

The impact of digitization on health and safety at work

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Abstract: The advent of technologies such as artificial intelligence, big data, collaborative robotics, the Internet of Things, algorithms and digital work platforms and at the same time a significant increase in the number of people working remotely brings opportunities as well as new challenges and risks in the field of health and safety. Addressing challenges and risks and maximizing opportunities depend on how technologies are used, managed and regulated in the context of social, political and economic trends [1]. This post describes digitization and its use in the field of safety.

Keywords: DIGITALIZATION, SAFETY, INDUSTRY 4.0

1. Introduction

The digitalization and automation of production and logistics technologies as part of Industry 4.0 bring a number of positive aspects to enterprises. They create conditions for expanding production capacities, asserting themselves in the competitive environment by increasing productivity and quality of manufactured products, new opportunities, and new customers, replacing humans in hazardous operations and events [1]. The introduction of modern technologies into education primarily requires the required infrastructure of the school, teachers who have the necessary digital competences and digital materials and concepts that will be used in teaching.

2. Industry 4.0

As Madsen [2] clearly summarized in his article, the concepts of modern management have evolved significantly in the last few years (e.g., Agile Management, Big Data analysis, Customer Relationship Management). As he said, I4.0 can be understood as a highly normative management concept that improves the performance of the organization, respectively: flexibility, productivity, and quality of processes or production. The versatility of this concept is that it includes many partial management concepts, such as the Internet of Things (IoT), Big Data, and digitalization, see Fig.1 [2,3,4].

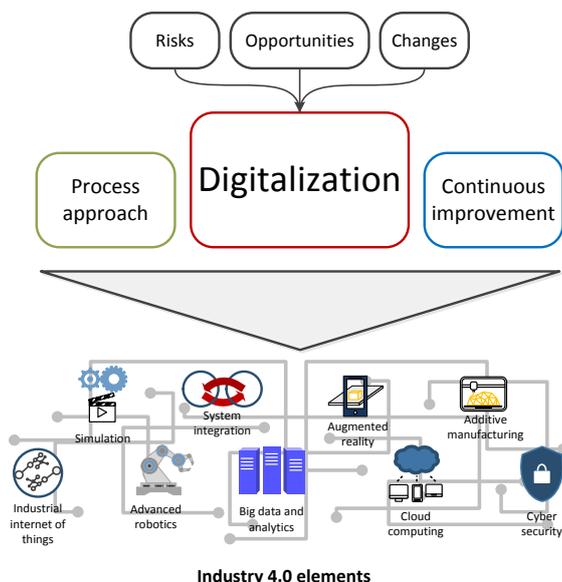


Fig. 1 The relationship between Industry 4.0 and digitalization.

Digitalization in all areas of life (Industry 4.0) has now become a trend, but also a necessity for obtaining information, storing and processing it so that it is the basis for correct decision-making. It is interesting that in Industry 4.0, the management of a manufacturing organization in particular is understood mainly as the implementation of 9 basic pillars representing modern technologies

(technological pillars), see Fig. 2. These technologies make it possible to process data from the design of the product to its delivery to the customer, even allowing to track its entire life cycle in a given market environment.

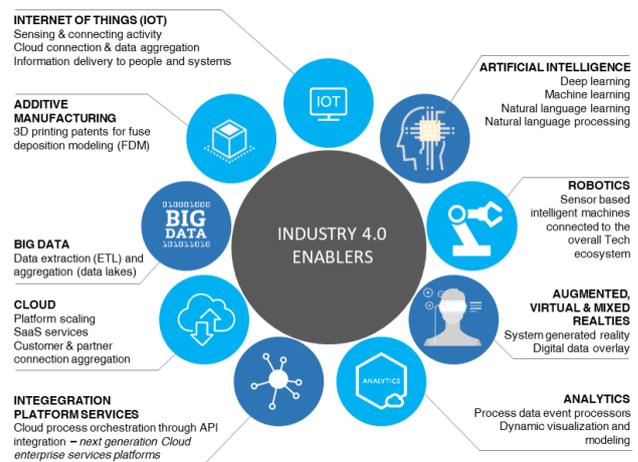


Fig. 1 Pillars of Industry 4.0 [5].

In recent years, the development of digital technologies has had a major impact on the economy, the functioning of companies and also on safety. Industry 4.0 has brought about a revolution through a high degree of automation and digitization of work activities. This has a significant impact on the competitive struggle not only on the part of companies, but also on the competition on the part of individual countries, which must make significant changes in preparation for the transformation of companies. The new transformation is based on new technological procedures, which are made possible by digitization processes. These changes have direct impacts on the operation of new intelligent operations. They must incorporate into their functioning:

- interoperability of machines and equipment,
- transparency of information,
- technical support of cyber systems,
- decentralized decision-making processes,
- virtualization,
- the ability to make changes in operation in real time,
- modularity and flexibility of processes [6].

Building upon its foresight study on digitalisation and OSH, EU-OSHA is running an 'OSH overview' research project (2020-2023) to provide in-depth information for policy, prevention and practice in relation to the challenges and opportunities of digitalisation in the context of OSH. [7].

Five priority areas give structure to the campaign:

1. Digital platform work.
2. Advanced robotics and artificial intelligence.
3. Remote work.
4. Smart digital systems.
5. Worker management through artificial intelligence [7].

3. Digital transformation

Digitization in the enterprise, see Fig. 3, is considered the first stage of digitalization of information and data. At this level, it does not affect business processes, it only provides information. *Digitalization* is associated with the introduction of new digital technologies into life. It is focused on the implementation of digital technologies in business processes [8]. From the point of view of the company, it means the digitalization of a certain specific area, process, or the creation of a digital workplace. The pursuit of such a workplace is also the support of new technologies among employees, which includes mobile devices, social cooperation, various communication and management platforms. *Digital transformation* is a complex and extensive process in which existing or even new business processes are either digitally modified to effectively meet changing business and market demands. It follows that digital transformation requires a significant re-engineering of processes to become digital and re-engineering of customer experiences to match the digital environment. *Digital business models* are based on a radical rethinking of the way a business interacts with its customers, which brings a fundamental change in performance.

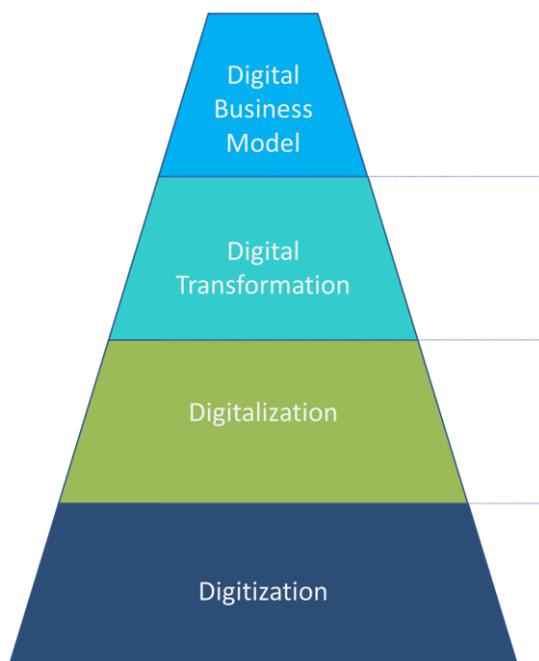


Fig. 3 Degrees of digitization in the company [8].

The new digital business model brings the linking of processes that are comprehensively digitized from the beginning to the end outputs [8].

4. Augmented and virtual reality in the field of safety

Augmented and virtual reality, which is part of the pillars of Industry 4.0. allows you to simulate any situation without any safety or financial risks.

Based on Garzon's analysis of its development, three generations of augmented reality (AR) applications in education are defined (see Figure 2). The first generation covers the period from 1995 to 2009 and could be described as hardware-based AR, as the delivery technology was the protagonist of the AR experience. The second generation covers the period from 2010 to 2019 and could be described as application-based AR, as the AR experience focused on AR applications rather than AR hardware. Finally, the third generation runs from 2020 onward and seems to be characterized by dedicated AR devices such as smartglasses and Web-based AR [9].

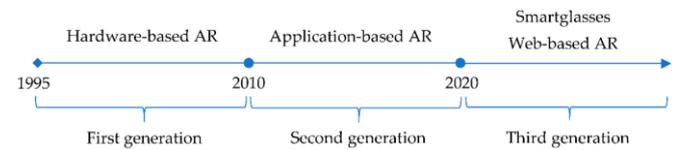


Fig. 3 Three generations of AR in education [9]

Augmented reality applications are a combination of digital and visual content into an individual's real environment. This combination of information can be used in many ways in the field of security. New combinations of simultaneously used technical devices, e.g. mobile phone, tablet, etc., also offer new possibilities in the field of security in the form of training for businesses. In essence, all the mentioned procedures can be represented as a combination of the real world and a model represented in various forms, from text to metadata [10]. Having immediate access to the necessary information right on the spot is very advantageous and thanks to this, AR finds application in industrial production as well.

Virtual reality (VR) technologies bring several possibilities of use in the field of security:

1. crisis situations that cannot be simulated in any way until they actually happen,
2. preparing employees for any risky activities,
3. consistent formation of correct habits that can lead to a reduction of risks in real operation,
4. employee training, which brings countless benefits that put this technology at the forefront of the ways in which training can be done. Among the most fundamental ones is, for example, the complete autonomy of training, in other words, the employee can learn and develop anywhere and at any time, moreover, there is no need for the presence of any other person, everything will be taught by a specialized VR application.

Another advantage of using VR compared to conventional training methods is that it can ensure the attention of the user, who performs the tasks in the training scenario completely naturally and subconsciously, so he remembers much more information. An indisputable advantage is also the fact that the VR application can monitor the user's behavior in detail, his strengths and weaknesses, according to which the training lessons can be modified, repeated, etc. [11].

The use of virtual and augmented reality has key impacts in the field of occupational health and safety:

- Increasing the quality and effectiveness of training and training of the OSH legislation,
- Freeing human resource capacities and reducing the burden on experienced workers through the automation of training and training, remote monitoring and control of the correctness of execution,
- Possibility of remote/contactless training and training,

- High added value of the project (influence of training in practice/efficiency) and at the same time easy accessibility for users [11].

5. Conclusion

The 4.0 industrial revolution is characterized by automation and digitization in various sectors, not excluding the field of education. Currently, digital technologies have an increasing impact on safety and health protection at work. Online OSH training tailored to your needs or classic training with new interactive elements, 3D technologies, virtual reality, and other elements can be combined for training. Of course, the expertise and experience of the trainer is important. And it is the same with other tools, the main competent creative team is always to clearly define the requirements, the target group and what the goal is, so that the use of new modern technologies is effective and contributes to safety and health protection at work and the prevention of occupational and occupational diseases accident.

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6. References

1. Sinay, J., Kotianová, Z., Glatz, J. Digitalizácia - efektívny nástroj pre zavádzanie systému riadenia integrovanej bezpečnosti. Current issues in occupational safety. 2018.
2. Madsen, D.Ø. The Emergence and Rise of Industry 4.0 Viewed through the Lens of Management Fashion Theory. *Adm. Sci.* 2019, 9, 71.
3. Felsberger, A.; Reiner, G. Sustainable Industry 4.0 in Production and Operations Management: A Systematic Literature Review. *Sustainability* 2020, 12, 7982.
4. Sartal, A.; Bellas, R.; Mejías, A.M.; García-Collado, A. The sustainable manufacturing concept, evolution and opportunities within Industry 4.0: A literature review. *Adv. Mech. Eng.* 2020, 12, 1–17.
5. Belaunzaran M. How Industry 4.0. Has Changed Manufacturing Forever. 2018.
6. Kolektív autorov. Analýza dopadov digitálnej transformácie na podnikateľov, v súkromnom a verejnom sektore. 2017.
7. Digitalisation of work. European Agency for Safety and Health at Work. 2022.
8. Morhác, M. Čo je digitalizácia a digitálna transformácia? Urobme si poriadok v pojmoch a významoch. 2022.
9. Garzón, J. An Overview of Twenty-Five Years of Augmented Reality in Education. *Multimodal Technol. Interact.* 2021, 5, 37. <https://doi.org/10.3390/mti5070037>
10. Oravec, M.; Kotianová, Z.; Glatz, J. Rozšírená realita – efektívny nástroj vo výučbe bezpečnosti. *Bezpečná práca.* 2021.
11. Cidlinová, A.; Bárty, M.; Bureš, M. Využití digitálních nástrojů ergonomie a BOZP v praxi. *New trends in Safety and health.* 2022.