.33), company concentrating on stress related factors (2.84). Meanwhile, the companies disagree towards company looking after fatigue of the employees (3.20)

Comparison between demographic variables and acceptance of employees towards machine operator Department

The respondents who are working production department (2.57), doing HR department (2.60) and doing

marketing department (2.48) agree towards machine operator factors.

Acceptance of employees towards equipment's of the company

The employees agree towards design of equipment's inside the premises (2.85), availability of emergency safety features inside the company (2.05), availability of guards (2.34), easy access towards the equipment (2.24), easy access towards controls and displays of equipment's (2.63), installation of equipment's inside the company (2.93), condition of equipment's (2.65), and maintenance of equipment's (2.95).

Acceptance of employees towards work place of the company

The employees agree towards physical space available with the place where the employees are working (2.33), layout of components at the work place (2.25), satisfaction towards work height at work place (2.24), acceptable work chair design at work place (2.65), and easy material movement at work place (2.57).

Acceptance of employees towards environmental factors of the company

The employees agree towards noise inside the company (2.78), avoiding pollution inside the premises as much as possible (2.36).

V. SUGGESTIONS

- The company may increase the number of interacting chances between the employees and their supervisors so that it will improve interpersonal relationship within the company.
- The company may provide higher education loan facilities to the employees.
- The company may provide transportation facility to the employees especially the night shift workers which will help the employees to avoid the difficulty of rush private vehicles.
- The company may include more feedback sessions for the employees to give than chance to express their views and tell their needs and wants to the management.

VI. CONCLUSION

The conclusion is that the company may include more feedback sessions for the employees to give than chance

to express their views and tell their needs and wants to the management.

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