

Vincenzo Morabito

Business Innovation Through Blockchain

The B³ Perspective

 Springer

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Foreword

The word “blockchain” is one of the most hyped IT buzzwords to have emerged in the last couple of years. Blockchain has found its way into major media headlines on a near-daily basis, but a year and a half ago, it was a word used by a relatively small number of people to describe the peer-to-peer distributed ledger technology that underpins bitcoin. What is so special about blockchain, and is it deserving of all the hype?

I was happy to discover that Bocconi University Prof. Vincenzo Morabito, whom I recently had the good pleasure to meet, was writing this book about blockchain technology and its impact on business. Dr. Morabito’s aim in this book is to take readers thorough the current state of the art on blockchain technology, as well as its future economic and practical implications. Readers who are new to the topic of blockchain will be surprised by the extensive and very diverse range of applications it enables, while those who are more familiar with the subject will gain from Dr. Morabito’s perspective and insights.

The challenge of innovation in an increasingly digitized business world requires a clear understanding about the role of information technologies like blockchain and how they can be fastened to shape new business models. Addressing the impact of blockchain is likely to require significant change on the part of both organizations and individuals, and significant change is something that many (if not most) of us often find hard to do.

The function and impact of complex technologies such as blockchain can often be difficult to grasp, and I hope Prof. Morabito’s book will positively effect blockchain literacy among not just business people but also policymakers, who will play a key role in shaping blockchain’s future.

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Preface

In this book, we aim to discuss and present the main challenges and trends related to blockchain for digital business innovation to a composite audience of practitioners and scholars. Blockchain became a hype topic, thanks to bitcoin diffusion at a global level. However, this cryptocurrency is often considered the main application of blockchain, and today, we are assisting to the implementation of blockchain also in other domains; property transfer and digital identity are among the most common examples. Industries that will be soon involved in this phenomenon are telco, data storage, registration services, insurance, and so on. Furthermore, notwithstanding the interest that surrounds blockchain as a key trend, especially with regard to the financial technology (*fintech*) industry, the phenomenon has been not yet fully investigated from a strategic and organizational perspective by both academic and practitioners. Actually, apart from the volume by Tapscott and Tapscott [1], most of the published monographic contributions concern technical, computational, and engineering facets of blockchain.

Taking these issues into account, this volume aims to provide a unified survey of current academic and practitioners' work on blockchain and related phenomena such as bitcoin, considering different perspectives, from information systems as well as technology management and innovation research to computer science and engineering, among others. Consequently, the main goal of this book is to connect research and industry practices suitable to be used by practitioners in their day-to-day activities as well as an update on what academia may offer with regard to the industry proposals. Yet, this book follows the same mission of the former volumes published by the author, thus aiming to identify the challenges, ideas, and trends that may represent "food for thoughts" to practitioners. Accordingly, as in previous books, each topic considered will be analyzed in its technical and managerial aspects, also through the use of case studies and examples.

Finally, please note that in this book, two topics are being used across all chapters: bitcoin and the distributed autonomous organization (DAO). The reasons behind using these two concepts at different points in this book are twofold: First, bitcoin and DAO have been the cornerstone for the advent of blockchain, and therefore, these will naturally emerge when we look at the blockchain from the different viewpoints adopted in each chapter. Second, the chapters of this book are meant to be part of a coherent whole, but also are meant to be read individually

without the need to read all other chapters, so the readers can select those chapters and themes that are more relevant to their personal interests. Therefore, it is needed to introduce and repeat some concepts of bitcoin and DAO to contextualize them within the chapter's theme.

Outline of this Book

This book argument is developed along three main axes. We consider first (*Part I Blockchain Technology and Management*) issues that are the structure and characteristics of the blockchain *paradigm change* (Chap. 1), its *value system* (Chap. 2), *governance* (Chap. 3), and *security layers*, by focusing on the challenges, advantages, and limitations of blockchain from a security point of view, likewise (Chap. 4). Subsequently, *Part II (Bitcoin Phenomenon and Trends)* will focus on *digital currencies* (Chap. 5), *smart contracts*, and *licensing* (Chap. 6), particularly discussing how organizations can leverage the smart contract technology and the blockchain for the purpose of overseeing agreements and licensing. An analysis of how blockchain can fit into the world of *enterprise systems* (ES) conclude this part of this book, by comparing the value system of existing enterprise systems to that of the blockchain technology (Chap. 7). Finally (*Part III*), this book will present and review cases of *business innovation* related to blockchain at a global level in a section called *Blockchain practices* (Chap. 8) and will end by presenting the *B³ perspective* we propose for blockchain business innovation (Chap. 9).

As in my previous volumes [2–5], this book adopts both a scientific approach and a concrete stance to introduce blockchain characteristics, challenges, and opportunity from the viewpoints of managers, thus adopting a clear and easy-to-understand language.

Milan, Italy

Vincenzo Morabito

References

1. Tapscott D, Tapscott A (2016) Blockchain revolution: how the technology behind bitcoin is changing money. Business, and the World. Portfolio
2. Morabito V (2013) Business technology organization—Managing digital information technology for value creation—The SIGMA approach. Springer, Berlin/Heidelberg
3. Morabito V (2014) Trends and challenges in digital business innovation. doi:[10.1007/978-3-319-04307-4](https://doi.org/10.1007/978-3-319-04307-4)
4. Morabito V (2015) Big data and analytics. Springer International Publishing, Heidelberg, New York, Dordrecht, London
5. Morabito V (2016) The future of digital business innovation. doi:[10.1007/978-3-319-26874-3](https://doi.org/10.1007/978-3-319-26874-3)

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Acronyms

API	Application Programming Interface
CEO	Chief Executive Officer
CIO	Chief Information Officer
CMO	Chief Marketing Officer
COO	Chief Operating Officer
CRM	Customer Relationship Management
CTO	Chief Technology Officer
DAO	Decentralized Autonomous Organizations
DLT	Distributed ledger technology
DNS	Domain Name System
ERP	Enterprise Resource Planning
EU	European Union
HTTP	Hyper Text Transfer Protocol
ICTs	Information and Communication Technologies
ID	Identification; Identity
IO	Input/Output device
IP	Internet Protocol address
IS	Information Systems
IT	Information technology
KSI	Keyless Signature Infrastructure
KYC	Know Your Customer
KYCC	Know Your Customer's Customer
LOC	Letter of Credit
MBA	Master of Business Administration
PLM	Product Life Cycle Management
PoS	Proof of stake
PoW	Proof of work
RFID	Radio-frequency identification
ROI	Return on investment
SCM	Supply Chain Management
SHA	Secure Hash Algorithm
SME	Small to medium-sized enterprise
SRM	Supplier Relationship Management