Chapter 1

Impact of the Technology Revolution on the Logistics Sector:
Autonomous Vehicles and Robotics for Intelligent Supply Chain

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EXECUTIVE SUMMARY

Developing in the smart cities concept and internet of things (IoT) technologies has become more demanding for the modern governments to overcome the growth of population and monitoring and controlling of the available resources. Smart cities with the use of the latest technologies in communications and electronics, which are the heart of IoT, have been developed and branched to cover most of the daily life needs. One of these branches is the intelligent transportation system (ITS), which is the heart of several fields like the logistics sector. This chapter aims to introduce a comprehensive overview for deploying two main examples of the technology revolution, which are autonomous vehicles and robotics technologies, in the logistics sector and illustrate the effect of using current and future approaches like IoT, AI, 5G, and more in the intelligent supply chain field.

INTRODUCTION

The development in the Smart Cities concept and Internet of Things (IoT) technologies become more demanding for the modern governments to overcome the growth of population, monitoring, and controlling of the available resources (Syed et al., 2021). Smart Cities with the use of the latest technologies in the electronics and communication engineering [ECE] field are the heart of IoT have been developed and branched to cover most of the daily life needs. Several subfields have been established like Infor-

mation technology which merged with computer engineering and computer science fields to be named Information and Communication Technology or ICT (Merzouk et al., 2020).

The development in ECE and other technologies affects several life branches like transportation and leads to what is called the Intelligent Transportation System (ITS) (Auer et al., 2016; Hasegawa, 2015; Neuweiler & Vanessa Riedel, 2017; Sun, 2021). Nowadays, ITS become the heart of several fields like the Logistics Sector. ITS represents the effect of integrating several advanced computer processing technologies, communication transmission techniques of data, control technology of autonomous vehicles, artificial intelligence, and electronic technology into the management of transportation systems for establishing a wide range of applications.

One of the important parts of the ITS future is autonomous vehicles. This part is based on several communication technologies whether internal in the vehicle, between vehicles, or among vehicles and the network infrastructure. Autonomous vehicles (or self-driving vehicles) attract several industry leaders like Amazon, Google, Uber, Tesla and more to make a great investment in these technologies. According to some references carmakers invested around $120 billion in the field of autonomous drive development in the interval between March 2017 and March 2019 (Sun, 2021).

On the other hand, development of the Robotics field with integrating IoT techniques has become more demanding in industry as it is considered an important part in the foundation of the Industry 4.0 revolution (Calia & D'Aprile, 2020; Paksoy et al., 2021; Virbahu Nandishwar Jain, 2019). The definition of Industry 4.0 concept can be stated as the digital transformation of production, manufacturing and the related industries that symbolize a new phase in the organization and control the chain of the industrial value.

Recently, the logistic sector has become one of the most demanding fields that needs to be improved by adopting these technologies, in order to improve this sector's performance in several fields like: supply chain, logistics and operation management, etc. (Dillmann, 2016; Kersten et al., 2017; Tay & Loh, 2021; Van der Meer et al., 2018).

Integrating artificial intelligence (AI), IoT, Autonomous Vehicles (AV) and Robotics with the supply chain field leads to a new approach which is called the Intelligent Supply Chain (ISC). This approach is considered as a digital transformation of the conventional supply chain process aiming to improve the economy globally. In this chapter we will consider Egypt as a case study for illustrating the digitizing approach as an example of developing the logistic sector in the Middle East.

This chapter aims to introduce a comprehensive layout of deploying autonomous vehicle in addition to robotics technologies in the logistics sector and illustrate the effect of using current and future approaches like IoT, AI, 5G, etc.

By the end of this chapter, reader will be familiar with following:

1. General information about the current and the expected future technologies
2. The basic concepts of the autonomous vehicles and Robotics technologies
3. The impact of these technologies in the Logistic Sector in general, and especially in the field of the Intelligent Supply Chain (ISC).
4. The expected development of integrating the mentioned technologies and ISC to improve the economy in Egypt is consistent with the digital transformation vision.

This chapter contains five sections. First section shows the research scope in this chapter. Second section starts the journey of this book by showing briefly the foundation of the latest technologies and

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