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Ergonomics Analysis of Human Fatigue to Improve Production in Automobile Industry

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Abstract: *Ergonomics factors are more influence on the productivity of the workers in an industry. The ergonomics factors such as cognitive factors, environmental factors, organizational factors, physical factors are imperative role to play the productivity. A questionnaires based survey has been proposed to evaluate performance and productivity of workers. The result has been analysis by SPSS software package. Then the suggestion is provided to reduce the fatigue of worker and to facilitate the work. Hence to improve the workers' productivity.*

Keywords: SPSS software, Ergonomics

I. INTRODUCTION

1.1 Definition of Ergonomics

OSHA defines ergonomics as the science of "designing the job to fit the worker, instead of forcing the worker to fit the job."

1.2 Types of Ergonomics

- Physical ergonomics.
- Cognitive ergonomics.
- Organizational ergonomics.
- Environmental ergonomics.

1.3. Cognitive Ergonomics

Cognitive Ergonomics is a sub discipline of ergonomics that studies the cognitive processes at work with an emphasis on an understanding of the situation and on supporting reliable, effective and satisfactory performance. This approach addresses problems such as attention distribution, decision making, formation of learning skills, and usability of human-computer systems, cognitive aspects of mental load, stress and human errors at work.In the traditional understanding, "cognition" refers to the acquisition, maintenance and use of knowledge as examples of operations within the realm of human information processing. However, within dissident conceptions such as the joint cognitive paradigm, cognition should be understood in a broader sense, exceeding the limits of individual's brain or body. An example is the Gibsonian notion of "affordance", which refers to all aspects of the environment supporting specific actions of individuals (Gibson, 1979). This notion is of obvious significance for cognitive engineering, to such a degree that some authors declare the design of affordances to the engineering (Vicente, 1999). In a similar vein, Norman (1986) stresses the importance of "external memory". Under influence of these ideas, the meaning of cognition in cognitive ergonomics now refer to a highly organized distributed systems ("distributed cognition"), such as the military, air traffic control, aircraft cabins or navigation systems for large ships. Both people and artifacts are jointly regarded as agents within such a system. The focus is placed on the transfer and processing of information within and between agents. In this framework, cognition is viewed as a phenomenon that emerges from the work of the system as a whole(Hutchins,1995).One consequence of this redefinition has been the incorporation of theories that have been developed outside the mainstream cognitive research. This is the explanation for a discovery of activity theory (see Leontiev, 1978), which has its roots in the European romanticism and Marxist philosophy. Activity theory, with its

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focus on socio cultural origins of human thought and action, is now considered as a promising starting point for doing research in cognitive ergonomics (Nardi, 1996). Accordingly, there are no sharp distinction between consciousness and behavior, and thus between external actions and internal thoughts, a distinction that is common for traditional cognitive science and ergonomics. Thoughts without external actions are considered as internalized social actions, similar to corresponding external actions (Vygotsky, 1978).As soon as the socio-cultural context is considered, the scope of analysis becomes broader than in cognitive science. These contexts include communicating with others as well as the context in which the person is growing. The cultural context also includes the history of the artifacts, actions and people. The incorporation of new approaches and theories of cognition into ergonomics let to a discussion on the relative merits of macro- and micro theories whereby the dominating view stressed the importance of the overarching explanations. For instance, Klein, Ross, Moon, Klein, Hoffman, and Hollnagel (2003) proposed that cognitive ergonomists should create macro theories that incorporate all the complexity of interaction within a socio-technical system. Simultaneously to this holistic trend, one can testify a growing influence of concepts borrowed from the field of cognitive neuroscience. Being closely related to the progress in methods of brain and behavioral research, the second trend recently let to development of neuro ergonomics (Parasuraman and Wilson, 2008; Velichkovsky and Hansen, 1996). This tendency is especially evident, in the analysis of several traditional topics of human factors studies

1.4. Environmental Ergonomics

Today's world present difficult environmental decisions for a consciences company. Complicated issues make it difficult to know with a strong degree of certainty how our actions affect our environment.

RGP has adapted a policy to consider sand evaluate the environmental impact of our business in all of our decisions. RGP's goal is to be as environmentally neutral as possible. This policy affects our administrative, design, engineering, purchasing, distribution and marketing decisions. We are constantly looking for environmentally better methods to produce the highest quality product possible..

We believe it is better to buy quality that last rather than use and dispose. We are always open to suggestions as well. If you have any suggestions on how RGP can reduce our effect on the environment, please contact us to discuss

Environmental ergonomics is concerned with human interaction with the environment. The physical environment is characterized by: climate, temperature, pressure, vibration, light etc

1.5. Physical Ergonomics

The human body's responses to physical and physiological workloads? Repetitive strain injuries from repetition, vibration, force and posture fall into this category. Physical ergonomics is about the human body responses to physical and physiological work demands. Repetitive strain injuries from repetition, vibration, force and posture are the most common types of issues, and thus have design implications .physical ergonomics is concerned with the impact of anatomy, anthropometry, biomechanics, physiology and the physical environment on physical activity. Areas of focus in physical ergonomics include the consequences of repetitive motion, materials handling, workplace safety, and comfort in the use of portable devices, keyboard design, working postures, and the work environment. Ergonomics more generally is the science of designing the job, equipment, and workplace to fit the worker

1.6. Organizational Ergonomics

The dominant public view of ergonomics focuses only upon the physical domain, and most ergonomic products and services fall into this field. Meanwhile, with the evolution of the automated workplace, the domains of cognitive and organizational ergonomics are gradually gaining importance.

1.7 The Focus of Organizational Ergonomics

Also sometimes known as macro-ergonomics, organizational ergonomics focuses on optimizing socio-technical systems and organizing structures, policies and processes in order to maximize efficiency. This domain addresses more subjective aspects of the workplace:

- Communication
- Crew resources and management

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- Work schedule design
- Teamwork
- Participatory design
- Cooperative work
- New work paradigms
- Quality management
- Virtual organizations
- Community ergonomics

The goal of organizational ergonomics is the attainment of a fully harmonized work system that ensures employee job satisfaction and commitment. It also includes the study of technology's consequences on human relationships, processes, and institutions. Typical interventions are as follows:

Including workers in identifying and resolving ergonomic issues. This is also known as participatory ergonomics

- Improving total system processes, such as manufacturing value streams and managerial processes
- Successfully installing safety as an integral part of the organizational culture.

The organizationally ergonomic workplace adheres to the balance model. All systems interact, and any change in one system impacts the other elements. If all elements are not designed to work in confluence, safety, productivity, efficiency, and quality can all suffer. Furthermore, attaining balance realizes cost savings or avoidance. Therefore under the balance model, every effort is made to anticipate and minimize the impact of changes. Factors that tend to impede balance can be individual or organization-wide:

- A worker lacks the skills or knowledge base to complete tasks effectively and efficiently.
- Employees disagree with management practices.
- The organization is harming the environment

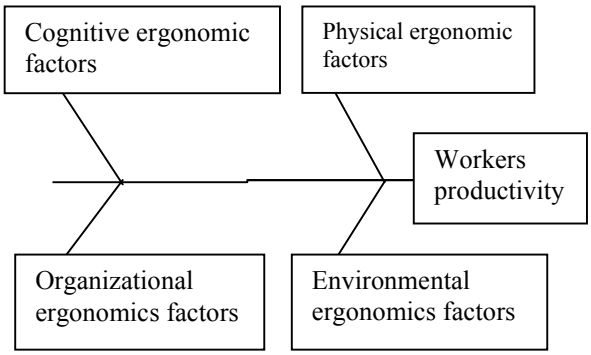
The most widespread application for organizational ergonomics is in the introduction and integration of new technology into the workplace. As companies implement new technologies, they must consider several factors of those tools:

- Functions
- Capabilities
- Capacities
- User-friendliness
- Integration

The organizational branch of ergonomics is often overlooked in the workplace because it concentrates on intangible factors.

II. EXPLANATION ABOUT ERGONOMICS FACTORS

2.1 Relationship Diagram



2.2 Background Information

First the nature of the job in the automobile industry was studied.raw material movements, work place design, human machine interaction , environmental conditions, worker and superior relationship, organizational relationship were

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studied .The idea got from analyzing the nature of job is utilized to prepare a questionnaire .The questionnaire contains 40 questions of five- point scale. It has five different ergonomics factors as follows , physical ergonomics factors, environmental ergonomics factors ,organizational ergonomics factors and cognitive ergonomics factors .Then by questionnaire the data collection was done among the workers of automobile manufacturing plant the answer are recorded on five point scale. The data entry and analysis may do by SPSS package. Then find out the maximum risk factors.

Then various suggestions are made to reduce the fatigue of the workers .When the fatigue reduces it increases the ability of worker to do work hence the productivity increases.

2.3 Need for the Study

In manufacturing industries the workers faced organizational ,environmental, cognitive& physical ergonomics problems .Above this problems are increase the human fatigue and they become exhausted very soon, hence productivity of industry reduces so to improve the productivity of the industry by reducing human fatigue with improved ergonomics, the study to be conducted among the workers along with the questionnaire, to find out the maximum risk factors by analyze the answers provided by workers and providing suggestions to reduce the risk factors, so reduce the fatigue hence it improves productivity.

2.4 Statement of the Problems

Ergonomics principles have for at least 50 years been thought and applied on a semi-empirical basis, but those things are not adopted by production related industries. So various factors like organizational, environmental, cognitive& physical ergonomics are affecting the productivity. They lower the ability to do work, hence the productivity decreases.

2.5 Objectives

1. To identify physical, cognitive, organizational and environmental ergonomics risk factors through interview with workers with questionnaires contain questions on ergonomic risk factors.
2. To made statistical analysis by using answers provided by the workers.
3. To find out which risk factor affects the productivity.
4. To provide possible suggestion to reduce fatigue and to get improved ergonomics which relieves the workers from stress hence improves their productivity.

2.6 Significance

1. Now a day's ergonomics plays major role in workplace design.
2. Machine tool design, material handling, environmental and personal considerations are taken into account during workplace design to have a good ergonomics design.
3. When the workers are facilitated to do work then doing the work is made easy.
4. When the worker is doing his/her work easily parallel it increases the number of components/unit time.
5. Ergonomics design of the products facilitates the worker to do work for a long time without any tiredness.

2.7. Methodology

2.7.1 Design of the Project

The framework of the project is shown in figure, from analysis the nature of work. To find the ways to enhance the productivity is explained.

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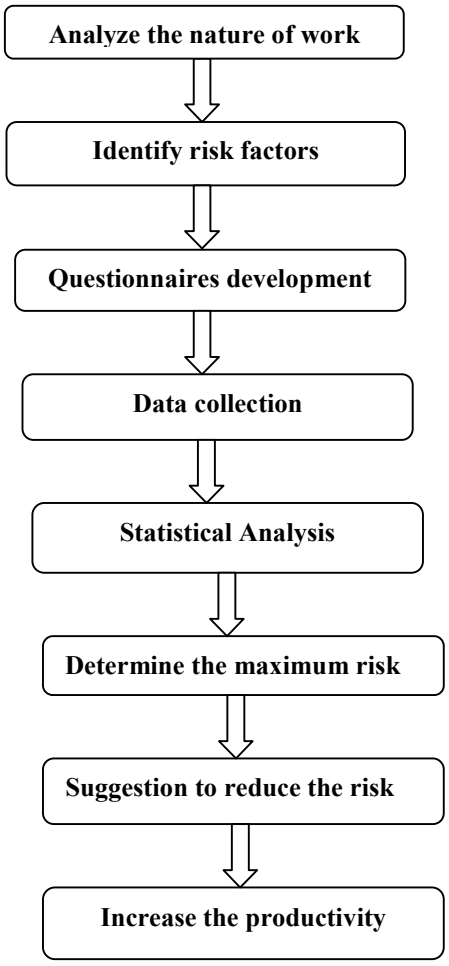

Analyze the Nature of Work

Before finding the risk factors through questionnaire the nature of job in the automobile parts manufacturing plant was done. Raw material movement, finished part transportation, worker and superior relationship were studied.

2.9 Development

The idea from analyzing the nature of job is utilized to prepare a questionnaire. The questionnaire contains 40 questions of four phases .It has five different scales as follows.

1. Cognitive ergonomics factors.
2. Physical ergonomics factors.
3. Organizational ergonomics factors.
4. Environmental ergonomics factors.

Statistical Analysis

Data entry and analysis is carried out with SPSS (statistical package for social studies).T- test is made to find out the maximum risk factors among various risk factors.

Suggestions

Various suggestions are identified for reduce the fatigue of the workers. When fatigue reduces it increases the ability of worker to do work hence the productivity increases.

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2.7.2 Tools Used

Two types of tools are employed in finding the risk factors. They are as follows

Questionnaire

A questionnaire was developed by us to collect the data to find out the risk factors. The questionnaire was developed as per the pre assessment made on the workplaces of the automobile company. The questionnaire consists of 40 questions in 5 scales. Each scales having equal number of questions .All questions are based on five point scales.

Interviews

To know the risk factors oral interview is made among the workers and helpers.

2.7.3 Data Collection

The study of ergonomics risk factors that affects productivity was conducted among the workers of automobile parts manufacturing plant, data collection was done using a questionnaire prepared to suit the environment of the company and according to their answer it is recorded in five point scales (strongly agree, agree, undecided ,disagree, strongly disagree)

The questionnaire is having five phases' scales as follows:

First phase **cognitive ergonomic factors** are defined by ten items.

- Job fear.
- Job satisfaction.
- Handlings.
- Memory lags.
- Boredom.
- Job stress.
- Decision making.
- Repetitiveness.
- Communication.
- Distraction.

The second phase **environmental ergonomics factors** are defined by ten items

- Temperature.
- Toxicants.
- Noise.
- Airflow.
- Vibration.
- Radiation.
- Dust.
- Glares.
- Illumination.
- Pollution

The third phase **Physical ergonomics factors** are defined by ten items.

- Working position.
- Working distance.
- Materials handling.
- Seat dimensions.
- Randomly packed materials.
- Restriction.
- Monitor height level.
- Size and position.
- Unstable machineries.

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- Workplace dimensions.

The fourth phase **organizational ergonomics factors** are defined by ten items.

- Superior.
- Leave.
- Co-workers.
- Promotion.
- Incentives, rewards.
- Staff welfare.
- Work shift.
- Team work.
- Payment.
- Medical insurance

2.8 Explanation About The Cognitive Ergonomics Factors

2.8.1 Job Fear

To find the causes of fear of failure, we first need to understand what "failure" actually means. We all have different definitions of failure, simply because we all have different benchmarks, values, and belief systems. A failure to one person might simply be a great learning experience for someone else.

Many of us are afraid of failing, at least some of the time. But fear of failure (also called "atychiphobia") is when we allow that fear to stop us doing the things that can move us forward to achieve our goals.

Fear of failure can be linked to many causes. For instance, having critical or unsupportive parents is a cause for some people. Because they were routinely undermined or humiliated in childhood, they carry those negative feelings into adulthood.

Experiencing a traumatic event at some point in your life can also be a cause. For example, say that several years ago you gave an important presentation in front of a large group, and you did very poorly. The experience might have been so terrible that you developed a fear of failure about other things. And you carry that fear even now, years later.

2.8.2. Job Satisfaction

At its most general level of conceptualization, job satisfaction is simply how content an individual is with his or her job. At the more specific levels of conceptualization used by academic researchers and human resources professionals, job satisfaction has varying definitions. Affective job satisfaction is usually defined as an unidimensional subjective construct representing an overall emotional feeling individuals have about their job as a whole. Hence, affective job satisfaction for individuals reflects the degree of pleasure or happiness their job in general induces. Cognitive job satisfaction is usually defined as being a more objective and logical evaluation of various facets of a job. As such, cognitive job satisfaction can be unidimensional if it comprises evaluation of just one aspect of a job, such as pay or maternity leave, or multidimensional if two or more facets of a job are simultaneously evaluated. Cognitive job satisfaction does not assess the degree of pleasure or happiness that arises from specific job facets, but rather gauges the extent to which those job facets are judged by the job holder to be satisfactory in comparison with objectives they themselves set or with other jobs. While cognitive job satisfaction might help to bring about affective job satisfaction, the two constructs are distinct, not necessarily directly related, and have different antecedents and consequences.

2.8.3. Handlings

Tools and equipment that are assigned to employees will be recorded by the supervisor or designee. The exact method for recording these transactions is at the discretion of the supervisor, but it is recommended that a written record of tool and equipment issuances and returns be kept. When a tool or piece of equipment is returned by employees, the supervisor or designee shall inspect the item for damage. Any employee who observes a loss of or damage to City-owned or leased property should report the occurrence to the responsible supervisor immediately.

If tools and equipment belonging to the City are lost or damaged through neglect or misuse, the supervisor of the responsible employee will prepare a memorandum to the responsible employee indicating the charges for repair or

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replacement. The cost of replacement should be determined through consultation with the Finance Department. The memorandum will be forwarded to the department director or designee who will review the memorandum and if in agreement, initial and approve the charge. Upon approval by the department, arrangements should be made for payment by sending a copy of the letter to the Director of Finance to effect the payment. A copy of the approved memorandum will go to the employee being charged. Employees must make cash payment for such charges to the City of Rockville within two weeks from the date that the memorandum was approved by the department director. If the employee is unable to pay the entire amount due within the two-week period, the Director of Finance will effect a payment schedule, with payments to be made on each successive payday following the determination of the charge. The minimum payment allowed shall be $10.00 or 10% of the item's value (whichever is greater) per pay period. In cases where the monies involved are extraordinary, then alternate payment schedules may be arranged through the Director of Personnel.

2.8.4.Task Difficulty

The need to process two tasks at once in everyday life is both common and sometimes a necessity. In other instances, it is merely convenient, such as talking on a mobile phone whilst driving a car. In some dual-tasking activities there is a deficit in one task or the other as a result of completing the two tasks simultaneously. This article will cover the nature of the dual task of talking while driving and its associated risks, and then attempt to link the constraints found in dual-tasking problems from laboratory studies to explain the deficit found when talking and driving. It is a well-known fact that it is difficult to perform two tasks at once. One such difficulty encountered in everyday life is talking on a mobile phone whilst driving. Whilst this at first may not seem a hard dual-task, there is a marked increase in vehicle accidents as a result of combining these activities. There has been mass media coverage of this problem, with several ad campaigns being produced designed to raise peoples' awareness of the danger of using a mobile phone whilst driving, and current legislation bans the use of hand-held mobiles whilst driving a vehicle. Findings that led to this ban include that of Redelmeier and Tibshirani (1997), who note in their epidemiological study of mobile phone records that there is a fourfold increase in the risk of an accident when using a mobile phone (indeed showing a similar increase in accident likelihood to that of driving under the influence of alcohol). The Mobile Phone Report (2002) showed that braking distances when using a hand-held mobile phone were on average over 14m longer than normal when travelling at 70mph.

The difficulty of driving and talking at the same time may not be present for all aspects of driving however, with little decrease in performance seen on "automatic" aspects of driving. No detrimental effect was found for performance on speed, distance from the middle of the road, the mean decision time at when emerging from side-roads (Spence & Read, 2003), or steering (Brown, Tickner& Simmonds, 1969). Redelmeir et al. (1997) suggest that the driving/talking deficit is not a result of loss of manual dexterity but instead a loss of cognitive and attention resources. Hartwell and McKenna (1999) state that driving studies demonstrate that there is an impairment in risk-taking judgments including judging gaps, close following, and gap acceptance when performing a secondary concurrent verbal task. This suggests that these dynamic risk-taking decisions are not automatic, and indeed the interference caused by completing a verbal task at the same time increases individuals' propensity to take risks.

2.8.5. Boredom

Boredom has been defined by C. D. Fisher in terms of its central psychological processes: "an unpleasant, transient affective state in which the individual feels a pervasive lack of interest in and difficulty concentrating on the current activity." M. R. Leary and others describe boredom as "an affective experience associated with cognitive attention processes." In positive psychology, boredom is described as a response to a moderate challenge for which the subject has more than enough skill.

There are three types of boredom, all of which involve problems of engagement of attention. These include times when we are prevented from engaging in some wanted activity, when we are forced to engage in some unwanted activity, or when we are simply unable, for no apparent reason, to maintain engagement in any activity or spectacle. Boredom proneness is a tendency to experience boredom of all types. This is typically assessed by the Boredom Proneness Scale. Consistent with the definition provided above, recent research has found that boredom proneness is clearly and

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consistently associated with failures of attention. Boredom and boredom proneness are both theoretically and empirically linked to depression and depressive symptoms. Nonetheless, boredom proneness has been found to be as strongly correlated with attention lapses as with depression. Although boredom is often viewed as a trivial and mild irritant, proneness to boredom has been linked to a very diverse range of possible psychological, physical, educational, and social problems.

2.8.6. Memory Lag

Memory lag create so many problems for industrial workers .mainly production will affected and error will create during production and proper communication also affects .they forgot to do next work it will create the major problem for industry. So proper treatment will avoid this kind of problems. Relaxation also reduce the memory lag.

2.8.7. Decision Making

One of the most active areas of human factors engineering from the beginning has been what is known as the "control of critical incidents". The category includes subtopics such as fire control, medical emergencies, control centers and civil emergencies, military operations, the stock market crises, the rescue of victims of kidnappings, etc. In dealing with these issues, ergonomists has been using several terms that could be considered at least partial synonyms: "command and control", “dynamic decision-making”, “distributed decision-making”, "natural decision-making" and “decision science" (Artman, 1998; Brehmer, 1992; Zsambok and Klein, 1997). In all these cases there is a common feature which is that persons who have to control these incidents should make decisions under time pressure and with little information to prevent (often) catastrophic consequences. Therefore, although, control of critical incidents involves a number of complex psychological processes, decision-making is considered to be the most important of them. Several interrelated trends are characteristic for contemporary decision-making studies in ergonomics. First of all, their authors turned away from tasks borrowed from formal logics to more naturalistic situations. As noted by Beach and Lipchitz (1993),13 psychologists have been traditionally focused on the endpoint of decision making: the choice between alternatives that are already given by the task conditions. They usually investigated inexperienced subjects and assessed the quality of decisions according to some "rational" criteria from context-free models. There are reasons to doubt the applicability of results found in these studies to real world situations (Hutchins, 1995).Indeed, if the conditions are changing, as in the control of critical incidents, the findings may be of marginal value. In natural situations, people are highly experienced and have to generate new alternatives under time pressure. Moreover, the training of professionals, which is based on formal algorithms of decision-making, can be rather misleading as the need to take a quick and obvious solution leaves no time to contract it with other theoretically possible moves (Salas, Cannon-Bowers, and Johnston, 1997).The combination of time pressure and the highly significant outcomes explains the interest that decision science demonstrates to ‘hot’, i.e. affectively loaded, rather than to’ cold’ cognition (see e.g. Kahneman, 2003).

III. Introduction to SPSS

3.1 Origin of SPSS

In 1968 at Stanford University, Norman H. Nie, a social scientist and doctoral candidate, C. Hadlai (Tex) Hull, who has just completed master of business administration, and Dale H. Bent, a doctoral candidate in operations research, developed a software system based on the idea of using statistics to turn raw data into information that is essential for decision-making. This statistical software system was called SPSS, the Statistical Package for the Social Sciences. This software is the root of present day PASW, the Predictive Analytics Software.

Nie, Hull and Bent developed SPSS because they need to quickly analyses volumes of social science data gathered through various methods of research. Nie represented the target audience and set the requirements, Bent had the analysis expertise and designed the SPSS system file structure; and Hull wrote the programmes. The initial work on SPSS was done at Stanford University with the intention that it would only be used within the university. With the launch of the SPSS user’s manual in 1970, however, the demand for SPSS software expanded. The original SPSS user’s manual has been described as “Sociology’s most influential book. Because of its growing demand and

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popularity, a commercial entity, SPSS Inc. was formed in 1975. Up to the mid-1980s SPSS was only available for mainframe computers.

With advances of personal computers in the early 1980s, the SPSS/PC was introduced in 1984 as the first statistical package for PC that worked on the MS-DOS platform. Similarly, SPSS was the first statistical product for the Microsoft Windows (version 3.1) operating system when a version for Windows 3.1 was launched in 1992.

3.2 SPSS Users

In the beginning, most users of SPSS were academic researchers, who were based in large universities with mainframe computers. Because of its very high price, employment of touch security systems and its difficult user interface, not many users or organisations used SPSS. SPSS was not popular among the researchers until the earlier personal computer version SPSS/PC+. Once the Windows version was launched, however, the use of SPSS increased rapidly because it was user-friendly and was easy to acquire (users could download a fully functional evaluation version with a specified trial period).

Moreover, the cost of obtaining an SPSS license is minimal for students, and it is within reasonable price range for members of corporations/organisations, although it is still expensive for general users. Many market researchers, health researchers, survey companies, government and education researchers use SPSS.

3.3 Strengths of SPSS

In addition to superb statistical analysis, SPSS offers good data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary is stored with the data). SPSS data files are portable (smaller in size compared to other database systems) and its program (SPSS syntax) files are quite small.

3.4 Organization of SPSS Statistics Software Package

SPSS has a base system with additional optional components or modules. Most of the optional components are add-ons to the base system. However, some optional components, such as the Data Entry component, works independently.

The base system, main component for running SPS, has the following functions:

Data handling and manipulation: importing from and exporting to the other data file formats, such as Excel, dBase, SQL and Access; and allowing sampling, sorting, ranking, subsetting, merging, and aggregating the data sets.

Basic statistics and summarisation: Codebook, Frequencies, Descriptive statistics, Explore, Crosstabs, Ratio statistics, Tables.

Significance testing: Means, t-test, ANOVA, Correlation (bivariate, partial, distances) and Nonparametric tests.

Inferential statistics: Linear and non-linear regression, Factor, Cluster and Discriminant analysis.

Some of the optional components (add-on modules) available are:

Data Preparation provides a quick visual snapshot of the data. It provides the ability to apply validation rules that identify invalid data values. You can create rules that flag out-of-range values, missing values, or blank values. You can also save variables that record individual rule violations and the total number of rule violations per case. A limited set of predefined rules that you can copy or modify is provided.

Missing Values describes patterns of missing data, estimates means and other statistics, and imputes values for missing observations.

Complex Samples allows survey, market, health, and public opinion researchers, as well as social scientists who use sample survey methodology, to incorporate complex sample designs into data analysis.

Regression provides techniques for analysing data that do not fit traditional linear statistical models. It includes procedures for probit analysis, logistic regression, weight estimation, two-stage least-squares regression, and general nonlinear regression.

Advanced Statistics focuses on techniques often used in sophisticated experimental and biomedical research. It includes procedures for general linear models (GLM), linear mixed models, variance components analysis, log-linear analysis, ordinal regression, actuarial life tables, Kaplan-Meier survival analysis, and basic and extended Cox regression.

Custom Tables creates a variety of presentation-quality tabular reports, including complex stub-and-banner tables and displays of multiple response data.

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Forecasting performs comprehensive forecasting and time series analyses with multiple curve-fitting models, smoothing models, and methods for estimating autoregressive functions.

Categories performs optimal scaling procedures, including correspondence analysis.

Conjoint provides a realistic way to measure how individual product attributes affect consumer and citizen preferences. With Conjoint, you can easily measure the trade-off

effect of each product attribute in the context of a set of product attributes – as consumers do when making purchasing decisions.

Exact Tests calculates exact p values for statistical tests when small or very unevenly distributed samples could make the usual tests inaccurate. Available only on Windows OS.

Decision Trees creates a tree-based classification model. It classifies cases into groups or predicts values of a dependent (target) variable based on values of independent (predictor) variables. The procedure provides validation tools for exploratory and confirmatory classification analysis.

Neural Networks can be used to make business decisions by forecasting demand for a product as a function of price and other variables, or by categorising customers based on buying habits and demographic characteristics. Neural networks are non-linear data modelling tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data.

EZ RFM performs RFM (recency, frequency, monetary) analysis on transaction data files and customer data files.

Amos™ (analysis of moment structures) uses structural equation modelling to confirm and explain conceptual models that involve attitudes, perceptions, and other factors that drive behaviour.

Another version, SPSS Server, is built on client/server architecture. It also includes some features not available in the normal version, such as scoring functions.

IV. STATISTICAL ANALYSIS RESULTS

4.1. One-Dimensional Analysis

Si no	Factors	No of items used	No of items retaine	Loading range	Variance %	Eigen values
1.	Cognitive ergonomics factors	10	4	0.806-0.968	35.885	3.908
2.	Environmental ergonomics factors	10	5	0.752-0.921	47.535	4.754
3.	Physical ergonomics factors	10	6	0.612-0.936	43.814	3.846
4.	Organizational ergonomics factors	10	5	0.621-0.972	50.389	5.038

Table 4.1: One-dimensional analysis

Interpretation:

- Out of 10 items of Cognitive ergonomics factors, 4 items are extracted to single factor. The 6 items receptiveness (.088), decision making (-.148), communication (-.078), memory lag (.006), handlings (.067), job fear (-.071) are deleted due to poor loading.
- Out of 10 items of Environmental ergonomics factors, 6 items are extracted to single factor. The 4 items Vibration(.188), Noise(.188) ,Pollution(.416), Radiation(-.105) and Glares(-.002) are deleted due to poor loading.
- Out of 10 items of Physical ergonomics factors, 6 items are extracted to single factor. The Monitor height level (-.015), Unstable machineries (.030), Size and position (.005) and Restriction (-.118) are deleted due to poor loading.
- Out of 10 items of Organizational ergonomics factors, 5 items are extracted to single factor. The five items Co-workers (.286), Training (.286) , Work shift(.161) , Medical insurance(.190) and Superior(-.076) are deleted due to poor loading.

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5.2. Reliability Analysis

Si. No	Factors	No of items used	No of samples taken	Cranach's alpha
1.	Cognitive ergonomics factors	4	75	0.935
2.	Environmental ergonomics factors	5	75	0.916
3.	Physical ergonomics factors	6	75	0.925
4.	Organizational ergonomics factors	5	75	0.939

Table 4.2: Reliability analysis:

Interpretation:
The result of reliability analysis is given in table.2 .An examination of the cronbach alpha for scales revealed that they are in 0.925 to 0.939 ranges for all the four dimensions. Reliability values of above are considered very well (Nunnally, 1970) for scale reliability.

5.3 Hypothesis for Cognitive Ergonomics Sub Factors

1. Null hypothesis H_0: There is no significance difference between task difficulties and productivity.
Alternative hypothesis H_1: There is significance difference between task difficulties and productivity.
2. Null hypothesis H_0: There is no significance difference between boredom and productivity.
Alternative hypothesis H_1: There is significance difference between boredom and productivity**.**
3. Null hypothesis H_0: There is no significance difference between job satisfaction and productivity.
Alternative hypothesis H_1: There is significance difference job satisfaction and productivity.
4. Null hypothesis H_0: There is no significance difference between job stress and productivity.
Alternative hypothesis H_1: There is significance difference between job stress and productivity.

5.4. One tailed t-test for cognitive ergonomics sub factors affects workers productivity:

SI. NO	Cognitive ergonomics sub factors	Mean Value	t-value	p-value	significance
1.	Task Difficulties	2.39	-4.283	0.001**	**H_1**
2.	Boredom	2.36	-4.520	0.001**	**H_1**
3.	job satisfaction	3.57	-2.850	0.006*	**H_1**
4.	Job stress	2.31	-4.926	0.001**	**H_1**

Table 4.1 One tailed t-test for cognitive ergonomics sub factors affects workers productivity Task Difficulties, Boredom, job satisfaction and Job stress, are accepted hypothesis H_1 at 1% level significance. These four factors mean values (2.39, 2.36, 2.57&2.31) less then test value (3). Task Difficulties, Boredom, job satisfaction and Job stress are affected the productivity.

5.5 Hypothesis for Environmental Ergonomics Sub Factors:

1. Null hypothesis H_0: There is no significance difference between Illumination and productivity.
Alternative hypothesis H_1: There is significance difference between Illumination and productivity.
2. Null hypothesis H_0: There is no significance difference between Temperature and productivity.
Alternative hypothesis H_1: There is significance difference between Temperature and productivity**.**
3. Null hypothesis H_0: There is no significance difference between Toxicants and productivity.
Alternative hypothesis H_1: There is significance difference between Toxicants and productivity.
4. Null hypothesis H_0: There is no significance difference between Dust and productivity.
Alternative hypothesis H_1: There is significance difference between Dust and productivity.
5. Null hypothesis H_0: There is no significance difference between Airflow and productivity.
Alternative hypothesis H_1: There is significance difference between Airflow and productivity.

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5.6 One tailed t-test for environmental ergonomics sub factors affects workers productivity:

SI. NO	Environmental ergonomics sub factors	Mean Value	t-value	p-value	significance
1.	Illumination	2.24	-5.091	0.001**	**H_1**
2.	Temperature	2.33	-4.312	0.001**	**H_1**
3.	Toxicants	2.97	-0.158	0.875	**H_0**
4.	Dust	2.81	-1.195	0.236	**H_0**
5.	Airflow	3.09	0.560	0.577	**H_0**

Table 4.6: One tailed t-test for environmental ergonomics sub factors affects workers productivity:

Illumination and Temperature are accepted hypothesis H_1 at 1% level significance. These two factors mean values (2.24, 2.33) less then test value (3).The Illumination and Temperature are affected the productivity. Toxicants, Dust and Airflow are accepted hypothesis H_0 at 5% level significance so there is no significance difference between Toxicants, Dust and Airflow and productivity.

Suggestions

1. Job Stress

A. Improve your time management and organization skills.

Of the many things you can to in this area the best ones include getting a to do list that works, learning to say "no", asking for help when you need it, and stop setting unrealistic goals for yourself.

B. Relax and breathe deeply.

Whether you are feeling overwhelmed by the amount or work you have to do or if someone is "in your face", a good thing to do is to "breathe through your nose". You can't get as worked up if you force yourself to breathe through your nose. Your body simply can't maintain the same level of energy without that extra oxygen you get when breathing through your mouth.

C. Take more breaks from your work.

Even a five-minute break will help. Get away from your desk. Go for a walk - outside is better, but up two flights of stairs and back down is good too. Getting more exercise in general will help you reduce your overall stress levels and that will make it easier to reduce your stress level at work.

D. Lighten up.

Smile more. We all know laughter reduces stress. You will be amazed at how much more pleasant the people around you are when you make an effort to be pleasant yourself.

E. Learn to listen better.

Rather than getting upset when others disagree with you, listen actively and find the areas of agreement. Be assertive and stand up for yourself, but don't be rigid.

F. Fix your environment.

Make whatever adjustments you need to the lighting, temperature, noise level, and other controllable factors in your office.

G. Don't sweat the small stuff.

Realize that there are some things that just aren't worth worrying about and there are some things you just can't change. Don't waste time stressing over the things in either category.

H. Get more sleep.

This is another of the things you can do to reduce your overall stress that will have benefits at the office as well. In addition to reducing your stress, it will increase your energy level and your ability to concentrate.

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I. Find a mentor

If not a mentor, a friend will do. Having someone to talk to can take a lot of stress off you.

J. Spend more time with optimistic people.

Negative people will pull you down to their level. Choose to work with people who have a positive attitude instead.

2. Bordom

1.Are you doing something that you have done many times before .try adding something new or doing it a different way. If that just doesn't cut it, stop doing the same thing over and over again, obviously, if repetitive tasks are a part of your occupation, then you may, unfortunately, have no choice but to stick it. You could consider getting a new job though, if this is the case .whatever the situation maybe, try and escape the monotonous task.

2. Try to do alternative method of working.

3. Task Difficulty

Task difficulty requires in-depth understanding of process to solve difficult Tasks.

4. Illumination

1. For low mounting heights (5m) and low lux levels (150 lux) - tms 122 / 254 with gms 122 Reflector is the best solution.
2. For low heights (5m) and higher lux levels (300 lux, 500 lux) – tps 325 / 428 open is the Best solution.
3. For higher heights (7m) and higher lux levels (300 lux, 500 lux) – tps 325 / 454 open top Is best solution.
4. For higher heights (9m) and high lux levels (300 lux) – tps 325 / 454 open top is best Solution.
5. For height (9m) and higher lux level (500 lux) – there is no great energy saving between Open normal and open top. However, open top has lesser quantity which will be an Installation benefit.

5. Temperature

1. Install insulation to prevent heat radiating through roofs or walls.
2. Use blinds, curtains or reflective coatings on windows to Reduce direct sunlight.
3. Place office machinery that produces heat in a well ventilated or isolated area.
4. Shield employees from any hot process.

6. Working Position

An operator workplace of a construction machine, comprising a seat with a seating surface; an armrest arranged to the side of the seating surface and having an arm supporting surface configured to support an operator's arm.

At least one control element arranged on the armrest for controlling at least one machine function,

where in an adjusting device is provided which is arranged in a manner that the armrest is adjustable between a sitting operating position and a standing operating position which in comparison with the sitting operating position is positioned upwardly in the vertical direction, the armrest and the arm supporting surface being arranged such that a position of the operator's arm relative to the arm supporting surface, and also relative to the at least one control element, is maintained as the armrest is adjusted between the sitting operating position and the standing operating position, and Wherein the adjusting device is arranged in a manner that in the standing operating position the armrest is automatically forwardly offset in the horizontal direction in relation to the seating surface relative to the sitting operating position

7. Increase promotion to the workers .productivity increases.

8. Increase payment workers productivity increase.

9. Increase the number of days leave workers productivity increases**.**

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V. CONCLUSION

In this project, I have examined workers productivity and its relationship to ergonomics, the workers productivity affected by ergonomics factors. The questionnaire based survey has been conducted .The t-test has been conducted to find out ergonomics risk factors. From the results the risk factors are work stress, Boredom, task difficulty, Temperature, illumination, Working position, Payment, promotion and leave are the factors affects workers productivity .

REFERENCES

[1]. Guide to Human Factors and Ergonomics, Second Edition text book byMartin Helander.2. Steven L. Sauter, Joseph J. HurrellJr, Lawrence R. Murphy and LennartLevi psychosocial and organizational factors(1987)

[2]. Hamidah Abdul Rahmana*, AzizahRajabb, RozianaShaaria, SitiAisyah "Reliability and validity of an ergonomics-related Job Factors Questionnaire". International Journal of Industrial Ergonomics, Vol: 39, Page no: 995–1001, (2006).

[3]. Li Huang, Yingxin Zhu*, Qin Ouyang, Bin CaoA" Study on the effects of thermal, luminous, and acoustic environments on indoor" Building and Environment Vol: 45 Page no: 581-59445–50, (2010).

[4]. N. Kamarulzaman, A. A. Saleh, S. Z. Hashim, H. Hashim, A. A. Abdul-Ghani* Study on "An Overview of the Influence of Physical Office Environments towards Employees" Procedia Engineering, Vol: 20, Page no: 262 – 268**,** (2011)

[5]. PascaleCarayon*, Michael J. Smith "Work organization and ergonomics" Applied Ergonomics Vol: 31 ,Page no: 649-662 ,(2000)

COGNITIVE ERGONOMICS FACTORS

1. Job involve extra work stress or mental work load?

1	2	3	4	5

2. Do you felt job fear affects your work?

1	2	3	4	5

3.Do you feel lake of communication affects your work?.

1	2	3	4	5

4. Do feel job satisfaction of your job?

1	2	3	4	5

5. Do you felt bored of doing routine work in the company?

1	2	3	4	5

6. Do feel continuous working to create a memory lag?

1	2	3	4	5

7. Are you confused to make decision on your job for a question?

1	2	3	4	5

8. Do you feel Repetitive work is creating a problem.

1	2	3	4	5

9. Do you face task difficulty of your work?

1	2	3	4	5

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10.Do you feel distracted by your colleagues while working?

1	2	3	4	5

ENVIRONMENTAL ERGONOMICS FACTORS

11. Do you feel that temperature is affect is your work?

1	2	3	4	5

12. Chemical toxicants are creating a problem.

1	2	3	4	5

13. Whether your ear drum is being affected due to high noise level.

1	2	3	4	5

14. Control of Airflow in your workplace is difficult.

1	2	3	4	5

15. Have you felt pain in your body due to vibration produced by machine?

1	2	3	4	5

16. Workers are affected against radiation exposure.

1	2	3	4	5

17. Whether the excessive dust substances are irritated.

1	2	3	4	5

18. The reflected glares are creating a problem.

1	2	3	4	5

19. Do you feel that illumination level is affecting your work?

1	2	3	4	5

20. Have you felt a problem due to pollution?

1	2	3	4	5

PHYSICAL ERGONOMICS FACTORS

21. The fixed working position (sitting or standing) affect the productivity.

1	2	3	4	5

22. Machines are away from the normal working distance.

1	2	3	4	5

23. Do you feel Job requires maximum materials handling.

1	2	3	4	5

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24. Does the Seat dimensions affect your work?

1	2	3	4	5

25. Randomly packed materials affect the productivity.

1	2	3	4	5

26. Do you feel Doorways, entrance/exit routes, are restricted?

1	2	3	4	5

27. Monitors are not to be placed at the proper height level.

1	2	3	4	5

28. Whether the Size and position of handles creates a problem.

1	2	3	4	5

29. Does the unstable machineries are affects your work.

1	2	3	4	5

ORGANISZATIONAL ERGONOMICS FACTORS

30. Workplace is not comfortable with human dimensions.

1	2	3	4	5

31. Do you feel your superior is not helpful?

1	2	3	4	5

32. Company is not provides adequate leave.

1	2	3	4	5

33. Co-workers are not helpful to complete task.

1	2	3	4	5

34. Company not provides promotion based on your performance.

1	2	3	4	5

35. Company not given financial incentives, rewards when your performance is good.

1	2	3	4	5

36. Company is not provides staff welfare.

1	2	3	4	5

37. Do you feel your work shift is not comfortable?

1	2	3	4	5

38. Do you feel teamwork is improving the work?

1	2	3	4	5

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39. Whether the less payment affects your work.

1	2	3	4	5

40. The Company not provides medical Insurance schemes?

1	2	3	4	5