

# A Review of Ergonomics towards Productivity

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**Abstract**—Nowadays often heard saying that ergonomics is one of the important things in improving the productivity of an industry. Ergonomic work culture must be applied in work space because reducing accident, injury, illness and the cost of treating employees and this can increase worker productivity thus give profit to the organization. Environmental ergonomics includes several factors such as lighting, thermal comfort, vibration, emotional and psychological needs of an individual. Psychological and physiological problems would increase stress levels and in turn affect the productivity of the organization. When employees feel stress and keep repeating the current situation they do the job, the potential of facing accident is high. In this research paper described ergonomic functions in the organization and also the relationship between ergonomics and productivity within an organization. At conclusion of the study the principles of ergonomics should be adopted and implemented by all sectors, especially in the industrial sector, to ensure that employees work safer, more comfortable, and healthier and productivity increased. It also can give a good impression, where employees work more efficiently in their workplace.

**Keywords**— Delphi, International Maritime Organisation (IMO), ISPS Code, SOLAS Convention, Qualitative Content Analysis

## 1. Introduction

Environmental factors such as brightness, sound, temperature and humidity should be emphasized and prioritized in ensuring occupational safety and health were not ignored. A work environment that is uncomfortable and dangerous can affect concentration and affect the health of employees. According to [1] ergonomic approach was developed to reduce fatigue and discomfort of working in order to improve the level of safety, health and comfort of humans. The importance of the environmental factors is the reason on the productivity of workers who in turn give the profits to the industry. A study is to identify the relationship between environmental factors and worker productivity have been implemented to

ensure that the environment is in a state that gives positive impact to health, psychology, job satisfaction, performance and productivity of an employee.

Ergonomic work station is a strategy that can be used by the organization to consume stress in the workplace [2][3][4]. Studies concerning human factors and ergonomics in the quality and safety and health of employees remain increased now according to [5][6][7]. According to [7][8] research concerning human factors, safety and comfort and health is an ongoing tradition. Risk assessment helps someone to evaluate the results which have done either high risk or not. In addition it can also help a person to make arrangements or action on the decisions that have been made. Environmental factors of work space should be taken into account in manufacturing activity for which environmental factors is continuous proportional humidity as a result of employees' respiratory and air temperature increase caused by the acceptance of thermal energy by the factory building itself. The role of humans in the system not only part of the system but is working to develop that system too [9]. Therefore it is important to characterize a system with studying the behaviour and activities as described by [9]. These conditions lead to workplace hazards, poor workers' health, and disabilities and will reduction in workers' productivity and products' quality. Designing the workplace environments with a firm's understanding of ergonomics can produce huge benefits [16].

Ergonomics sometimes has a negative connotation, as it is seen to be connected to illness or guidelines that limit innovations. This paper is focused on the positive aspects of ergonomics in improvement of the working environment. It consists of a part that studies the literature on success factors in the process towards higher productivity and greater comfort, the formulation of a model and a hypothesis [22].

## 2. Literature Review

### 2.1 Ergonomic

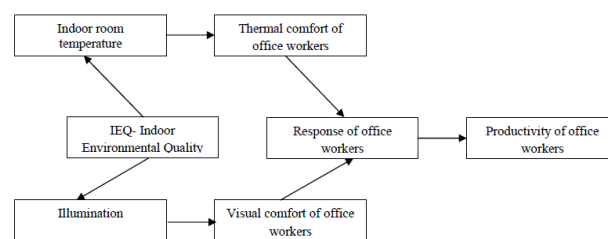
Ergonomics is compulsory in organizational culture, as this is the most efficient manner of incorporating the best ergonomic decisions at all hierarchical levels of the organization. The main goal of enhancing ergonomics intervention is continuous improvement, the only factor that drives success and competitiveness in the market [11] “Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance”. Ergonomics allow workers to do their jobs. Does it right, do it safely, do it with comfort, and, do it with accuracy. A good ergonomic workspace takes into consideration many types of furniture, devices and tools that can improve the space itself for the employee. This can include adjustable workbenches, chairs, accessories, tool rack solutions, tilting storage bins, adjustable computer screens, arm rests, foot rests, temperature controls, air conditioning, lighting, seating, and more.

Human factors and ergonomics is a multidisciplinary field incorporating contributions from psychology, engineering, industrial design, graphic design, statistics, operations research and anthropometry. In essence it is the study of designing equipment and devices that fit the human body and its cognitive abilities. The two terms "human factors" and "ergonomics" are essentially synonymous. Human factors and ergonomics are concerned with the ‘fit’ between the user, equipment and their environments. It takes into account of the user's capabilities and limitations in seeking to ensure that tasks, functions, information and the environment suits each user. A proper understanding of the aims of an ergonomics intervention creates the right context for improvements and their incorporation in the daily processes as well as in the organizational culture. A major aspect that needs to be considered when analyzing the status of the systems and its processes from the ergonomic point

of view are the position of the person or team that establishes the improvement areas and implements the recommendations: a theoretician has a different perspective than a practitioner [10].

Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over the time and can lead to long-term disability. Ergonomics improvements improve quality and operators productivity [7] [9]. Usually, ergonomics evaluations are performed by ergonomists, while workplace layouts are designed by planning engineers, and the results are often unsatisfactory and do not improve productivity [5][6]. So, a study of ergonomic factors or facilities affecting workers in an industry is important. In an industry, ergonomics plays a key role, where if proper ergonomic facilities are not provided it will affect the performance of the company. Figure 1 shown a Relation between Indoor Environment factors on productivity.

**Figure 1-** Relation between Indoor Environment factors on productivity

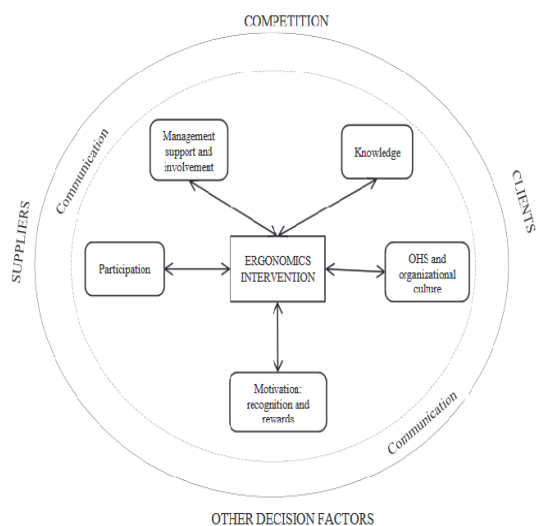


### 2.2 Ergonomics in Organization

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theoretician has a different perspective than a practitioner[21]. Figure 2 shown a proposal for ergonomics intervention in the organization which are connected between suppliers, competition and clients.

**Figure 2-** Proposal for ergonomics intervention in the organization



### 2.3 Ergonomics Towards Productivity

The ergonomics intervention is characterized by the idea of transforming a work situation through a real action. Intervention means interfering in the work environment, understanding the organizational activity, its knowledge and values in order to produce resources, develop, evolve and transform performance and work conditions[11]. Intervention has a complex dimension, due to its goal of improving human life and work conditions in the organization, through changes in systems, processes, procedures and machines.

The best manner to improve worker's performance and reduce errors and over-communication is to provide continuous feedback. The organization is a cybernetic system, meaning that feedback will ensure an adaptation and improvement. In this context, human performance at the workplace is conditioned by adequate feedback [12]. In addition, human feedback forwarded to the management of the organization would allow a better ergonomics intervention, as the user of the system is the one who can signal all the drawbacks and difficulties faced during work. The importance of the organizational environment consists in how the

system interacts and affects with the human, from a social, physical and mental perspective. The impact of the organization on its members is a major point of interest to ergonomics [13].

System safety may be evaluated through comparison between environmental performance requirements to human performance limits. To ensure human safety at work, it is important to understand what are the limits imposed by perception, decision making and action and how they can be considered in the design process, in order to create systems with low and stable performance requirements [13]. Accidents and injuries in the workplace are not normal situations. It is preferable to predict safety issues rather than implementing decisions to avoid in the future an event that already happened. Ergonomics improvements improve quality and operators productivity [17]. Usually, ergonomics evaluations are performed by ergonomists, while workplace layouts are designed by planning engineers, and the results are often unsatisfactory and do not improve productivity[18].

A survey was conducted [14] to investigate the relationship between environmental factors and job satisfaction that influence the workers' discomfort in four automotive manufacturing in Malaysia. Discomfort level of operator in workstation often were associated with workstation design, posture comfort operator at work, activity which involved work and place influence environment such as heat, noise and lighting. In the data analysis, research showed that the left arm was the part of the body that most involved with a lot of activity such as lifting, pulling, twisting, carrying and holding. As a conclusion, the study revealed that the dominant factors contribute to the productivity at the body assembly production line is WBGT and luminance whereas the empirical finding was closely related to the perception study by survey questionnaire distribution.

However the conclusion in this study, the work reports data and insights from two real industrial cases, where advanced simulation software is used, to validate the procedure and support methodology applicability. Relevance to industries, this work provides an extremely valuable methodological framework to companies who recognize the link between assembly and ergonomics. Generally, these issues are related to technological innovations

and organizational and environmental changes. From this point of view [15] proposed a model presented in Figure 3 for ergonomic intervention based on four principles: management support and logistics, knowledge support, HR participation and motivation through evaluation, recognition and rewards. According [19], the need of a new methodology for the initial selection of the assembly layout configuration is often recognized in industries.

The term productivity entails many aspects. Recently, [23][24], described four effects of a participatory approach related to productivity. The number of products per person per day was increased by 44%, the order lead-time was reduced by 46%, the direct time (time of added-value activities) was increased by 18% and the required workspace was reduced by 44%. These specific effects are not new, but the general philosophy has proven its effect in a study in 1999, in which higher returns on investments than their industry peers were produced by companies that place workers at the core of their strategies. A study among 702 firms showed that better human resource attention is associated with an increase in shareholder wealth of 40,000 Euro per employee [25]. The involvement of employees in a participatory process is thus also essential from a business perspective. Apart from the classification, it is interesting to know what factors influence the chance of being successful. Success factors have been described in various studies [26]. There are:

- a. Arrange direct workers' participation
- b. Arrange strong management support
- c. Carry out a good inventory
- d. Use a step-by-step approach
- e. Arrange that a steering group is established with responsibilities,
- f. Check the effects, including side-effects, at an early stage
- g. Do not focus only on health issues
- h. Describe the cost: benefit ratio in monetary terms and with non-quantitative measures.

### 3.0 Discussion

In this context, the principles of ergonomics should be adopted and implemented by all sectors, especially in the industrial sector, to ensure that employees work safer, more comfortable, and healthier and productivity increased. It also can give a good impression, where employees work more efficiently in their workplace. Manufacturing industry is something important especially in developing countries, as it plays an important role in employment and the transition to an industrial process. The main objective to examine the work environment in terms of ergonomic aspects not only to ensure the health and safety of workers but also to create a work environment for them where they can activate physical characteristics and physiological and psychological capabilities. Considering that an ergonomics intervention is, in fact, an improvement process in all aspects of the organizational activity, a suitable model for a successful intervention should aim at including all organizational aspects in order to address as many types of issues as possible. Generally, these issues are related to technological innovations and organizational and environmental changes. Thus, the ergonomics intervention is a process developed by managers, staff and member of working groups through their inter-relationships. Another element of the model is the feedback, provided and designed on the basis of the four pillars (principles) of this model as in Figure 3. A communication systems and the corresponding network established between those involved in the intervention needs to set the general framework of this model, in order to ensure a successful continuity of the ergonomics intervention. Another important element for understanding the requirements of an ergonomics intervention is the description of the organizational systems from the ergonomics perspective. Therefore, the system has two major subsystems: environment and machines. Each of the two systems has particularities that define direction and key areas for ergonomics intervention.

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