

Chapter 2

Impact of Industry 4.0 Revolution on Science, Technology, and Society (STS): Challenges and Opportunities in the Industry 4.0 Era

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ABSTRACT

The Industry 4.0 concept, which leads the Fourth Industrial Revolution, was introduced by Germany in 2011 at the Hannover Messe trade fair and attracted the attention of the world. Since that time, its effects have been seen in different fields, such as science, technology, and society. In this chapter, in order to investigate the effects of Industry 4.0 revolution, answers to the following questions will be presented: Are there any concerns about technological unemployment as a result of Industry 4.0. revolution? Which professions have emerged? How has Industry 4.0 affected society directly or indirectly? What are the technologies of this concept? How do these technologies affect manufacturing and service systems? What are the challenges of implementing the technologies of Industry 4.0? What are the benefits of digitalized manufacturing? Which studies are conducted to accelerate the shift of Industry 4.0 from science to reality? and Which studies have been conducted so far about this concept?

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BACKGROUND

Numerous studies, which examine Industry 4.0 from various perspectives, can be found in the literature. While some of them focus on the technologies related to Industry 4.0, in some studies, the topic is discussed as based on countries. However, to the best knowledge of the authors of this chapter, there is no study that presents the effects of Industry 4.0 on science, technology, and society together.

This chapter deals with Industry 4.0, which means digital transformation in manufacturing by using high-technology. Since its effects lead to some changes in science, technology, and society, it is important to take attraction to this issue. Many resources indicate that this transformation has both negative and positive impacts. These impacts of Industry 4.0 is presented to shed light on different aspects of the concept of Industry 4.0 in this chapter. In this regard, this chapter can be a guide for the decision makers, who engage with education, industry, and politics.

Introduction

Since Germany, which is one of the European countries, has faced some problems related to product quality and product cost, German government recognized that transformation in the industry is required in order to compete with Eastern countries, like China, which has advantages in terms of low production cost. The concepts of this transformation which lead to the fourth industrial revolution were introduced by Germany in 2011. The transformation is stimulated by the Internet and Cyber-Physical Systems (CPS) which enable digitalized manufacturing and smart factories. The fourth industrial revolution, namely Industry 4.0, has affected not only the manufacturing industry but also the social life. Although it is expected that the technologies related with Industry 4.0 will bring benefits on different aspects, such as economic and social, it brings some concerns related to employment.

The global effects of Industry 4.0 Revolution in science, technology, and society are presented in the remainder of this chapter.

Impact of Industry 4.0 Revolution on Science

In this section, information about scientific studies related to the concept of Industry 4.0 is presented to provide a literature review, which deals with the studies focusing on different aspects of the issue.

German government published an article in November 2011 in which the “Industry 4.0” concept was introduced as a high-tech strategy for 2020 (Zhou, Liu & Zhou, 2015). After this date, papers related to the concept of Industry 4.0 started to be seen in the literature.

When the term “Industry 4.0” is searched in the Web of Science (WoS) database, 1684 papers are found from its core collection. The number of papers for the years from 2012 to 2018 is given in Figure 1.

According to the web of science database, the number of papers has increased year by year. It shows that interest in this issue has continued to be increased since its introduction.

Numbers for types of papers can be seen in Figure 2.

As seen in Figure 2, the largest number of papers are proceedings papers. There is also a significant number of articles in the journals which are indexed by WoS.

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