DIGITALIZATION Contexts, Roles, and Outcomes

Sergey V. Samoilenko



Digitalization

Conceptually, as well as practically, digitalization is similar to the implementation of a modern computation model – the model may be a centralized setup using a mainframe or it may be extended to an N-tier architecture. Regardless of the specifics of the implementation, however, the conceptual model of data processing remains the same. Digitalization is nothing but a system relying on digital technologies to create, conduct and, potentially, expand a business activity of some sort. Digitalization can be used to create an e-commerce model for a small business or to create a global supply and distribution chain geared toward almost any kind of a business. It could also be used for non-profit purposes, such as on-line education and telemedicine or e-government.

Digitalization: Contexts, Roles, and Outcomes is a contemplation and analysis of the socio-technical system that is known as digitalization. It considers the context of digitalization as well as the ways by which digitalization offers value to the context within which it operates. This book aims to offer readers an entry point to a path of inquiry into the different aspects of digitalization. The goal is to identify main directions for further inquiry, as well as to outline the most obvious obstacles along the way. The book aims to guide readers on their own unique journeys using the basic ideas, principles, and concepts synthesized, developed, and presented in the book. It is beneficial to both practitioners and researchers.

The book covers:

- The functionality of digitalization
- The significance of digitalization
- Identifying the context of digitalization
- Designing a control system
- A cognitive model for the theory of digitalization
- Designing a theory of digitalization

The book helps readers to consider the subject of digitalization in a rigorous and rational way so their own perspectives can emerge stronger and be substantiated and reinforced by building an argument vis-à-vis perspectives and points examined in this book.



Digitalization

Contexts, Roles, and Outcomes

Sergey V. Samoilenko



First Edition published 2023 by Routledge 605 Third Avenue, New York, NY 10158

and by Routledge 4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

© 2023 Taylor & Francis Group, LLC

The right of Sergey V. Samoilenko to be identified as author of this work has been asserted in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Trademark notice: Product or corporate names may be trademarks or registered trademarks and are used only for identification and explanation without intent to infringe.

ISBN: 978-1-032-11409-5 (hbk) ISBN: 978-1-032-30397-0 (pbk) ISBN: 978-1-003-30490-6 (ebk)

DOI: 10.1201/9781003304906

Typeset in Minion Pro by KnowledgeWorks Global Ltd.

Contents

About the Overview.	Authorix
Introductio	on: Trouble with Wordsxv
Chapter 1	Conceptualizing and Defining Digitalization1
	Reader Notes11
Chapter 2	Conceptualizing Digitalization – What is a Good
	Lens to Use:
	Complex Systems Theory and Chaos Theory16
	Digitalization, CST, and CT
	Digitalization is a Complex System21
	Reader Notes
Chapter 3	Assessing the Present and Planning the Future25
	Reader Notes
Chapter 4	Assumptions Underlying Structure of
	Digitalization
	Reader Notes
Chapter 5	Essential Structural Components of Digitalization 39
•	Reader Notes
Chapter 6	Functionality of Digitalization
	Reader Notes
Chapter 7	Improving the Output of Digitalization via Process
	Optimization
	Reader Notes

vi • Contents

Chapter 8	Impact of Digitalization on Its Internal	
	Environment	61
	Reader Notes	65
Chapter 9	Impact of Digitalization on Its External	
	Environment	67
	Reader Notes	71
Chapter 10	Significance of Digitalization – Why Is It	
	Important?	73
	Reader Notes	78
Chapter 11	Mechanism of the Impact – What Is the Theory?	79
	Consideration of An Appropriate Meta-Model of	
	Theory of Digitalization	80
	TM1: Syntactic Model	82
	TM2: Semantic Model	83
	TM3: Pragmatic Model	84
	TM4: Paradigmatic Model	85
	TM5: Third World Model	86
	TM6: Cognitive Model	87
	Note	89
	Reader Notes	89
Chapter 12	ldentifying the Context of Digitalization	91
	Digitalization: Digital Consumers	92
	Digitalization: Digital Activists	93
	Reader Notes	95
Chapter 13	Digitalization: Platform Acquisition	97
	Reader Notes	101
Chapter 14	Digitalization: Outcomes of Using a Platform	103
	Reader Notes	109



About the Author

Sergey V. Samoilenko is a Professor in the Department of CIS/CS at Averett University, Danville, Virginia. He holds his PhD and MS in Information Systems from Virginia Commonwealth University. Sergey's research is focused on the areas of Information Technologies for development, decision support systems, and design of quantitative multi-method methodologies. He is an author of multiple books and book chapters and has published in a variety of journals, as well as in numerous conference proceedings. Sergey can be reached at samoilenko@averett.edu.



Overview

The purpose of this book is to engage a reader in a discussion about some of the issues and aspects relevant to the subject of digitalization. The primary goal is neither to cover, nor to summarize the published research done in this area. Neither the purpose is to delve into the details of various case studies. There will be no references to articles or books – all that is in this text is a, pretty much, a common sense' discussion on the subject.

Instead, the primary intent is to contemplate and analyze the sociotechnical system that is known as *digitalization*, to consider the context of digitalization, as well as to consider some of the ways by which digitalization offers its value to the context within which it operates. As a result, we hope this effort may offer a reader an entry to a path of inquiry into variety of the aspects of digitalization, where the goal is to identify main directions for a further inquiry, as well as to outline the most obvious obstacles along the way. Consequently, we hope that the interested reader can continue on her unique journey using the basic ideas, principles, and concepts synthesized, developed, and presented in this book.

We hope that the material presented in this book would be especially beneficial to the practitioners and researchers working in the area of digitalization, where by reading the presented content one can agree or disagree with the points developed by the author. Our reader does not have to agree, or disagree, on the presented points, for the only requirement is to consider the subject of digitalization in more or less a rigorous and rational way, so our reader's own perspective can emerge stronger and be substantiated, or reinforced, by building an argument vis-à-vis perspectives and takes introduced in this book.

In any case, and regardless of "Yeah" or "Nay" on any particular point stated in the text, the reader, as a result of reflecting on the subject, would end up further along in his/her own contemplation and investigation of digitalization. This is simply because that our reader found something to agree or disagree with, and was invited to create her own opinion. For this purpose, we leave the space at the end of each chapter for those who are interested to make their own notes and arguments, and to pose possible research questions related to digitalization as we go along with the chapters of the book. The text can be approached in two ways. First, a reader could follow a sequence of chapters as arranged within the book. Second, a reader could view the contents as a collection of three interrelated parts. Part 1 focuses on fundamental assumptions and the structure of digitalization. Part 2 deals with functionality of digitalization, its behavior, as well as with constructing a candidate *Theory of Digitalization*. Part 3 considers the intended impact of digitalization and the expected context-specific differences in the impact. Chapter 1 serves as an introductory chapter to all three parts. Next, we provide a brief overview of the topic that each chapter aims to cover.

Chapter 1 is dedicated to the goal of conceptualizing what digitalization is – in this chapter we aim to provide a general well-structured definition of the term and to demonstrate the importance of the precise definition to research and practice.

Chapter 2 deals with the selection of the appropriate lens for investigating digitalization. In this chapter, we present our arguments for why digitalization should be viewed as a *complex system* and why *Complex System Theory* and *Chaos Theory* are good lenses to apply when studying digitalization.

Chapter 3 is concerned with two questions – how to analyze a current state of digitalization and how to plan its future state. The point the chapter makes is that unless we know what "this thing" called digitalization is, we cannot adequately plan for the future – for what "this thing" is going to be and what is it is supposed to do.

Chapter 4 attempts to explicate the fundamental assumption underlying digitalization. This allows for a more disciplined approach to discussing what the essential structural elements of digitalization must be. Intuitively, it is important to know whether the structural components of digitalization are, indeed, the components that *must be* the part of the system.

Chapter 5 builds on developments of the previous chapter and identifies the essential components of a complex system that we refer to as "digitalization". Specifically, the content of the chapter is dedicated to the delineation between a social and a technical components comprising the system.

Chapter 6 extends the considerations of Chapter 5 and investigates the functionality of digitalization. By asking "What is digitalization supposed to do, exactly?", this chapter pinpoints the subprocesses that must be completed within the system in order to deliver the outcome to the context.

Chapter 7 has a main purpose of identifying ways of improving performance of digitalization as of "input-output" system. Specific venues for improvements are identified, and the consequences of the improvements are pointed out. Chapter 8 considers the impact of digitalization on its internal environment. This chapter looks into directions that digitalization may follow to optimize its internal performance in order to deliver the desired end result to its context.

Chapter 9 is dedicated to the impact of digitalization on its external environment. By considering that the context of digitalization is an open dynamic system, this chapter identifies some of the possible changes that expansion of digitalization may bring to its external environment.

Chapter 10 raises the issue of significance of digitalization. By asking the question "Why is digitalization important?", the chapter points to the context as the obvious reason of being of digitalization. It is noted that the *importance* manifests itself on different levels, and that it is relative to a type of a customer.

Chapter 11 points out that in order to improve the impact of digitalization, the mechanism of the impact needs to be known or, at least, hypothesized. Thus, this chapter considers some of the types of the models that could serve as foundations for *Theory of Digitalization*.

Chapter 12 is concerned with the context of digitalization – the larger system within which digitalization supposed to generate its impact. Two fundamental roles are identified as a result of the analysis – *digital consumers* and *digital activists*.

Chapter 13 considers using digitalization for the purposes of acquiring a digital platform, as well as the benefits that such acquisition provides. The chapter points out the importance of the customers' perspectives on defining the outcome of digitalization.

Chapter 14 builds on the previous chapter and goes a step further by asking "What are the outcomes of using a newly acquired digital platform?" This chapter identifies some important differences between digital consumers and digital activists in terms of the goals they pursue, as well as in terms of their expectations for the outcomes of digitalization.

Chapter 15 aims to outline a scope of digitalization for digital consumers and digital activists. The question of "How deeply digitalization can be embedded within its context?" is asked and some of the scenarios are suggested.

Chapter 16 is directed at identifying outcomes of digitalization. Specifically, the chapter's aim is to develop an idea of what is it, specifically, digitalization can provide to its context – what is the value of using digitalization and where that value comes from?

Chapter 17 investigates the impact of the pressures of the context of digitalization on its structural components – social and technical subsystems. This chapter considers the impact of internal as well as external forces on digitalization, and reflects on how a complex dynamic system may react to those forces.

Chapter 18 is dedicated to the application of digitalization within a noncompetitive context of social groups comprised of digital activists. The chapter identifies a possible social stratification as a consequence and a response to using digitalization in such context.

Chapter 19, unlike a previous chapter, places the usage of digitalization within a competitive social context, which brings some additional complexity to considerations of the previous chapter. However, it is still a context that allows for the development and a balanced growth of digitalization.

Chapter 20 is dedicated to considering digitalization being used by adversarial social groups – and the implications that such context brings to the structure and the behavior of digitalization. The analysis of the scenario suggests a set of important implications that must be considered to manage digitalization successfully.

Chapter 21 raises the question of inevitable conflict that is brought about by certain scenarios involving digitalization. The main question of the chapter is "How a conflict environment can be managed?" The chapter demonstrates some of the benefits of using *Chaos Theory* in order to answer the question and propose the solution.

Chapter 22 considers a design of a system capable of managing the conflict environment of digitalization that is brought about by the disturbances in its internal behavior and the changes in structure. The content of the chapter demonstrates that the principles of *Cybernetics* could be used as a guide in proposing a conceptual design of such control system.

Chapter 23 returns to the issue of theory building and constructs a cognitive model for *Theory of Digitalization*. The resultant framework is the model that is flexible and easily extendible to a variety of domains.

Chapter 24 extends the contents of the previous chapter by using the developed cognitive model for the purposes of designing *Theory of Digitalization*. A set of possible research questions and hypotheses are presented to a reader to demonstrate the simplicity and flexibility of the developed theory. This concludes the book.

Introduction Trouble with Words

A purpose of any language is to enable a process of communication, and this purpose is achieved, fundamentally, by relying on linguistic constructs we call *words*. To that extent a "word" is a made up token that has an assigned meaning and stands for something or expresses something. In that role a word can be viewed as a *sign* – a reference to something empirically accessible (e.g., table, tree), or a word could be perceived as a *symbol* – a pointer to something conceptual yet accessible by proxy (e.g., love, black hole) or transcendental – something accessible only via meta-proxies (e.g., God, Brahman, Good, Evil).

Some words are *terms*. A *term* is a word, or a collection of words, that is *intended to convey a specific meaning in a specific context*. For example, "and" is a word indicating that two things go together – with the meaning "to connect" or "to add". However, in electronics "and" has a specific meaning – the *word* becomes a *term* by acquiring a meaning of *a Boolean operator which gives the value one if and only if all the operands are one, and otherwise has a value of zero* (https://languages.oup.com/googledictionary-en/). Similarly, *pancreatitis* is a medical term denoting *a condition of inflammation of the pancreas*, and it means, as a *term*, much more to a medical doctor, than, as a *word*, to a lay person on a street. We can say that the meaning of the terms is not universally distributed among the people who use it.

We can see the relationship between "words" and "terms" as a *hierarchy* of meanings – a "word" could be upgraded to a "term" via provision of a specific meaning in a form of a definition, and a "term" can be downgraded to a "word" via wide spread adoption that removes the specific meaning replacing it with a vague idea for what it supposed to denote originally. For example, "freedom of speech" is a well-defined legal term that becomes a string of words with a loose meaning if used in the context of the general population. On the other hand, such common and long used words as "insanity" and "reasonable person" became upgraded to becoming well-defined legal terms with a specific meaning in the field of Law. But, regardless of the rigor with which words and terms are defined, in order for them to be utilized for the purposes of communication, they must become *common*. This implies that their meaning must be commonly understood, for this is a prerequisite for words and terms becoming a part of a *common language*. Simply put, we have to encode our messages using the same conversion scheme – be it an English language, or ASCII, or Manchester scheme. It is fair to say that the efficiency and effectiveness of the process of communication via a common language is impacted by the precision with which the words and terms comprising the language are defined and, therefore, understood by the users of the language.

Let us turn our attention to a subset of the common language that is represented by *well-defined words* – this places *terms* within that subset. Consequently, within the context of our discussion we use *word* in the sense of a *well-defined syntactic structure with a clearly stated meaning*, where:

- "well-defined" means (based on Merriam-Webster' dictionary see https://www.merriam-webster.com/dictionary):
 - 1. having clearly distinguishable limits, boundaries, or features, or,
 - 2. clearly stated or described
- "meaning" is the thing one intends to convey especially by language (https://www.merriam-webster.com/dictionary/meaning).

In short, in our discussion we are dealing with those words that are terms.

One of the goals we pursue in this text is very simple – we want to demonstrate to our reader some of the aspects of a potential problem associated with a utilization of poorly defined words with an ambiguous meaning in a common language. Specifically, we would like to call an attention to *hype words* – those linguistic constructs that came to existence and became popular within a specific subset of a society, and then became "released into the wild" for a consumption by the general public. The word of interest to us is *digitalization*, and we are aiming to discuss with our reader a hidden complexity behind the concept that underlies it.

It all starts with *digitization*, which is *the process of using digital information technologies to convert analog data into its digital counterpart*. If Paul scanned his drawing, then he used digitization in the process. And if we use digitization to improve the existing state of affairs in business and to change, or create new, business models and streams of revenue, then we get *digitalization*. If Scott, how is a hairdresser, uses his phone to schedule his appointments (instead of serving only walk-ins) and to automatically reorder his barbershop supplies from the vendor (instead of doing so in person), then Scott used digitalization to do so. And if we use digitization to change/transform major (or all) aspects of a business, then we get *digital transformation*. *Instagram* story is illustrative of digital transformation that did miracles for Instagram, bud did not bode too well for Kodak. Mostly, delineating lines are blurry – go figure where "major change" ends and "transformation" begins.

For the purposes of this study we adopt the following definition (provided by Gartner Group – see: https://www.gartner.com/en/informationtechnology/glossary)

Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.

Given this definition, we consider *platformization* to be a subset of *digita-lization*, because a former requires the latter, while the latter offers opportunities beyond the former. We use the following definition of a *platform* (similarly, provided by Gartner Group):

A platform is a product that serves or enables other products or services.

And we define (our own definition due to the absence of the established one) *digital platformization* as:

A process of development and utilization of a digital interface – of a digital product that serves or enables other products or services.

And, from this point on, we refer to the subject of our interest as *digitalization*.

But, let us pause for a moment and ask the following question: *Why* not to call digitalization and platformization using simpler terms – digital interface and digital interface' development? The answer is simple – by acquiring a fancier label the subject also acquires the air of sophistication otherwise not perceived by those who are not "in the know". Simply put, the Cloud sounds cooler and is easier to sell than *N-tier distributed architecture*. This substitution, of course, makes a perfect business sense, because a person aiming to "elucidate the perilous consequences of

perfunctory implementation of digitalization" commands a greater level of attention and resources from her "not in the know" colleagues, then a person speaking in a plain language would. Be it academia or business, the size, the magnitude, and the extent of the allocated resources matters in the Darwinian fight for survival of the fittest and the most funded. One cannot escape dealing with triple constrain of scope, cost, and time.

We must note that the current work is not definition-dependent. This is because, for all intents and purposes, all available definitions of *digita-lization* or *platformization* (as well as definitions of majority of IS-related concepts) are so severely lacking, that they all proudly wear large targets on their backs to invite a lethal dose of criticism. A lot of it is too general, and a lot of what is too general is by design, so a sale could be made or a paper could be published.

Instead, our work is suggestive in spirit – we aim to advocate for precision and specificity in terms and definitions used in the field of Information Systems. Such terms as "the Cloud", "cybersecurity", "ICT4D", "business intelligence", and so on, do sound grand to lay people and they do add pizzazz to sale pitches, but they do not add to the progress of the field, and they do not help telling a true story of what is it that the field of Information Systems is trying to accomplish. But, it is only if we know what is it that we are trying to do, with what resources, and for what purpose, only then we can actually assess the current state of the efforts and to adequately plan for the desired future. And, as an added benefit, will be able to explain to others outside of the field, clearly and specifically, what is it we are trying to do, which is not a bad idea also.

1

Conceptualizing and Defining Digitalization

While it is a use of a common language or some sort of communication that makes interactions productive, that allows individual people to aggregate and form societies, there is also something else that is needed – a shared culture. Even in a very diverse and multicultural society, there must be a common understanding of the nature of *everyday reality* among its members – a *weltanschauung* that supports the shared culture and allows the society to function.

It is worth noting the importance of the concept of "everyday reality" – it is a legally, ethically, formally, and informally bound subset of the social, physical, and cultural world that is shared by the individuals living in a given society. Meaning, an atheist, a Muslim, a Christian, a Jew, and a Buddhist may all have their own views on the nature of the "big R" *Reality* – each one of them would have their own big weltanschauung, which may be quite incompatible or outright irreconcilable with that of their counterparts. However, as long as they share a common little weltanschauung pertaining to everyday reality within a given context, they can co-exist in the same society quite comfortably and to their mutual benefit. Regardless of whether you subscribe to modernist or postmodernist philosophical principles, you still have to pay your taxes, and over-the-board Satanists pay for their groceries just as well-behaving Christians do.

Leaving out the inevitable uniform acceptance of the common physical laws by the members of a society (e.g., if you drop your sandwich it falls due to the force of gravity), the individuals must agree on *little weltanschauung*, and this agreement means accepting a shared meaning of the words that describe it. This agreement is forged via the process of *acculturation* – by utilizing its formal and informal components. Formally, the

2 • Digitalization

acculturation takes place when an individual participates in formal social transactions *vis-a-vis* other members of the society. For example, if Mary attended Best University and was taught a definition of "computer network", which she then used in conversations with her neighbor, then Mary acquired a shared meaning of the term via the process of *formal accultura-tion*, and then she re-enforced that meaning via the process of *informal acculturation*.

On the other hand, if Bob, who knows nothing about different types of computer architecture, brings his laptop to his friend and is told that he cannot print any longer because he needs to update his device driver, then Bob just learned that a device driver is an "important thing that allows a laptop to print", and he acquired this shared meaning via the process of informal acculturation. If, after this encounter, Bob submits his request to update a device driver to the Help Desk at his work, and his request is understood by the representative, then Bob re-enforced and validated the meaning of "device driver" via the process of formal acculturation.

Those are different venues, and we would like them to work in unison and synergy by providing a congruency between the meanings they supply. Most of the times they do – when a girl starts attending her school, she is taught to value her education by her teacher in a classroom (e.g., formal acculturation), but she is also told to value her education by her parents at home (e.g., informal acculturation). However, sometimes they do not play well together – when a young man is told that alcohol is poison by his doctor (e.g., formal acculturation), but is persuaded by his friends that alcohol is fun (e.g., informal acculturation), then what we have is a conflict to deal with.

As an interlude, let us ask a question: What does "digitalization" mean and what does this term stand for? At this point, there is no shared meaning of digitalization that can be reliably acquired through either formal or informal processes of acculturation. We use the clause "reliably" to indicate not the shortage of the practitioners and academics willing to define the term and explain it to willing bystanders, but a lack of consistency in the assigned meaning to the term.

However, an agreement, we must have.... And once the agreement regarding everyday reality is achieved, then even some *big weltanschauung*-related concepts could be incorporated successfully into an understanding of *little weltanschauung* – this allows for such phrases as "Don't do it – there will be hell to pay!", "His new business is in limbo", "This tastes like heaven!" to be understood in the same way by an atheist, a Muslim, a Christian, a Jew, or a Buddhist.

At this point, we can summarize the stated above content as the following assertion (A#):

A1: One of the prerequisites for a functioning society is a common understanding by its members of the meaning of the words that describe:

- 1. The society in general, and
- 2. The everyday reality of living in that society in particular.

A viable society is a dynamic and open system, and a viable dynamic system transitions through its states – let us say, its past, its present, and its future. This allows us to put forward the second assertion:

A2: A common understanding of the meaning of words allows a functioning society to analyze its past, to assess its present, and to plan for its future.

Just consider a phrase "The day was young and life was beautiful and Bob was gay, but when the clouds rolled in he was no more". There are ways to understand this sentence...

This implies that the viability of a society is dependent, at least in part, on a common understanding and shared interpretation of the meaning of the words in the vocabulary used by the members of the society. For example, if we are to inquire into changes regarding the state of infrastructure of Information and Communication Technology (ICT) in the US, and if we are to plan for its future state, then we must, clearly, define what "ICT infrastructure" is and how we are going to represent it and how we are going to measure it.

Taking this into consideration, it is clear, prior to even reading, that a hypothetical article titled "Assessing State of Cybersecurity: Past, Present, and Future" will contain, highly likely, a lot of hype words and not a lot of substance. And this is not a reason for antagonism toward the author who wants to publish his paper or the subject – it is that the breadth of the undertaking makes a meaningful assessment impossible. But, if a reader attends to the content of the article, then it is the fault of the reader because it is he who gives the authority to the writer and the subject.

After all, when one sees a paper titled "Assessing State of Health..." or "Assessing Quality of Movies...", one does not expect a serious treatment of the topic. However, it is, probably, fair to say that a conference titled "Assessing State of Digitalization: Past, Present, and Future" would attract a large share of participants who are in awe and bewilderment of the topic. The *cool* factor is hard to beat.