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Advances in Concepts of Ergonomics with Recent Industrial Revolution

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Abstract. Change is constant and as such we must always look forward to ways to help us adapt to these changes. With constant improvement being revised on evolving better and improved ways in which individuals and workers can function in their various organizations and industries, better and improved methods would have to be constantly developed in order to gain maximum efficiency from workers. The emergence of the Industry 4.0 industrial stage era has witnessed with its arrival tremendous industrial performance. This paper seeks to provide a review on the various advances of ergonomics concepts with the advancing industrial revolution with supporting roles on importance of training workers on the new innovative techniques

Keywords: Ergonomics; Human; Revolution; Environment.

1. Introduction

Throughout the years over time, various and different approaches bothering and centering on ergonomics has changed. Specific emphasis is still placed on mode of identification, investigation and putting an end to the dangers in various working environments. Be that as it may, there has been several contrasts at the conceivable outcomes of current ergonomics, through various science innovations and specialized future outcomes [1]. With proper ergonomic programs in place an industry will significantly reduce all possible occupational hazards from occurring in the industry resulting in lower cases of diseases, illness and in some cases death. An inappropriate management system always leads to the aforementioned consequences [2]. Various authors over time have all come out to give their various arguments on their ideas of what ergonomics is and should be. Based on some researchers concept and ideology on the existent relationship between the various factors and conditions in a workplace as it affects individuals and workers, taking into consideration the various tools being employed by the organization, division of Labour how individuals are organised. [3] ascertained the study of workers' efficiency with industrial ergonomics aims to exploit this competence by designing and changing industrial work studies, using a multidisciplinary purpose.

More so, [4] stated that Ergonomics provides a scientific discipline concerned with understanding interactions between humans and other elements of a system, with the career



that makes use of model, ethics, data, and methods to establish strategy to enhance human well-being in relation to total performance.

In every organization its most important asset is its human resource. There is a constant effort and need to improve the safety and working conditions of individuals in any organization or industry, safe working environments means comfortable working situations to enable workers carry out their various tasks with ease. Advances in ergonomics coupled with innovations from science and technology has contributed to massive industrialization globally. In the work environment, the selection and creation of tools, machines and work processes are continuously being developed. For instance over time hammers, axes and plows have been further improved bringing about a more efficient and effective use of these tools in performing their various tasks and operations. Recent research in ergonomics are tilting specifically to logistics in innovation activities as this forms one of the key obtainable area in ergonomics. Better improved flexible schemes involving internet of Things, information gathering and their continuous assessment and their sharing. Electronic instruments are another course in ergonomics [5] with the help of versatile applications we see an approach to make concrete conclusions at work for generation and furthermore non-creation specialists, gathering and coordination. Up until the beginning of the twentieth century a lot of individuals and organizations specifically did not have an idea of what ergonomics really represented or why it is expedient to develop an ergonomic program [6]. There exists numerous strategies and devices of present day ergonomics which empower us to acknowledge investigation and streamlining of representative's work to their advantages. It is essential to acknowledge ergonomic assessment flawlessly, broadly and for the most part rapidly [7].

2. History of Ergonomics

The term Ergonomics being coined from two greek words ergon and normos which means work or labour and natural laws respectively [8]. The word ergonomics was actually instituted by a polish scholar [9] and issues bothering on medical problems goes as way back during antiquated Egypt, Roman and Greek eras. Industrial Revolution which involved the transition from regular jobs to mass production then now towards large scale production has brought about an improvement in production, efficient measures in operation. As a means of checking fallouts of employees there is always a continuous effort for division of labour while seeking to increase productivity. Ergonomics is established on an interdisciplinary characteristic. Ergonomics is now a factor determinant for safety in any working environment. The musculoskeletal system comprises of the muscles, tendons, bones, ligaments, [10] and injury or disorder in the system is usually when one of the aforementioned part is stressed or exposed over a long duration of time in a work environment [11, 12].

3. Ergonomic Developing and Advanced Countries

[13] was able to distinguish between an industrially developing country (IDC) and an industrially advanced country (IAC) state the various features

Nigeria is an industrially developing country (IDC), this is established by some very key features used by [13]. He was also able to establish certain key features of Industrially Advanced Countries (IAC).

Table 1 carefully analyses some of the distinguishing factors that is obtainable in both an industrially developing country(IDC) and also an industrially advanced country(IAC).

[13] was able to establish some of the key difference between (IDCs) and (IACs).

Table 1: Spedding's IDC and IAC analysis

| Industrially Developing Countries | Industrially Advanced Countries |
|-----------------------------------|---------------------------------|
| Underproduction | Overproduction |
| Low Yields | High Yields |
| Starvation | Overeating |
| Low Body Weight | Obesity |
| Poverty | Affluence |
| Crop Product Consumption | Meat Consumption |
| Muscle Powered | Oil Powered |
| High Percentage of Young People | High Percentage of old people |
| Contaminated Water | Clean Water |
| Poor Control | Good Control |
| Food Processed at Home | Industrially Produced Food |
| Poor Hygiene | Good Hygiene |

Table 2: North's characteristics analysis of IACs and IDCs [14]

| Industrially Developing Countries | Industrially Advanced Countries |
|---|---|
| There is a widespread presence of agricultural industries | There is a widespread presence of manufacturing industries |
| The individual defines the work task | Work tasks are clearly defined and rationalized |
| There is usually a very close contact between manufacturers and consumers | There is usually little or no contact between the manufacturer and the consumer |
| Usually different technologies, productivity and working conditions are employed. | Consistent technology, productivity, and working conditions |

| | |
|---|---|
| There is little or no knowledge of technology here. | Workers are very conversant with available technology |
|---|---|

4. Influence of Ergonomics in Organizations

When delving on the influence of ergonomics in organizations an important consideration is given to the work environment and basic activities carried out in the organization [15]. When one has full understanding of these factors it helps for better productivity, transformation of working conditions in an organization by an overall replacement of previous working methods like equipment and machineries coupled with varying new technology. The central point whenever analysing ergonomics is the human factor. Understanding how individuals work in an organization and how their performance can be better improved. Every organization's hierarchy should endeavour to improve its feedback mechanism between staff and management this will help channel complaints in a better fashion and also give workers a particular sense of belonging in that institution or organization. A working environment's influence on an individual constitutes a major factor in ergonomics.

Continuous improvement on structure is a necessity that will improve human interaction between components and equipment in the organization. When a new system is developed various factors are being sought after particularly how it will affect humans. In ergonomics various designs and innovations will be incorporated into the operation or working condition of any system that is being developed [16].

4.1. Technological Innovation with regards to Ergonomics

The impact of technology can never be overemphasized coupled with its major improvement and enhancement of ergonomic techniques in organization [16]. With new manufacturing materials and research results in continuous innovation. Table 3 carefully analyses the ergonomic technologies that have been developed over time and their presence has significantly helped to increase production over time.

Table 3: New technological methods with regards to Ergonomics

| Technology | Usage |
|--|---|
| Computer Aided Design (CAD) | The incorporation of computer systems to develop work models has significantly brought about increased industrial performance [17]. |
| Integrated Engineering System | this involves incorporating IT support systems in developing products and manufacturing [18]. |
| Automation with Sensors | These are systems meant for monitoring purposes with little or no human intervention [19]. |
| Supervisory Control and Data Acquisition | monitoring with real time data collection with some degree of accuracy [20]. |
| Simulations and analysis of virtual models | helps for model based design of systems [21]. |

| | |
|------------------------------------|--|
| Fast Prototyping and 3D impression | used for having a more versatile and flexible manufacturing system [22]. |
|------------------------------------|--|

Basically about every activity today is tailored towards achieving sustainable development. Goals (SDG) developed and set to be achieved by the UN in 2030 . The new ergonomics concept will seek to improve a wide range of these goals like Good health and well-being (SDG 3). Ergonomics seeks to provide a safe working environment for workers in an organization and this will help improve the general safety of individuals in that establishment. Then there is the decent work and economic growth which is SDG 8. When workers work in a safe environment this will prevent certain hazards in the organization and also invariably increase productivity for these individuals. Then SDG 9 which is basically about industry, innovation and infrastructure will employ all the new technologies that are being set in place to improve the production level in an organization. From table 3, the technological methods aforementioned when employed helps to reduce certain health and risk hazards compared to when an individual would have carried out manufacturing processes manually.

5. Conclusions

The possible influence of ergonomics cannot be overemphasized as it is a major factor in the running operation in manufacturing industries. There has to be a conscious effort to continuously improve on the working conditions between individuals and workers in their various working environments and the first step to achieving this will be raising an awareness level in employees about the various risk factors associated with their jobs and tasks so as to bring about optimum performance by workers and staff. Also with major ergonomic programs delving into technology it will become however paramount in educating workers and staff on the use of these various technologies so they become conversant with them over time.

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