

# Chapter 19

## Innovative Solutions for a More Sustainable Food Supply Chain: Role of New Technologies in Food Waste Prevention

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### **ABSTRACT**

*This chapter explores the technologies involved in certification systems designed to prevent food waste. First, it presents the state-of-the-art in IoT and blockchain technologies applied to the food supply chain, followed by a summary of the key certifications in this domain. The chapter then provides a comprehensive overview of how these technological innovations are being integrated to tackle the pressing challenges of the food industry, with a particular focus on food waste prevention. Finally, it concludes with insights and conclusions drawn from the analysis of these systems.*

### **INTRODUCTION TO THE INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS)**

Information and Communication Technologies (ICTs) are those technological systems that enable people to control and manage different types of information (Carter & Grover, 2015). The development of these ICTs is leveraging what is known as Industry 4.0 (Peraković et al., 2020). This is an industrial revolution where interconnected objects and systems use, communicate and analyse information (Snider-

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man et al., 2016). According to small and mid-sized digital technologies users in manufacture, ICTs show advantages as concerns product quality, productivity, innovation and cost saving (Beaty & Quirk, 2018).

ICTs are transforming production lines. Particularly, integrated supply chain management is heading for IoT cloud distributed solutions and big data analysis of the captured information. Every object (physical layer) provides information to an ICT system (data exchange layer), which virtually creates a representation of every object (information integration layer). The physical layer updates constantly the information integration layer, which is then shared with the stakeholders (application service layer) (Ramundo et al., 2016). There is a growing trend by companies towards allocating investments to optimise operating systems. This is causing industry to be driven by the data provided by the aforementioned technologies, whose facilities are interconnected with each other (Bai et al., 2020; Dantas et al., 2021; Hatzivasilis et al., 2019; Manavalan & Jayakrishna, 2019). Thus, having every facility monitored and therefore the energy and resources waste generation are reduced (Andrews, 2015; Inoue et al., 2020).

Among these new technologies, some like the IoT, cloud computing and big data are identified as crucial by 28 EU Member States (Peraković et al., 2020). A brief summary of them is given below.

Big data is defined as “Information assets characterised by such a high volume, velocity and variety to require specific technology and analytical methods for its transformation into Value” by De Mauro et al. (2014). Since nowadays digitalisation is becoming a major subject, big data is gaining relevance because of the need to manage all that analogue information that is being digitised. Moreover, it has a heavy impact on both society and companies (De Mauro et al., 2014).

The cloud computing definition provided by the United States National Institute of Standards and Technology states that cloud computing is “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell & Grance, 2011). Cloud computing includes five key features: On-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service (Dillon et al., 2010). In order to ensure the data integrity that cloud computing environments require, Blockchain has become an outstanding technology when building and deploying databases (Gaetani et al., 2017). Blockchain is a digital ledger capable of recording and storing information organised in a chronological order. It prevents manipulation by making that information permanent and immutable. Besides, it is decentralised and distributed, thereby resulting in a more reliable data management system (Treiblmaier, 2018). Blockchain has remarkable applications in a broad range of areas, among which supply chain management is a prominent example (Kshetri, 2018).

And last but not least, a larger explanation of IoT will be given as it is an essential component of Industry 4.0 (Hofmann & Rüsçh, 2017) and so more substantial within the framework of this chapter. According to Vermesan & Friess (2013, 2014), IoT is a network conformed by a set of embedded devices. They can be integrated in a wide range of objects, such as vehicles, buildings, machines, instruments, etc. All of which are interconnected sending and receiving information with a defined objective. It shows improvement capacities and therefore has applications in tracing, safety, control, monitoring, administration, etc. An IoT system can share this information between people, between people and machines/things, and between machines/things. In systems such as these, the set of devices is even able to be ever-present through wireless and wired connections, interacting with each other in order to perform common tasks. Gathering data along the way and analysing it. They can run those tasks due to the intelligence they acquire, becoming capable of making decisions in accordance with the context. Thus, elaborating a complex service (Vermesan & Friess, 2013, 2014), the design of which can be constantly improved

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