7 Blockchain: A Disruptive Technology in the Sustainable Economic System

Ioannis Karamitsos, Mohamed Salama and Mohamed El Gindy

Learning outcomes

By completing this chapter, the reader should be able to:

- Discuss how the disruptive technologies relate to the digital transformation.
- Explain the basic Blockchain building blocks.
- Describe the consensus mechanisms as PoW and PoS.
- Describe how to design and implement a smart contract application.
- Discuss the benefits of Blockchain in the shared economy.
- Discuss how Blockchain can assist in sustainability energy.

Introduction

This chapter aims to provide managers in general and project managers in particular with the basic information about one of the most hyped disruptive technology concept in the shared digital economy today: *Blockchain*. Blockchain and other disruptive technologies such as Internet of Things (IoT), Artificial Intelligence (AI), and Big Data are important disruptive steps that are increasingly relevant when defining and managing projects in the sharing digital business economy.

The chapter comprises three main parts. The first part introduces the basic concept of the disruptive technologies in the digital transformation context and the main blocks required for the build of Blockchain framework. The focus is on describing each block in details applicable for any selected platform. The second part of the chapter outlines the concept of the *smart contract*. The general aim is to provide knowledge with actionable guidelines on how best to implement a smart

contract using the Ethereum platform. All the components for the design, deployment, and implementation of decentralized applications (*Dapps*) are discussed. The final part discusses the benefits of using smart contract on the Blockchain technology and wraps up by two brief illustrative case studies, enlightening project managers about the Blockchain technology applications in different vertical segments; Life Cycle Assessment (LCA) leading to Environmental Product Declaration (EDA) and energy trading in pursuit of sustainable development.

Background

The parade of the new disruptive technologies has the potential to truly reshape the world in which we work and we live. All these new emerging technologies do not alter the business or the social landscape but some of them have the potential to disrupt the status quo, change the way people live and work, and rearrange the business models and the value propositions.

A report from the McKinsey Global Institute (2016) identifies five new disruptive technologies: Internet of Things (IoT), Artificial Intelligence (AI), Big Data, Cloud and Blockchain, that could drive massive economic transformation and disruptions in the coming ten years. These disruptive technologies complement each other, becoming enablers for the IT digital transformation of each organisation.

Blockchain is a fast-disruptive technology that is becoming a key instrument in the sharing economy. In recent years, Blockchain has received considerable attention from many researchers and government institutions. Blockchain is a novel disruptive technology based on decentralized computing, cryptography, security and trust-less environmental. Nakamoto (2008) showed how this technology can become the core component to support transactions of a digital currency (bitcoin). With the introduction of Blockchain, many fields such as trading energy, assets tracking, finance, accounting and healthcare will receive a positive impact using the benefits of this technology. A Blockchain is the distributed public ledger for all transactions, eliminating the need of trust between the users and the central administrator and the control is distributed among different computers/nodes in the peer-to-peer (P2P) network. Moreover, Blockchain resolved the double-spend problem using P2P technology in combination with public/private key cryptography.

One promising area is the energy market which consists of complex mechanisms involving many middlemen and clearing settlement mechanisms (Clancy 2017). The Blockchain technology provides the potential to cut out energy operators, wholesale and payment providers from the ecosystem; making the system more efficient and reducing the operational costs (OpEX) (Hasse et al., 2015). The introduction of smart metering systems and smart meters with combination of Blockchain system can be utilised to transmit payment transactions in tamper-proofed way and control electricity flow and storage via smart contracts implemented into a Blockchain infrastructure.

Blockchain has the potential to become an effective tool for sustainability into different areas such as: tracking and allocation of environmental data concerning energy consumption and waste generation, developing microgrids that use Blockchain for the local energy trading, and helping companies with Life Cycle Assessment (LCA) to develop Environmental Product Declarations (EPDs) for their products.

The potential benefits of the disruptive technologies are obvious, yet the most important are the challenges of getting prepared for the impact amid the anticipated transformation. Government institutions and business organisations should keep their organisational strategies updated in the context of the new technologies and use technologies to improve external or internal performance. Disruptive technologies can change the whole ecosystem with new models for businesses; creating new products and defining a new value chain model. Organisations will need to use digital transformation innovations to capture the value of the disruptive technologies, as discussed earlier in Chapter 4.

Disruptive technologies

Disruptive technologies are those that significantly change the way businesses or entire industries operate. Clayton Christensen (1997) popularized the idea of disruptive technologies in the book *The Innovator's Dilemma*. His defined the term disruption as "the process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors". In the beginning, the disruptive technologies have considered as innovation, tools to enable any change in the industry and organisation, transforming the whole industry ecosystem into new digital business. Each organisation or industry is starting to re-think and re-design their traditional business models and processes in the context of the today's disruptive technologies, such as IoT, AI, Blockchain, Cloud, Big Data/Analytics, and mobility 5G. While these six technologies comprise the core of the new platform for digital business, other technology enablers such as 3D printing, AR, and VR come into the industry as well. One of the keys to maximising the benefits of the disruptive technologies lies on their powerful platform combinations.

> *"Platform companies are emerging as important engines of innovation. They are increasingly at the cutting edge of rapid worldwide digital transformation."*
>
> Peter.C.Evans, The Center for Global Enterprise (Evans, and Gawyer, 2016)

Digital transformation is applied to any function of the organisation; from finance, human resource, sales and marketing using the IT enablement technology. The concept of the digital transformation is very often confused by senior management. A business may go through radical changes and significant restructuring, but it's only a transformation if it's highly visible from the outside, to its customers, and was driven by external factors.