

# e-Proceeding

# V-GO GREEN 2020<sup>29-30</sup> SEPT

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"SUSTAINABLE ENVIRONMENT, RESILIENCE AND SOCIAL WELL-BEING"

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# ASSESSING FACTORS IN CONSIDERING ERGONOMICS AT CONSTRUCTION PROJECT– AN OVERVIEW

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## **Abstract**

Construction activities in Malaysia are industries that interact with humans with technological support and tools in performing various tasks given to a large environment. However, these construction activities are among the sectors that are exposed to high risks of accidents and injuries. An organization must be vigilant in knowledge and procedures involving the management of Occupational Safety and Health (OSH). This will indirectly affect the life cycle of its project. Therefore, this research is conducted for the purpose of identifying Human Factors associated with Ergonomics (HF/E) to increase safety and professional satisfaction in terms of comfort and convenience in the workplace. Based on the literature, there are five (5) factors in HF/E consideration. Starting from human interaction to health and safety, environment, design of equipment and work task, workplace and work process. While there are economic factors that drive continuous HF/E principle and improvement in the workplace, organizational management should have an appropriate investment in HF/E prior to on-site implementation is a good economy for organizations towards human well-being and happiness among society. The noble intention of management by placing people as a priority, positive reflection on the organization is a timely project, cost-saving with a profitable project and the quality shown by the controlled OSH itself is being pursued. This is a valuable investment at the early stages of the project with a high emphasis on safety and human performance on project costs.

**Keywords:** *ergonomics integration; human factors; occupational safety and health; organizational performance*

## **1.0 INTRODUCTION**

Every job that a human being carries out with their own expertise, satisfaction with safety requires the full support of the management. Employees, as an organizational asset, must strive for the best in each task and together aim to succeed in every angle of time, cost, and quality. "HF/E factors (and synonymously ergonomics) is defined as the scientific discipline concerned with the understanding of interactions among humans and other elements of a system in order to optimize human well-being and overall system performance" (Neumann et al., 2016). Therefore, According to Boatca & Cirjaliu (2015), ergonomics integration acts as a key driver for a healthy and prosperous organization in the present socio-economic environment. Management and all stakeholders are responsible for avoiding unnecessary costs outside the contract but without prioritizing safety at the workplace, this will jeopardize the productivity and reputation of the organization. According to Douphrate (1995), Ergonomics play a vital role in injury reduction and prevention. The managing board should focus on ensuring the best conditions in the workplace (Boatca & Cirjaliu, 2015). Ergonomic integration must be discussed at the forefront before project implementation for loss prevention. "This is especially known in high-risk industries where near misses are being investigated as well as incidents that result in losses" (Risktec, 2014). Considering ergonomics will help human interaction of tasks for comfort and productivity in their various disciplines. Ergonomics is a

good business practice, and effectively contributes to the economic well-being of the company highlighted by Douphrate (1995). In addition, interpreted by Shaver et al. (2008), in the business world, benefits are often judged by their return on investment and cost benefits analysis. The workplace is a major area of focus of ergonomics, as functional and physical conditions should meet the needs of human beings and not the otherwise as mentioned in the International Ergonomic Association.

According to Mahmoudi et al. (2014) construction industries are among the most hazardous industries, and need a comprehensive and simple-to-administer tool to continuously assess and promote its health and safety performance. For most Malaysian managers, ergonomics is not considered to be associated with performance, but rather with occupational health and safety and legislation. Therefore, another opinion is "Ergonomists practitioner and engineer must be aware of ergonomics" (Da Silva et al., 2012). Ergonomists and Engineers capable of presenting an economic as well as technical argument to justify recommended ergonomic integration. "Health and safety professional must fully understand as well as communicate the financial costs of injury" (Douphrate, 1995). Douphrate(1995) again highlights that ergonomics plays a vital role in injury reduction and prevention, but economically effective ergonomic principles can lead to improved corporate financial performance and strategic competitive advantage. HF/E is essential because of its importance in contributing to the project lifecycle and profitability while the company is successful in maintaining long-term employee safety. At the same time, it can enhance the reputation of the company as a whole and be known as the company that protects the welfare of employees. The application of simple ergonomic principles can reduce cost such as worker's compensation, absenteeism, employer turnover, and product quality defects (Douphrate, 1995). "Leave no stone unturned to help your clients realize maximum profits from their investment" (Wood, 1962). Thus, this research intends to study about factors to consider HF/E in the workplace at construction projects.

## 2.0 LITERATURE REVIEW

Ergonomics comes from Greek words *ergon* which means "work" and *nomos* means "law". Ergonomics is about the laws of work derived from humans, machines, tasks, environments. (Boatca & Cirjaliu, 2015) highlighted that ergonomics (also known as Human Factors) is the key science that is focused on ensuring work environment adaptation to human beings' talents, abilities, skills, and limits. "All work systems consist of human components and machine components embedded in a local environment" (Bridger, 1995). According to Bridger (2003) the definition of Ergonomics is the study of the interaction between people and machines as a technology and tools and the factors that affect the interaction. Its purpose is to improve the performance of systems by improving human machine interaction. This can be done by 'designing-in' a better interface or by 'designing-out' factors in the work environment, in the task or in the organisation of work that degrade human-machine performance. "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 to optimize human well-being and overall system performance"(International Ergonomics Association, 2015). In Malaysia, Department of Occupational Safety and Health, Ministry of Human Resource introduced The Guidelines on Occupational Safety and Health in Construction Industry (Management) 2017 (OSHCIM 2017) encourages the duty holders and stakeholders towards working together to improve safety and health, resulting in fewer construction workers dying, being injured or becoming ill while carrying out the activities on construction site (Health, 2017). HF/E emphasizes the idea, design of systems and selection of ergonomic equipment and machinery to suit work for people who will perform tasks in line with organizational needs and project goals. In order to remain competitive, the organization aims at continuous improvement, and an ergonomic integration is compulsory in achieving this goal. Hendrick (2003) commented that managers usually can justify financially supporting a proposed ergonomics project only when it is supported by a sound cost-benefit analysis. Table 1 below presents factors to consider ergonomics at the workplace of construction projects derived from literature review.

**Table 1: Factors to consider ergonomics at construction project**

Factors	Authors	1	2	3	4	5	6	7	8	9	10	Total
Human		/	/	/	/	/	/	/	/	/	/	10
Task, Workplace and Work Process							/	/	/	/	/	5
Health and Safety		/	/			/	/	/	/	/	/	8
Design of Equipment and Facilities			/					/	/	/	/	5
Products								/	/	/	/	4
Environment		/		/		/	/	/	/	/	/	8
Business Performance			/		/		/		/		/	5
Stakeholders		/							/		/	3
The Management		/	/				/		/		/	5
1-(Da Silva et al., 2012) 2-(Doughrate, 1995) 3-(Risktec, 2014) 4-(Shaver et al., 2008) 5-(Mahmoudi et al., 2014) 6- (Boatca & Cirjaliu, 2015) 7- (Bridger, 2003) 8-(International Ergonomics Association, 2015) 9-(Neumann et al., 2016) 10-(Health, 2017)												

HF/E exists from the first factor which is a human then it interacts to the highest factors which are health and safety and environment. Depending on the nature of the job, it shows that the priority at the task, workplace, work process, and design of equipment are significant, while business performance and management's lack of implementation are equally important. Whereas, stakeholders are a minor factor due to management's decision. As per Stanton & Baber (2003), ergonomics integration is likely a small fraction of the total budget and ranging 1% to 12% as payback periods of less than 1 year which presents a very optimistic picture of ergonomics. In conclusion, organizational management should consider ergonomic integration in human health and safety as it can contribute positively to business performance in terms of cost. The motivation for the importance of ergonomics among management in this situation is to reassure by calculating Return on Investment (ROI) on ergonomics integration at the forefront of projects to achieve ergonomics principles.

### 3.0 FINDINGS AND DISCUSSION

The goal of ergonomics is to optimize human performance. When ergonomics is done right, and human performance is optimized, there are two primary positive outcomes: improved employee well-being and improved business performance (Dul et al., 2012). In addition, Sharma (2012) ergonomics has both a social goal (well-being) and an economic goal (system performance) for solutions in technical and organizational domains. This is the value of ergonomics. Work systems are made up of people, the tools, processes, and technologies they use, and the work environment. Ergonomics contributes to the creation of sound, safe and sustainable work systems with consideration of the interplay between human, technical, and environmental components, and the possible impact of changes in the design of work systems on all parts of the system. "Four reasons have traditionally been used to justify ergonomic principles i) injury reduction/safety improvement, ii) improvement in the overall quality of work life, iii) improved product quality, iv) improved production efficiency/ productivity" (Doughrate, 1995). It can be argued that a fifth reason for ergonomic justification is the contribution to the profitability and strategic competitive advantage of the company. Ergonomics is good economics, and should be justified from both a humanitarian and an economic standpoint". (Doughrate, 1995). Many changes need to be made within the ergonomics research, education and practice community by integrating concepts from the social sciences with technological advances into Malaysian culture to enhance cost benefits parallel to the ergonomics achievement on productivity and sustainable improvements in the quality of life, while achieving essential health and safety goals. If all these are put on the ground, then we have a comprehensive integration scheme which through courses and well-organized education

campaigns will create awareness in all stakeholders for project cost performance not only technically achieved.

## 4.0 CONCLUSION

Ergonomics came about because of the designs and operational problems presented by technological advances in the last century. The construction industry is one of the most dangerous industries to work in. Although incidents have reduced in the past 20 years, there are still many fatal and serious injuries. Focus on ergonomics integration in coordinating things that interact with people in terms of needs, abilities in respects of human individual difference, and their limitations. Considering ergonomics will help human interaction of tasks for comfort and productivity in their various disciplines. HF/E management expectations end with projects where costs are controlled by prioritizing human safety.

## REFERENCES

- Boatca, M.-E., & Cirjaliu, B. (2015). A Proposed Approach for an Efficient Ergonomics Intervention in Organizations. *Procedia Economics and Finance*, 23, 54–62. [https://doi.org/10.1016/s2212-5671\(15\)00411-6](https://doi.org/10.1016/s2212-5671(15)00411-6)
- Bridger, R. S. (1995). Introduction to Ergonomics. In *Introduction to Ergonomics*. <https://doi.org/10.4324/9780203426135>
- Bridger, R. S. (2003). Design of Repetitive Task. In *Introduction to Ergonomics* (Vol. 53, Issue 9). <https://doi.org/10.1017/CBO9781107415324.004>
- Da Silva, M. P., Pruffer, C., & Amaral, F. G. (2012). Is There Enough Information to Calculate the Financial Benefits of Ergonomics Projects? *Work*, 41(SUPPL.1), 476–483. <https://doi.org/10.3233/WOR-2012-0199-476>
- Douphrate, D. I. (1995). The Economics and Cost Justification of Ergonomics. January, 29–40.
- Dul, J., Bruder, R., Buckle, P., Carayon, P., Falzon, P., Marras, W. S., Wilson, J. R., & van der Doelen, B. (2012). A Strategy for Human Factors/Ergonomics: Developing the discipline and profession. *Ergonomics*. <https://doi.org/10.1080/00140139.2012.661087>
- Health, D. of O. S. and. (2017). Guideline on Occupational Safety and Health in Construction Industry - Guideline Notes (Principal Designer). <https://doi.org/10.1017/CBO9781107415324.004>
- Hendrick, H. W. (2003). Determining the Cost-Benefits of Ergonomics Projects and Factors That Lead to Their Success. *Applied Ergonomics*. [https://doi.org/10.1016/S0003-6870\(03\)00062-0](https://doi.org/10.1016/S0003-6870(03)00062-0)
- International Ergonomics Association. (2015). What is Ergonomics? <https://iea.cc/>
- Mahmoudi, S., Ghasemi, F., Mohammadfam, I., & Soleimani, E. (2014). Framework for Continuous Assessment and Improvement of Occupational Health and Safety issues in construction companies. *Safety and Health at Work*, 5(3), 125–130. <https://doi.org/10.1016/j.shaw.2014.05.005>
- Neumann, W. P., Kolus, A., & Wells, R. W. (2016). Human Factors in Production System Design and Quality Performance – A Systematic Review. *IFAC-PapersOnLine*, 49(12), 1721–1724. <https://doi.org/10.1016/j.ifacol.2016.07.830>
- Risktec. (2014). Human Factors Engineering in the Oil and Gas Sector. *RISKWorld*, 25(1), 6.
- Sharma, R. (2012). Conceptual Framework for Improving Business Performance with Lean Manufacturing and Successful Human Factors Interventions – a Case Study. *International Journal for Quality Research*, 6(3), 259–270.
- Shaver, E. F., Ph, D., & Braun, C. C. (2008). The Return on Investment (ROI) for Human Factors & Ergonomics Initiatives. January, 2003–2006.
- Stanton, N. A., & Baber, C. (2003). On The Cost-Effectiveness of Ergonomics. In *Applied Ergonomics*. [https://doi.org/10.1016/S0003-6870\(03\)00060-7](https://doi.org/10.1016/S0003-6870(03)00060-7)
- Wood, J. (1962). Leaders in Marketing: Arthur C. Nielsen. *Journal of Marketing*.



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