

Occupational Health and Safety, and Environmental management on the age of Fourth Industrial Revolution

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Abstract. The effective management of safety, health and environment in all workplaces has many benefits. These benefits include, for example, the improved overall wellbeing of the workforce, increased productivity, reduced work-related accidents, injuries and fatalities, and a positive public impression of the organization and its management. The paper highlights the importance of effectively managing occupational health and safety, and the environment during general industrial activities

Keywords. Occupational Safety, Occupational Health, Environment, Fourth Industrial Revolution

1. Introduction

The Fourth Industrial Revolution is the new workplace challenge, enabling data collection and processing on all machines. This new digital industrial technology, also known as 4IR, allows faster and more flexible processes resulting in reduced costs during the production of high-quality products. It is the revolution of manufacturing character that will bring about economic change, increase productivity, boost industrial growth, and transform the competitiveness among companies and even among regions. Of course, consequently, new parameters will appear as a risk to health, safety, security, quality, and the environment. The real difficulty, however, is that the impending danger cannot be predicted in advance, as so far, we cannot know the work activities that will cause it. All the above poses a special but also interesting challenge for the business world - both for employers and employees - who will have the choice of either adaptation or simple survival or disappearance. The remainder of the paper is organized as follows. First, the 4th industrial revolution and its impact is described. In the next section, the reasons for HSE programs are presented and discussed. The findings of this study are summarized in the conclusion.

2. 4th Industrial revolution and its impact

The manufacturing sector uses digital technology of the previous generation but now, with 4IR, the output of products and the services provided will evolve significantly. Then the current production forces in the supply chain will be differentiated, among suppliers, producers, and customers, reaching down to the relationships between individuals and machines. Basic perceptions of what being human really means will be doubted. Among the key elements of Industry 4.0 (4IR) that will work towards the transformation of industrial production are the following nine [1-9]:

Big Data and Analytics: In an Industry 4.0 context, the gathering and evaluation of data comprehensively from a large number of different sources such as production systems and equipment as well as the management systems of enterprises and customers will become universally standard to support real-time decision making.

Autonomous Robots: It is already possible for robots to interact with other robots and work safely alongside humans while learning from them. The benefits of this development are that these robots will be less expensive and have a greater range of capabilities than those already currently used in present manufacturing.

Simulation: Simulations will be used more extensively than presently in plant operations to strengthen current data. These simulations will effectively mirror the physical world in a virtual model. This model could include machines, products, and humans. This increased usage of simulations will allow operators to test and optimize the machine adaptations to a virtual environment to produce the next product before the physical change occurs changeover, thereby driving down machine setup times and increasing quality, health, and safety. Simulations, therefore, provide an effective and efficient form of ‘what if’ scenarios.

Horizontal and vertical system integration: Within the context of 4IR, it is possible for organizations, departments, functions, and capabilities to become increasingly cohesive, due to the evolution of cross-company and universal data-integration networks and enable truly automated value chains.

The internet of things (IoT): The 4IR framework practically means that many older devices, which at times include incomplete products, will be enriched with new software and, so, they will be able to communicate and even to interact with central systems. In addition, it will lead to the decentralization of data analysis and decision-making and will expand the possibility of immediate responses.

Cybersecurity: One parameter to consider is the frequent use of standard communication protocols and 4IR connectivity, which will intensify the need to protect important systems and production lines from risks that may affect cybersecurity. For this reason, protected and reliable communications are a prerequisite, as well as the management of the identity and access of users and machines.

Additive manufacturing: Many organizations use additives, such as 3-D printing, as a method of creating prototypes or producing individual components. 4IR favors the manufacture of additives mainly to produce custom products of a limited number to offer, for example, construction advantages, such as complex, lightweight designs.

Augmented reality: Augmented-reality-based systems support a variety of services. It is likely that organizations will use augmented reality on a much broader basis in the context of 4IR to provide their workers with real-time information to improve their on-the-job decision-making and work procedures. [1-10]. (

3. Reasons for HSE programs

What an organization believes to be morally correct and justifiable when questioned on the health and safety of its workers is a reflection on how it values its people. Many organizations make health and safety their number 1 priority. Sadly, priorities change from time to time. Instead, if health and safety was an organizational core value it is not subject to change. That is what organizations should be striving for. According to vision the health and safety as a value, the basic reasons for HSE programs are:

3.1. Legal considerations

In all over the world several laws influence and affect the employer/worker relationship. It is imperative that HSE practitioners must familiarize themselves fully with all sections and regulations applicable to health, safety, and the environment. Failure to comply with Acts, which regulate health and safety in industry and in the mines, can result in unnecessary delays in production, legal liability claims and possible criminal prosecution. It has long been argued in some quarters that accidents happen by chance. Consequently, accidents therefore cannot be influenced because one cannot affect chance. Because one cannot change chance trying to do so is wasting energy, time, and resources. Accidents are then perceived as an inevitable and integral part of life and work and caused by ‘bad luck’. This argument and attitude create the situation where nothing is done, or a minimum effort is made to prevent accidents. The fact is that accidents are not fate or chance but unfortunate events that can be prevented. Everyone can do something about SHE. Prevention is the responsibility of everyone. Many organizations around the world have shown that having a profitable business does not require accidents to occur. These

organizations have adopted a high standard HSE culture and the zero-accident vision by accepting that accidents are preventable.

3.2. *Moral and social considerations*

Risks are accepted as a part of daily life. Working cannot be stopped just because there are risks associated with the work, but the risks and exposure to them can be effectively managed. There is no perfect workplace without risks. However, health and safety in the workplace is both a state of mind as well as a way workers work and act towards each other. Joint responsibility and self-regulation are necessary. All the role players in an organization such as the employer, workers, and trade unions, should work together and accept joint responsibility to make the workplace a safer place.

Effective communication channels are critical. Communication channels should be available and regularly revised to ensure that health and safety issues and risks are communicated effectively. Communication should not only be focused on enforcing policies and procedures but also on reporting potential problems. Therefore, all workers should know to whom they must report these problems or improvement suggestions as well as the rules for reporting injuries sustained on duty.

Occupational health and safety legislation specifies that a workplace must ensure that persons other than those employed in the workplace and who are directly and indirectly affected by the activities of the workplace may not be exposed to health and safety risks. The implication is that, for example:

A workplace may not pollute the natural environment or discard any material that may cause a health risk to others such as industrial toxic effluence and waste into rivers and canals.

Persons who use products manufactured by the workplace must be informed of any health or safety risk they could be exposed to by using those products.

Management and workers have, apart from their legal responsibilities, a moral and a social obligation towards other workers and themselves to ensure effective health, safety and environmental management and protection. Management also has a moral and social responsibility towards safeguarding the public, contractors and visitors who may be affected by the activities of their operations and the use of their products. Organizations must act responsibly regarding the hazards of the articles or substances they produce, process, use, handle, store, or transport. Social and moral obligations interlink with legal and financial considerations.

3.3. *Economic considerations*

Serious work-related injuries and diseases have an enormous cost implication on the economy of the countries. The following are therefore important, namely:

The financial implications of injuries or health problems for the worker. The potential suffering for the injured or sick worker and his / her family.

The potential effect on the career and future employment opportunities of the worker.

Loss in productivity associated with workers who are absent from work due to occupational injuries or illness. The loss in needed skills if the worker is no longer able to perform the duties, he / she previously performed. The cost of re-training workers if they are to be accommodated in an alternative position within the organization.

The cost of recruitment and employment of replacement staff.

Disruption of the normal flow of work and delivery of services if key staff are lost or if operations must stop due to workplace accidents.

The effect on the general morale of other workers when workplace accidents occur.

According to Peter Drucker, the well-known Austrian-born American management consultant, educator, and author, "The first duty of an organization is to survive, and the guiding principle of business economics is not the maximization of profit, it is the avoidance of loss." Business enterprises or public institutions must be financially viable by making profits to survive. In the case of the public sector, or other service orientated institutions and organizations, the profit refers to providing "optimum service levels at least cost".

3.4. Government objectives

Government, like any business, sets objectives to be effective. These objectives are formulated and published. Measures are then implemented to achieve these objectives and the private sector is motivated to assist government in its efforts. In terms of health and safety government may aim to increase the awareness of health and safety by training more people to a certain level of competence. To motivate trade and industry to participate in the effort, government may offer various incentives, such as, for example, subsidizing part of the health and safety training fee, and other tax incentives for having a consistent annual positive performance record. The policy of the organization will determine its specific objectives regarding safety, health, and environmental protection procedures. In addition to these objectives the organization may set its own standards and procedures within the law. Notably, the Act and associated regulations prescribe the minimum requirements necessary to conform to the law. Corporate governance has been defined as 'an internal system that includes the policies, processes and people, which serves the needs of shareholders and other stakeholders, by directing and controlling management activities with good business sense, objectivity, accountability and integrity.'

Key elements of good corporate governance principles include honesty, trust and integrity, openness, performance orientation, responsibility and accountability, mutual respect, and commitment to the organization.

Commonly accepted principles of corporate governance concerning health and safety in the workplace include:

Interests of stakeholders, including workers: Organizations should recognize that they have legal and other obligations to all legitimate stakeholders.

Integrity and ethical behavior: Ethical and responsible decision making is a necessary element in risk management and avoiding lawsuits. Organizations should develop a code of conduct for their directors and executives that promotes ethical and responsible decision making.

Disclosure and transparency: Organizations should clarify and make publicly known the roles and responsibilities everyone employed by the organisation and establish a level of accountability.

Compliance with health and safety legislation and regulations should form part of good corporate governance and not be the sole objective of HS interventions.

4. Conclusions

Given the recent global challenges presented by the COVID-19 pandemic, the opportunity is presented to expand research into technologies that will prevent or at least limit the exposure of all industry stakeholders to potential infection of not only the current health crisis but also to enforce preparedness for any future pandemic or possible universal threat. The consequences of social distancing between workers in the workplace of around 2m places challenges in the way work activities are traditionally executed.

Core work activities will be increasingly examined in the future and technologies will be developed that can execute them either without the physical involvement of workers themselves or involvement from a distance from other workers. Further, pre-workplace entry screening and detection technologies will be developed as early warning mechanisms to prevent possible infection at the point of entry to work premises. Protocols to promote off-site and working from remote locations while still monitoring work activities and production progress will receive attention. Issues of cybersecurity will be addressed when using virtual communication platforms for meetings. A fully automated operator-less plant and equipment will be developed. New logistics that will be implemented in the supply chain will be examined in the light of the "new norm" with a view to expanding and improving them.

Finally, the institutional framework governing the industries will be adapted to regulate the new conventional, labor, and employment conditions, including the use of new technologies, the relevant training of workers, as well as the possible redefinition of the concept of "force majeure". There are countless opportunities in this field, due to the fact that special efforts are made to ensure health and safety nationally and globally for workers, projects, and productive sectors, using advanced

technologies. From the above, it is understood that organizations will have to manage an extraordinary challenge in the integration of new technologies. In order to survive in the midst of competitiveness and the effort of full application of new digital technologies, but also to maintain their position in the market, they will have to improve their practical knowledge on them. In parallel, within the new evolving environment they will need to manage HSE, keeping its goal and principles unchanged. Noting, however, that the HSE framework should be flexible enough, so as in the future to be associated with professions that have not yet been invented.

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