Effect of Ergonomical Factors on the Employees

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Abstract—*To improve and enlightening production ergonomics is a search widespread to numerous organizations in diverse engineering and management zones. At the foundation is an ambition to eradicate hazards for job concerned musculoskeletal disorders, but recent observations on ergonomics have developed the discipline from a merely physiological, anthropometrical, and Psychosocial influential apprehension to an organizational, systems performance discipline. This research recommends that in an organization ergonomics infrastructure is made up of the structural, technical, executive and stakeholder comparative circumstances that allow or obstruct development of ergonomics. These circumstances spotlight on the positioning of diverse employees towards ergonomics concerns in an organization, the relationships between user, workers or employees, scenario, scheme and strategy they use for arguments, and the manipulate that occur from industry-particular culture, insolences and technical incorporation (or elimination) of ergonomics into engineering and production progressions. The information deduced from the research in this paper has been produced together with pertinent theoretical perceptions originated in the literature, into a Tentative Agenda which conducts empirical data assembly intended at planning the ergonomics infrastructure in an organization. Its step-by-step methodical appraisal of circumstances at diverse hierarchical levels in the organization should serve ergonomics experts and managers alike in classifying pathways and obstructions to improve production ergonomics.*

Keywords—Anthropometry, Ergonomics Risk factor (ERF), Human Factors and Ergonomics (HF&E), Human Engineering, International Ergonomics Association (IEA), Musculoskeletal Disorders (MSD), Musculoskeletal injury (MSI), Physiology, Psychosocial, Work Performance.

I. INTRODUCTION

Human beings are not superior at liability of tedious, cyclic and recurring jobs or numerous profound lifting. Software's, technology in contrast are responsible for doing immense calculations, lifting loads but cannot perform odd jobs such as assessment, decision assembly or problem solving techniques which need sufficient verdict of situation nor fabricate creative work itself. Thus it is now obvious that men and machines have their own area of expertise. Ergonomics is a science which is based on a realistic discipline that, by considerate, perceptive, men, machine, physical, psychological, social, cognitive, rational and intellectual distinctiveness and characteristics. It also inquiries about most favorable relations among humans and machines for example work-apparatus /tools, surroundings, association, community coordination and organizational cultures. Science apprehensive with the 'fit' among people and their work is termed as Ergonomics. Taking description of people capabilities and boundaries ergonomics puts people first. An aim of ergonomics is to formulate convinced that all responsibilities, apparatus, knowledge, data and the surroundings robust every employee. It also narrates data, skills concerning individual attitude, approach, capabilities, their restrictions and additional uniqueness to the design of apparatus, machines, responsibilities, works and environments for dynamic, secure, contented & well-organized individual use" (McCormick and Saunders 1993). The main aim of the Ergonomical factors on the workers is to ensure that human and equipment effort in absolute concord, with technology and errands associated to human distinctiveness. Basic aim of an organization/business is to earn maximum profits. The researchers in the field of management sciences are working on the point i.e. "Ergonomics" that how to resources can be utilize optimally to work and logic of its efficiently defined. The rationale of this paper is to study the problems of people to adjusting with environment that inquire about to adopt operational situation which suits the workers. The objective of ergonomics is to lessen anxiety, abolish trauma, sprain in addition to disarrays coupled with excess use of muscles, incorrect stance and frequent responsibilities that not only affect the workers' health but also influences on the product. These abrasions, disabilities and disorders have been related with six broad categories of ergonomic risk factors which are establish in a broad variety of mechanized and examine works: powerful physical exertion, discomfited work pose,restricted contact stresses, whole-body or segmental vibration, extreme temperature and monotonous movements or protracted activities. The corporal phases of a workplace atmosphere can have an

undeviating blow on the yield, physical condition, protection, reassure, attentiveness, work contentment and self-esteem of population contained by it. In the workplace and its environment there are vital issues that should be considered which includes building infrastructure, employee age, administrative center design, workplace arrangement, fixtures, apparatus layout, eminence, aspects, area, capacity, climate condition, exposure to air, illumination, sound, tremor, energy emission or emission of radioactive rays & air eminence. The research and application of the association among community, the utilization of apparatus and the corporal surroundings where people work is known as ergonomics. Employing ergonomics philosophy to the layout, infrastructure design, alteration and preservation of workplace environment has an advantage on people's work presentation and short-medium and long period strength, vigor and safety policies. This research is intended to help employers, managers, and others to comprehend HF&E in the place of work. The aim is to reveal ergonomics issues and simple, effective advice about how to solve them. This research also assists to elucidate how applying ergonomics can perk up wellbeing, health, safety & security in administrative center and in field work. The atmosphere in which a staff operates must be incorporated as a deliberation in design of the man-machine system since the environment circumstances can acutely influence their presentation and performance. When indulging to the environment, it is supportive to differentiate two kinds i.e. Internal and External Environments. The surroundings outside the man for instance air pressure, humidity, temperature, order, vibration, noise and acceleration are all considered in as external environment. Whereas internal environment condition includes body temperature, blood pressure, oxygen supplied and blood chemistry in general. It should be considered the ecological surroundings that must be sustained so as not to surpass the abilities of the body regulatory mechanism for keeping stable interior atmosphere and therefore relative standard and usual routine.

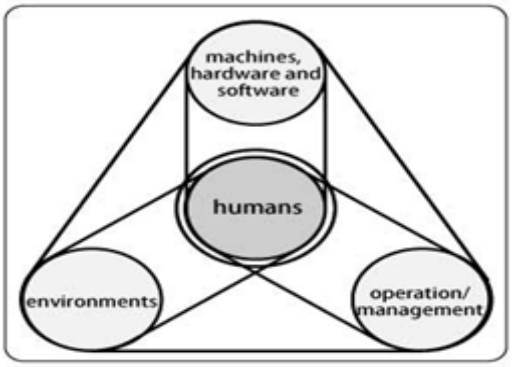

Fig.1: Ergonomics Relationship

II. RISK FACTOR ERGONOMICS

Risk is not simply defined on the association among risk aspects, revelations and the height of musculoskeletal injuries. Even though physical risk causes are vital foremost hazard issues, whereas others are reasonable aspects like psychosocial, industrial, biomechanical and organizational causes which might aggravate a chaos or obliquely manipulate the consequence of physically threat aspects. Biomechanical exposures comprise features such as inadequately designed place of works and rhythmic movement, maximum forces and divergence from normal position alignments (Musculoskeletal disorders and the workplace, 2001). During work workers faces psychosocial pressures that includes high perceived and low perceived stresses. The high perceived psychosocial pressure factors include workplace stresses whereas low perceived psychosocial pressures include minimum community backing, fewer work manage and moment in time anxiety. Individual factors include sexual category, age, unconstructive anxiety responses particularly abdomen effects, and unacceptable spare time and furthermore household workload (Huang G.D,Feuerstan Kop W.J, Arroya, 2003). Negative features perception and attentiveness of Ergonomics Risk Factors (ERF's) are crucial and indispensable for counter-measures to get before clarifications and answers to the troubles might be found. The most important ergonomic risk factors are re-emergence, power, discomfited position, shuddering, contact anxiety, static loading and severe hotness and coldness. RFE is a primary caution of increasingly more severe issues bodily signs and indications that can escort to severe wounds. Excellence of existence can also be condensed by long period hazard issue exposures. All work holds threat and risk. Individuals, association, people and workers should be aware of risk factors and can be informed priory to reduce MSD injuries, risk and hazards. They should be accomplished in identifying and classifying all these risks and hazards furthermore occurrence and interval of risk factors exposures can be minimized by examining all options. The assignment and job becomes peaceful and further expected in its result by minimizing exposure to risk factors. Whereas the foundation of any fastidious circumstance of a Musculoskeletal Disorders (MSD's) is remarkably complicated to recognize with absolute accurateness, assured threat issues are usually argued in the literature of ergonomic field. MSD's is a situation or an illness that disrupts normal physical body conditions i.e. our body muscles, nerves, tendons, ligaments, joints, cartilage, or spinal cord. MSD's are collective types of injury. It is necessary to comprehend about the kind of risk issue. For every meticulous musculoskeletal disorders RF's are not necessity a causation factor. On several occasions it does

not cause due to the presence of RFs but caused due to the extent by which RFs are articulated which lead to musculoskeletal disorders. Correspondingly, to the degree of RFs which causes MSD can also be due to the combination of many risk factors, instead of any single risk factor (WilliamJ, Wiehagen, Fred C.T, 2004)

III. ANTHROPOMETRY

To reassure the workplace efficient, the skills and knowledge of engineering anthropometry is being applied to tools, equipment's, and place of work, chairs and further user goods together with garments design. The objective is to make the office, field area more well-organized, secure and at ease for the employee that will increase the productivity and employee performance at work area. In applied Anthropometry, Biomechanics, Illumination, Seating, Cumulative Trauma Disorder, Physical space arrangement etc. concerns to the capacity of the human individual. Physical anthropology is considered as the earlier tool because it has been considered for recognition, for the principle of perceptive person and corporeal distinction, in paleoanthropologists and in a variety of efforts to associate physical with cultural and psychological behavior. Applied anthropometry promotes employee security by all ways that governs the deed of forces with awareness of human being body such as the knowledge based on the properties of proper illumination that makes safer place of work by minimizing employee exhaustion, utilizing hand tools and strategic management of machinery operations to reduce employee injures and proper sitting position can also reduce stress to the lumber region. It is also important to seek the piece of equipment, maintain good relationship among the workers the sex and race should also be considered. Biomechanics purpose is to describe the sub-discipline of ergonomics which can be applied for the purpose of achieving maximal physiological and emotional workers or wellbeing of the working population, while at the same time enhancing the economic efficiency of the industry (R.Tichauer & ScD). Biomechanics is the movement of human body organs such as limbs, muscles and working postures. The main aspect on which nature of light is resolute is quality and quantity of light. Amount of lightening is included as the quantity of light while the colour of the beam, the path and dispersion of the brightness is being included as quality of light. European standard recommended that 300 Lux as the intensity of light is ideal for working machine work whereas necessarily higher light intensity approximately of 2000 lux is good for precision working. High physical activities with high thermal resistant clothing impede the cooling mechanism of the body and increase the metabolic heat production (Grundstein, et al., 2010). Core body temperature of 37^{o}C is considered as normal which is liable to increase with the physical activity and metabolic heat production within the human body. Excessive heat produced in the body has to be dissipated to the external environment to maintain the normal core body temperature. Six fundamental factors including air temperature, radiant temperature, humidity, wind speed, clothing and metabolic heat generated by physical activity determine the body heat balance. Heavy clothing or increased physical activities contribute to increase core temperature and may lead to heat stroke or death in extreme conditions. Heat stroke can occur at a core body temperature greater than 40^{o}C along with other body organs and system failure due to hyperthermia (Butt & Salman, 2012).

IV. PHYSIOLOGY

The method of an act in response to several kind of energy in the surroundings by a commonly constructive activity which is constructive to existence is termed as physiology behavior. The energy or fewer accurately entity from which physiology is resultant, are termed as the stimulus, whereas the consequential movements are known as response. The response habitually has a number of trait relations to the stimulus which suggest it, for example imminent approach, offensiveness, replying, overwhelming, caress, or flees. The physical compositions and purpose operating in activities is identical either the stimulus is equipped by a social or a non-social entity. Bodily fitness is vital as poor physical conditions hinder working and performance of the workers, thus it may result exhaustion. Physiological factors are apprehensive through the individual knowledge, wisdom scheduling as well as judgment building abilities, furthermore assisting the cognitive fit among individual & the belongings they employ. Individual physical conditions, health, tiredness, quantity and quality of foods, employee age, fatigue levels, etc are all included in the physiological factors on instance of wisdom & working.

V. PSYCHOSOCIAL

Psychosocial risks factors are coupled with the method of people's cooperation by the stress of their work and their occupation surroundings. Community associations surrounded by their job is included in it. Psychosocial RF's are very vital if it exist during working situation as it might also be sources of pressure. Anxiety has significant influences on the diligence and development of musculoskeletal ache and disarrays. The existence of these RF's during work effects the danger of persons rising musculoskeletal strains. Thus, this sequentially has

impact on injury concerned costs, non-attendance and efficiency. Modern researches have shown that psychosocial RF's also influence productivity on person own account. Too much production and work demands causes the worker to work overtime are also hazard issues for person proclaimed minimize productivity because of neck and back stresses and pain.

VI. HUMAN ENGINEERING AND ENVIRONMENT

HFE&E (human factors engineering and ergonomics) employs scientific data and knowledge concerning to community acknowledgment & conduct to sustain the layout and pattern of products and organizations which improves employee performance, individuals and employees. Human to system relations at the entity, grouping and executive levels are being investigated by HFE&E professionals. The objective is to plan the commodities, goods that add to person corporeal, psychological, incentive, encouragement capabilities, to get better the societal, practical and organizational characteristics of an association. HF&E have been used for development of security and efficiency, specifically in complicated social technological systems. Human factors and ergonomics specialists observed that user, individual, worker and in general accomplishment of an organization normally affected by organizational causes. The research of such aspects and issues are referred to as organizational ergonomics or macro-ergonomics. During the study HFE and ergonomics are termed as similar.

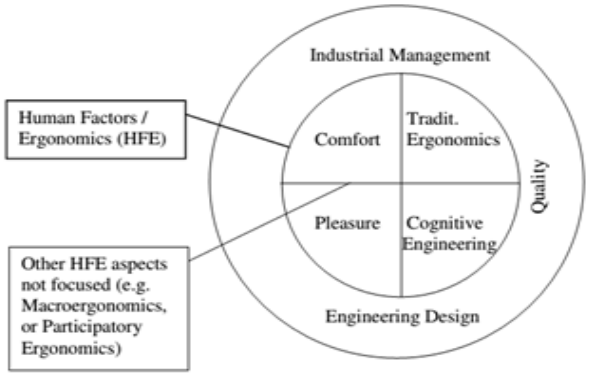

Fig.2: Human Design and Engineering

Early in 2000 IEA (International Ergonomics Association) conference was organized. In accordance with the Executive council of the conference it was considered that ergonomics or human factors is the logical regulation associated with the indulgent of the relations between individuals, other essentials of an organization, occupation that relates hypothetical philosophy, data and procedures to propose in order to progress workers, individuals, employees, human being and complete organization performance.

VII. THEORETICAL FRAMEWORK

The compounds skills of various disciplines are required in order fully to understand develop the subject.

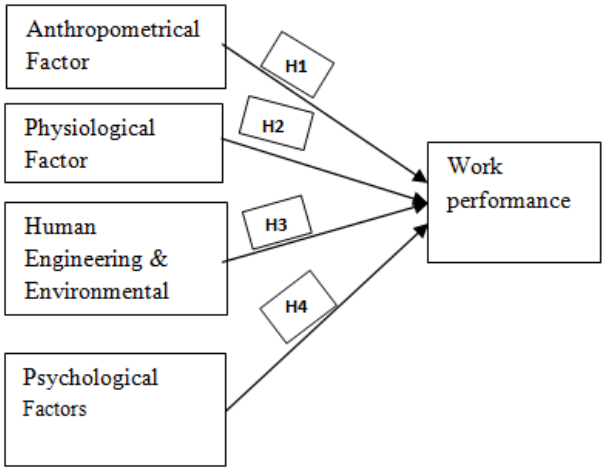

Fig.3: Factors Effecting Dependent Variable

VIII. EXPERIMENTAL SETUP

The sample size chosen is of 240 workers working in different organization by questionnaire data. While the observed sample being limited to more than 200 studies these trends still indicate a focus on a larger sample size is important and may have a direct influence on the results.

Table. I: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.778	.753	58

The reliability of measurement scales, Cronbach's Alpha, was used in this study and the reliability result of total scale was 0.778 Therefore the scale used in this study was considered quite acceptable.

IX. CORRELATION

Table II: Correlation

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
Anthropometry	3.0235	0.68083	199
Physiology	2.446	0.50611	199
Psychosocial	3.1307	0.55048	199
Human Engineering	3.5818	0.44923	199
Work Performance	3.4372	0.25916	199

In the above table from 199 numbers of observations, anthropometry shows 3.0235 mean values and deviated 0.68083 from the mean value. Whereas Physiology shows 2.4460 mean value and it is deviated at 0.50611 values from mean. Psychosocial has 3.1307 mean values and it is deviated at 0.55048 values from the mean. Human Engineering shows more mean value and it has 3.5818 mean values, 0.44923 value is deviated from mean value of human engineering. Whereas work performance has shown 3.4372 mean values and it is deviated at 0.25916 from the mean values.

X. REGRESSION

This table specifies that the regression model which calculate the dependent variable significantly well. At the "Regression" row "Sig." column, point outs the statistical significance of the regression model that was run. Here, $p < 0.151$, which is more than 0.05, and indicates that, overall, the regression model statistically rejected.

Table III: Regression Analysis

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	.451	4	.113	1.703	.151[b]
	Residual	12.847	194	.066		
	Total	13.298	198			
a. Dependent Variable: Work Performance						
b. Predictors: (Constant), Human Engineering, Physiology, Psychosocial, Anthropometry						

Table IV: Regression Statistical Relationship

Co efficients[a]					
Un standardized Coefficients		**Standardized Coefficients**			
B	**Std. Error**	**Beta**	**t**	**Sig.**	
(Constant)	3.227	0.178		18.128	0
Anthropometry	0.021	0.027	0.049	0.688	0.492
Physiology	0.049	0.039	0.091	1.284	0.218
Psychosocial	0.072	0.033	0.153	2.177	0.031
Human Engineering	-0.002	0.043	-0.004	-0.062	0.952
a. Dependent Variable: Work Performance					

In anthropometry Beta value is 0.049 which shows positive direction. This means that 0.049 means one-unit increase in anthropometry will bring 0.049-unit increase in work performance. Physiology Beta value is 0.091 shows positive direction. This means that 0.091 means one-unit increase in physiology will bring 0.091-unit increase in work performance. Beta value is 0.153 shows positive direction. This means that 0.153 means one-unit increase in Psychosocial will bring 0.153-unit increase in work performance. Human Engineering contributes 0.4% statistically significantly to the model. Beta value represents the direction of impact of independent variable on dependent variable. In this hypothesis Beta value is -0.004 shows negative direction. This means that -0.004 means one-unit decrease in Human Engineering will bring 0.004-unit increase in work performance.

Table V:Two-Tailed Correlation

	Anthropometry	**Physiology**	**Psychosocial**	**Human Engineering**	**Work Performance**
Anthropometry	1				
Physiology	.391**	1			
	0				
Psychosocial	.409**	0.111	1		
	0	0.119			
Human Engineering	0.127	0.041	.293**	1	
	0.075	0.568	0		
Work Performance	0.049	0.091	.153*	-0.004	1
	0.492	0.201	0.031	0.952	

XI. CONCLUSION

This research has subsidized to macro-ergonomics information by concentrating on the organizational influences that constitute facilitators and barriers to day-to-day ergonomics effort. It is anticipated that industrial organizations must be aware that effective ergonomics developments do not effect from methods alone, but likewise from attentively establishing social support structures around their use. It was noted that employees are sturdily motivated by their socio-technical environment, relationships with all ergonomic factors and industry explicit principles concerning information needs and who ought to be detained responsible for ergonomics. Similarly, it is obvious that psychosocial risk factors manipulate the occurrence and expansion of

musculoskeletal distress and disarrays.

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