Amy Van Looy

From Emerging Technologies to Business Opportunities

Interviews with Academics and Business Experts

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Fictive representation. This simplified image represents the need for a forward-looking idea of digital work while embracing inclusivity and sustainability. Different digital technologies can be integrated to create synergy in a connected world. Courtesy: Amber E. D. M.

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To my two beloved daughters who still have open minds and whose curiosity is still triggered by the unknown. Accordingly, this book is dedicated to all who would like to wisely embrace a digital future at work.

Preface

Before beginning, the reader is invited to consider what can be expected from this book.

Who Is This Book For?

This book is written as an international professional handbook that uniquely combines theoretical inputs with practical applications. Business people (ranging from employees to managers and executives) who wish to become acquainted with the basic terminology and diverse business aspects related to emerging digital technologies will profit from the book. This publication describes how to make the emerging topics work in real-life organizations by offering descriptions from academic leaders in the field along with information and advice from industry people. As such, this book can help professionals better prepare for a digital economy.

Additionally, the book targets undergraduate business students and computer science students. Other students interested in digital innovation, transforming an organization's way of working or IT management in general, are encouraged to read the book.

Moreover, thanks to its accessible layman's language using an interview style, the book is approachable to anyone wishing to know more about the potentially disruptive character of emerging technologies and their impact on the future of work.

How Does This Book Differ from Other Technology Books?

This book offers an overview of the essentials related to emerging digital technologies by taking a novel angle based on interviews with academics and business experts. The reader will be introduced to various strategic and operational aspects related to a selection of digital technologies and become acquainted with basic terminology while also overseeing critical reflections related to the underlying business cases. The book encourages readers to follow recent technology developments in the context of lifelong learning. Because this book offers an introduction to a wide range of digital technologies, it serves as a complement to the more specialized books that (mostly technically) elaborate on a technology separately. Moreover, by using real-life cases

and expert interviews, this book complements the theoretical outlets on the subject (such as regular textbooks about information systems, strategic management, or innovation management) and especially extends them by demonstrating the practical implications of current market trends in the IT industry. Because the book intends to explain technology trends in an approachable manner, no prerequisites are needed. However, some basic knowledge of digital innovation, information technology, or management information systems might be recommended.

The unique selling points of this book are as follows:

- The reader obtains a timely overview and critical discussion of disruptive technologies. By taking a varied approach across multiple digital technologies, the reader can become acquainted with a wide range of organization-relevant considerations to strategically take advantage of contemporary opportunities.
- The book presents a series of in-depth interviews and examples in an approachable manner using layman's language. The focus is truly on knowledge sharing based on real-life experience and success stories.
- The book offers the reader critical reflections on a recent and hyped phenomenon of digital innovation and transforming organizations accordingly, based on a combination of academic insights and practical tips and tricks. As such, a bridge is established between research knowledge and managerial practices.
- Basic concepts and practices related to emerging digital technologies are explained to introduce the reader to the business essentials of technology-related trends. By describing and explaining such trends, undergraduates and professionals alike will better understand how to survive in a digital economy.
- Recent and relevant business cases demonstrate the practical implications of current market demands that challenge the IT industry.
- Each chapter offers a self-test and suggests further readings to learn and better comprehend the material.

How Is This Book Organized?

After two introductory chapters, dedicated chapters elaborate on a selection of digital technologies. Each chapter explains which terminology and basic knowledge are primarily involved in a specific technology and how technology adoption in a real-life business setting can look like.

- Chapter 1 "Introduction to a Digital Economy"
- Chapter 2 "Introduction to Selected Digital Technologies"
- Chapter 3 "Artificial Intelligence"
- Chapter 4 "Internet of Things"
- Chapter 5 "Virtual Reality and Augmented Reality"
- Chapter 6 "Digital Twin Technology"
- Chapter 7 "Blockchain Technology"
- Chapter 8 "3D Printing"
- Chapter 9 "Biochips"

Each chapter is organized as follows. It starts with an abstract that summarizes the chapter's outline and is accompanied by a list of keywords characterizing the topic under study. The body of the text first introduces a specific digital technology, followed by one interview with an academic expert for further describing and explaining the technology and one interview with a business expert for illustrating a successful business case. Each chapter ends on a recap of the takeaways, supplemented by links to further readings for those who are eager to delve more into the chapter's topic as well as a self-test to challenge the reader's understanding of the topic.

Disclaimer and Trademarks

This book intends to give an objective state of the art of the digital landscape at a certain moment in time, without supporting one or another digital technology, tool, or online service. Being an international handbook, it does not intend to give specific advice to organizations. This book is an independent publication and has not been sponsored by any organization, product, or vendor mentioned in the book. All trademarks are the property of their respective owners. All interviewees have given their informed consent to participate in the interviews.

We Would Like to Hear from You

As digital technologies are situated in a rapidly evolving IT landscape, we are interested in your feedback to prepare a next version of this book (Amy.VanLooy@UGent.be).

Enjoy reading!

Ghent, Belgium Amy Van Looy

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- Christian Janiesch, Technische Universität Dortmund (Chap. 4, "Internet of Things")
- Selen Türkay, Queensland University of Technology (Chap. 5, "Virtual Reality and Augmented Reality")
- David Jones, Aberystwyth University (Chap. 6, "Digital Twin Technology")
- Ingo Weber, Technische Universität München (Chap. 7, "Blockchain Technology")
- Brecht Van Hooreweder, KU Leuven (Chap. 8, "3D Printing")
- Krishnendu Chakrabarty, Arizona State University (Chap. 9, "Biochips")

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- Paul Snauwaert, CNH Industrial (Chap. 3, "Artificial Intelligence")
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- Dirk Hartmann, Siemens (Chap. 6, "Digital Twin Technology")
- Jolanda Kooi, tex.tracer (Chap. 7, "Blockchain Technology")
- Yves Jamers, HP Inc. (Chap. 8, "3D Printing")
- Mark Verheijden, Qurin Diagnostics & Hans Dijk, Surfix Diagnostics (Chap. 9, "Biochips")

Contents

About the Author

Amy Van Looy holds a PhD in applied economics. Before entering academia, she worked as an IT consultant. Being an associate professor at Ghent University, she coordinates the research cluster of process orientation at the Department of Business Informatics and Operations Management. Additionally, she is a research fellow at Vlerick Business School. She conducts courses on research methods, process management, technology innovation, and social media among others. Amy Van Looy received the Highest Award for Achievement at the Dale Carnegie Consulting Program in 2007, the Award for Best Contribution at the OnTheMove Academy in 2010, the faculty's PhD Tutor Award in 2022, as well as paper nominations (e.g., BPM2018) and paper rewards (e.g., BPM2019). The Belgian magazine *Data News* nominated her in the top 10 for Young ICT Lady of the Year 2014, and the nonprofit InsipringFifty Belgium recognized her as a tech role model in 2020 (i.e., for being one of Belgium's 50 most inspiring women in technology).

List of Abbreviations

24/7	Twenty-four hours a day, seven days a week
2D	Two-dimensional
3D	Three-dimensional
3DOF	Three degrees of freedom
3G	Third generation of wireless telecommunications technology or mobile network technology
4D	Four-dimensional
4G	Fourth generation of wireless telecommunications technology or mobile network technology
5G	Fifth generation of wireless telecommunications technology or mobile network technology
6DOF	Six degrees of freedom
ACM	Association for computing machinery
AI	Artificial intelligence
AM	Additive manufacturing
API	Application programming interface
AR	Augmented reality
ASEAN	Association of Southeast Asian Nations
ASR	Automatic speech recognition
B2B	Business-to-business
B2B2C	Business-to-business-to-consumer
B2C	Business-to-consumer
BMI	Business model innovation
BPM	Business process management
C#	C-Sharp
CAD	Computer-aided design
CCD	Charge-coupled device
CO2	Carbon dioxide
CoE	Center of Excellence
COVID-19	Coronavirus disease 2019
CPS	Cyber-physical system
CPU	Central processing unit
CRUD	Create, read, update, delete

CxO	Chief X officer (i.e., a generic term to indicate a corporate officer or C-level manager). The letter "x" is to be replaced by an organizational domain (e.g., Chief Executive Officer, Chief Technology Officer, Chief Information Officer).
DevOps	Development and operations
DFV	Desirability, feasibility, viability
DLT	Distributed ledger technology
DNA	Deoxyribonucleic acid
e.g.,	Exempli gratia (Latin for "for example")
EMC	Electromagnetic compatibility
EMEA	Europe, the Middle East, and Africa
et al.	Et alii (m)/Et alia (f) (Latin for "and others")
EU	European Union
FFF	Fused filament fabrication
G20	Group of 20 is an intergovernmental forum comprising 19 sovereign countries, the European Union, and the African Union
GP	General practitioner
GPS	Global positioning systems
GPT	Generative pre-trained transformer
GPU	Graphical processing unit
HCI	Human–computer interaction
HMD	Head-mounted display
HQ	Headquarter
HR	Human resources
HTTPS	Hypertext Transfer Protocol Secure
ICT	Information and communications technology
i.e.,	Id est (Latin for "that is")
IIoT	Industrial Internet of things
INVEST	Independent, negotiable, valuable, estimatable, sized appropriately, testable
IoT	Internet of things
IP	Intellectual property
ISO	International Organization for Standardization
IT	Information technology
LNBIP	Lecture notes in business information processing
LNCS	Lecture notes in computer science
LOC	Lab-on-a-chip
LPBF	Laser powder bed fusion
Manuf.	Manufacturing
MEA	Microelectrode array
microCT	Microcomputed tomography
ML	Machine learning
MVP	Minimum viable product
NASA	National Aeronautics and Space Administration
NFC	Near-field communication

NFT	Non-fungible token
p.	Page
PC	Personal computer
PCR	Polymerase chain reaction
PCT	Patent Cooperation Treaty
PLM	Product lifecycle management
POC	Proof-of-concept
PoS	Proof-of-stake
PoW	Proof-of-work
PTSD	Post-traumatic stress disorder
QR	Quick response
R&D	Research and development
RFID	Radio-frequency identification
RNA	Ribonucleic acid
ROI	Return on investment
SaaS	Software-as-a-service
s.d.	Sine die (no date of publication)
SIM	Subscriber identity module
s.l.	Sine loco (no place or page of publication)
SSS	Smart service system
STEM	Science, technology, engineering, and mathematics
SWOT	Strengths, weaknesses, opportunities, threats
TAM	Technology acceptance model
TCO	Total cost of ownership
TOE	Technology–organization–environment
UK	United Kingdom
USA	United States (of America)
UTAUT	Unified theory of acceptance and use of technology
UX	User experience
VR	Virtual reality
Web2	Second iteration of WWW with user-generated content and end user participation
Web3	Third iteration of WWW with decentralization, blockchains, and token-based economics
WIP	Work in progress
WWW	World Wide Web
XP	Extreme programming
XR	Extended reality

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Introduction to a Digital Economy

1

Abstract

This chapter places digital technologies in the context of more general phenomena, such as a digital economy, digital innovation, digital transformation, digitalization, and digitization. In this way, the reader is oriented to the wider playground in which organizations operate and make informed decisions about potential technological implementations. A distinction is also made between IT and a digital technology. Next, we delve deeper into the role of a digital business model when making those strategic decisions about using digital technologies in an organization and how this relates to an agile way of working and a Scrum approach. All these phenomena and concepts offer the required context to understand better and to position the remaining chapters in this book because they provide an overview as well as guidance in an important first chapter.

Keywords

Digital economy · Industry 4.0 · Industry 5.0 · Digital technology · Digital innovation
Digital transformation · Digitalization · Digitization · Agility · Scrum · Lean start-up

1.1 The Rise of a Digital Economy

An increasing number of technology-driven business opportunities has arisen with a potentially high impact on how organizations operate and how individuals live. As such, those opportunities affect the economy and society at large. Although the notion of a digital economy is rapidly growing, its understanding is not new because a digital economy closely relates to the notion of an information society that is seen as the outcome of the third industrial revolution, namely, after introducing computers in the 1970s–1980s and later with the Internet's impact in the 1990s. Moreover,

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