



Gerhard Oswald  
Michael Kleinemeier  
*Editors*

# Shaping the Digital Enterprise

Trends and Use Cases in  
Digital Innovation and Transformation

 Springer

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Editors

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# Foreword

The chapters in this book offer possible answers to some of the pressing questions that arise when practitioners seek to shape a digital enterprise. The chapters are classified into three sections:

1. Cross-industry trends—chapters that primarily present industry-independent insights on digitalization.
2. Industry-specific trends—chapters that focus on digitalization in a specific industry.
3. Use cases—chapters that primarily deal with concrete examples of digitalization.

## Chapters in the Cross-Industry Trends Section

Our introductory chapter, “*Digitalize or Drown*,” shows first that digitalization, defined as the process of moving to a digital business, is the only reasonable reaction to persistent digitization in any industry. It then introduces a framework that can serve as orientation for digitalization.

In “*The Business Consequences of a Digitally Transformed Economy*,” Kowalkiewicz, Safrudin, and Schulze describe how five emerging digitalization trends are pushing organizations to reimagine their business models, their business processes, and how these processes and models work in a digital economy. The authors present what the trend entails with ample examples and two important tasks for digital enterprises: digitize the core and digitize the mind-set.

Organizational change management continues to be a challenge, particularly when uncertainties arise as a result of the digital economy. In “*It’s Not Just about Technology: The People Side of Digitization*,” Kohnke highlights four major areas

in organizational change management that should be considered when leading individuals in digital enterprises.

Companies must have solid innovation and transformation capability if they are to survive and stay competitive. In “*Antithetic Leadership—Designers Are Different, Business People Too*,” von Kutzschenbach, Wagner, and Mittermeyer introduce the notion of “antithetic leadership” to describe this required duality in management behavior for digital enterprises to succeed.

In “*Digital Culture—Why Strategy and Culture Should Eat Breakfast Together*,” Wokurka, Banschbach, Houlder, and Jolly suggest that one of the reasons digital transformation initiatives fail is that they collide with the company culture. The authors discuss how to avoid such failure by driving the necessary changes toward a digital culture.

In response to the challenges of the digital economy, Blaschke, Cigaina, Riss, and Shoshan’s “*Designing Business Models for the Digital Economy*” introduces a methodology for systematic digital business modeling based on a language that both business and technology experts understand.

## Chapters in the Industry-Specific Trends Section

The concepts of bitcoin and blockchain have revolutionized the banking and finance industry. In “*The Unbanked Don’t Need More Brick-and-Mortar Banks*,” Kehr, Tonkin, and Bihler describe how the blockchain model and mobile technologies are triggering a new era of mobile financial services in developing countries, potentially eliminating the need for brick-and-mortar banks.

As new digital technologies disrupt the automotive-supplier industry, Farahani, Meier, and Wilke’s chapter “*Digital Supply Chain Management Agenda for the Automotive Supplier Industry*” presents a guiding agenda for bringing new technological innovations into use, cohesively based on the analysis of seventeen digital SCM use cases.

Companies in the manufacturing industry are reconfiguring their value chains to increase their service orientation. In “*The Value of Lifecycle Information to Transform the Manufacturing Industry*,” Gudergan, Buschmeyer, Feige, Krechting, Bradenbrink, and Mutschler reveal the principles behind offering additional value through industrial product-service systems and advise best practices and management guidelines.

## Chapters in the Use Cases Section

In “*Creating a Market Analytics Tool That Marketers LOVE To Use—A Case of Digital Transformation at Beiersdorf*,” vom Brocke, Fay, Böhm, and Haltenhof address marketers’ challenge with big data. The authors describe a joint initiative between Beiersdorf and SAP to establish a solution that marketers LOVE to use: a (L)ean process to produce the expected (O)utcomes that bring (V)alue to users and create (E)xcitement among the project team, its stakeholders, and its users. The user-centric market analytics tool allows Beiersdorf to reimagine its business processes through analytics automation and to reimagine work by shifting its perspective from “what” to “why.”

The world is experiencing outbreaks of infectious diseases across geographies in magnitudes of size and speed rarely seen before. Moyer, Tom-Aba, Sharma, and Krause’s chapter “*Taking Digital Innovation into the Field of Infectious Diseases—the Case of SORMAS®*” describes how a successful collaboration between several institutions jointly developed the Surveillance Outbreak Response Management and Analysis System (SORMAS), enabling an innovative approach to managing infections at their source using mobile and real-time technologies.

The Hilti Corporation has a long history of leveraging digital technologies to innovate and transform itself continuously. In “*A Journey of Digital Innovation and Transformation—The Case of Hilti*,” vom Brocke, Fay, Schmiedel, Petry, Krause, and Teinzer report on the key activities, challenges, and success factors of each phase of Hilti’s digital journey and discuss the lessons learned and their implications for digital enterprises.

Increasing the efficiency of car usage is one of the major areas of interest for sustainable mobility. In “*The Future of Automobility*,” Janasz and Schneidewind present the efficiency potential of innovative mobility concepts, which flourish at the frontier of digital technologies, shared mobility patterns, and vehicle automation.

Condea, Hagedorn, and Cruickshank’s chapter “*What Co-Innovation Can Mean for Digital Business Transformation—Sharing and Managing Risk To Achieve IT Business Innovation*” presents three co-innovation case studies with various SAP partners (Element Five, allvisual AG, Orianda Solutions, Wikitude, Mtell, and Rolta). The case studies show how each case leveraged co-innovation and contemporary technologies to achieve a successful digital transformation.

In “*Virtual Reality Goes Mobile in the Digital Age*,” Poppe, Gilgen, and Safrudin show how three businesses—Samsung Italy, Tommy Hilfiger, and Biogen IDEC—embarked on a digital innovation initiative to get closer to their customers. Enabled by mobile virtual reality, the companies show how a purposeful use of digital technologies can bridge the divide between the real world and the virtual world.

We express our sincere thanks to all of the authors and all of the customers, partners, academic institutions, and other organizations involved in contributing to this book. Special thanks go to Michael Kleinemeier and Gerhard Oswald for editing the book; to our SAP Business Transformation Services consultants for



sharing their knowledge; to the dedicated book project team (Vivienne Zhong, Maria Fay, Tomasz Janasz, Roman Persiyantsev, and Pavel Balan), under the leadership of Niz Safrudin, for making it all happen; to Jan vom Brocke for comprehensive academic support; and to Barbara Bethke and Christian Rauscher from Springer Publishing for frictionless assistance and cooperation.

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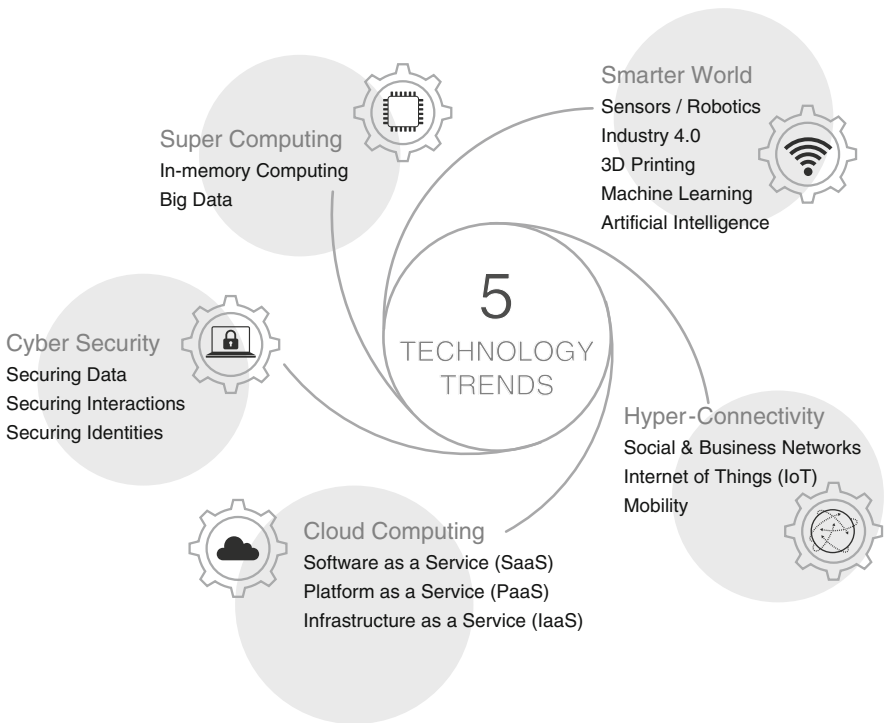
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# Editors' Preface

The digital economy is real—and it is here to stay. We are witnessing an era unmatched in the history of business innovation and transformation. Breakthrough technologies have matured and hit scale together, enabling five defining trends (SAP 2015): hyper-connectivity, supercomputing, cloud computing, smarter world, and cyber security (see Fig. 1).



**Fig. 1** Five technology trends (SAP 2015)

The resulting pace of change is staggering. Over the next 10 years, 40 % of the companies indexed as Standard & Poor's 500 will have ceased to exist (Ioannou 2014) unless they keep up with these technology trends. Winning companies are particularly agile in three areas (SAP 2015):

1. Reimagining business models
2. Reimagining business processes
3. Reimagining work

Leaders in the digital economy are emerging seemingly from out of nowhere (e.g., Uber, Airbnb). Digital business models are disruptive (e.g., in the automobile industry being affected by Google/Alphabet, Tesla, and Apple). Lines defining industries are blurring. Alibaba, for instance, is not just the largest e-commerce company; it is also a financial services and technology company. Every business is now a digital business.

Many CEOs believe the digital economy will have a major impact on their industry, but only a few have a digital strategy in place and execute it. Our CEO, Bill McDermott, has recently introduced a structured digital business framework that lets companies plan on how to develop and execute their digital business strategy (SAP 2015). This digital business framework comprises the following five pillars:

1. Engaged workforce
2. Supplier collaboration (Business Networks)
3. Core business processes
4. Assets and Internet of things
5. Customer experience (omni-channel)

Every company can develop a digital strategy across these five pillars. Research shows that companies having embraced the digital world and executed their digital strategy are seeing real shareholder and stakeholder value. Value creation through digitization strategies is significant, with +9 % revenue creation, +26 % impact to profitability, and +12 % market valuation (Westerman et al. 2013). When it comes to defining and enabling digital business strategies, SAP offers not only an end-to-end digital business solution (see Fig. 2) but also a corresponding digital service and support portfolio (SAP 2016, Oswald 2013).

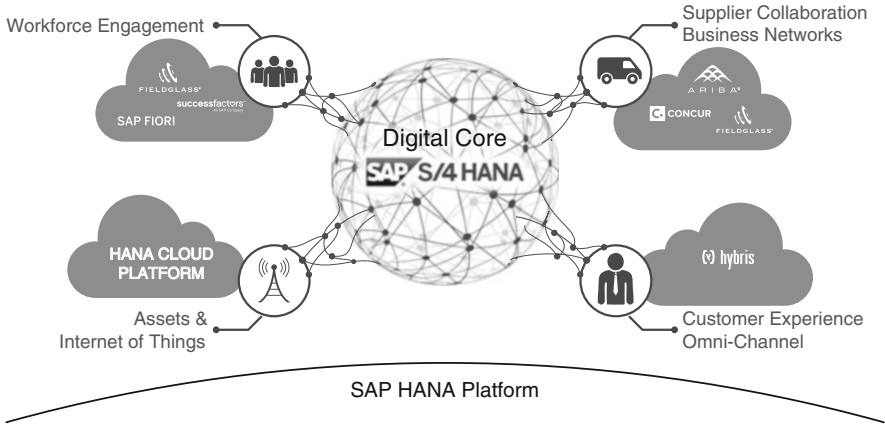


Fig. 2 SAP digital solution portfolio (SAP 2015)

The tremendous opportunities and challenges of digital innovation and transformation can only be mastered jointly in cooperation with customers and partners from different regions and industries, to the benefit of everyone involved.

Together with international researchers, consultants, and practitioners, the SAP Digital Thought Leadership & Enablement team within our Business Transformation Services (BTS) unit has in this book compiled key trends and case studies in digital business innovation and transformation. This collection of chapters, entitled “*Shaping The Digital Enterprise*,” continues the successful SAP BTS book series by illuminating both the aspects mentioned above (technology foundation, business models, and processes) and further aspects of digital innovation and transformation (customer centricity, leadership and strategy, structure and governance, people and skills, and culture).

The editors would like to cordially thank all authors as well as all involved customers, partners, academic institutions, and other organizations for their contributions to this book. Special thanks goes to our Global Head of BTS, Dr. Christoph Steiger, and our Head of Digital Thought Leadership & Enablement team, Dr. Edward Schreckling, who initiated and conceptualized this publication.

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# Contents

## Part I Cross-industry Trends

<b>Digitalize or Drown</b> . . . . .	3
Edward Schreckling and Christoph Steiger	
<b>The Business Consequences of a Digitally Transformed Economy</b> . . . . .	29
Marek Kowalkiewicz, Niz Safrudin, and Bert Schulze	
<b>It’s Not Just About Technology: The People Side of Digitization</b> . . . . .	69
Oliver Kohnke	
<b>Antithetic Leadership: Designers Are Different, Business People Too</b> . . . . .	93
Michael von Kutzschenbach, Peter Mittemeyer, and Werner Wagner	
<b>Digital Culture: Why Strategy and Culture Should Eat Breakfast Together</b> . . . . .	109
Guido Wokurka, Yvonne Banschbach, Dominic Houlder, and Richard Jolly	
<b>Designing Business Models for the Digital Economy</b> . . . . .	121
Michael Blaschke, Marco Cigaina, Uwe V. Riss, and Itzhak Shoshan	

## Part II Industry-Specific Trends

<b>The Unbanked Don’t Need More Brick and Mortar Banks</b> . . . . .	139
Henning Kehr, Graham Tonkin, and Reiner Bihler	
<b>Digital Supply Chain Management Agenda for the Automotive Supplier Industry</b> . . . . .	157
Poorya Farahani, Christoph Meier, and Jörg Wilke	
<b>Value of Lifecycle Information to Transform the Manufacturing Industry</b> . . . . .	173
Gerhard Gudergan, Achim Buschmeyer, Boris Alexander Feige, Denis Krechting, Stefan Bradenbrink, and Ralph Mutschler	

**Part III Use Cases**

**Creating a Market Analytics Tool that Marketers LOVE to Use:  
A Case of Digital Transformation at Beiersdorf . . . . . 197**  
Jan vom Brocke, Maria Fay, Martin Böhm, and Volker Haltenhof

**Taking Digital Innovation into the Field of Infectious Diseases:  
The Case of SORMAS® . . . . . 219**  
David Moyer, Daniel Tom-Aba, Shuchi Sharma, and Gérard Krause

**A Journey of Digital Innovation and Transformation:  
The Case of Hilti . . . . . 237**  
Jan vom Brocke, Maria Fay, Theresa Schmiedel, Martin Petry,  
Felix Krause, and Tim Teinzer

**The Future of Automobility . . . . . 253**  
Tomasz Janasz and Uwe Schneidewind

**What Co-Innovation Can Mean for Digital Business Transformation:  
Sharing and Managing Risk to Achieve IT Business Innovation . . . . . 287**  
Cosmin Condea, David Cruickshank, and Pascal Hagedorn

**Virtual Reality Goes Mobile in the Digital Age . . . . . 309**  
Erik Poppe, Désirée Gilgen, and Niz Safrudin

**Epilogue . . . . . 331**

**Disclaimer . . . . . 335**

**Part I**  
**Cross-industry Trends**



# Digitalize or Drown

Edward Schreckling and Christoph Steiger

**Abstract** Digitization, defined as the process of changing from analog to digital form, is inevitable, irreversible, tremendously fast, and ubiquitous. Drivers of digitization include digital technology breakthroughs; changes in people’s behavior, attitudes and expectations; comparatively low barriers to entry; and the availability of huge amounts of venture capital. Objects of digitization are processes and work; products and services; and business models. The impacts of digitization include large and varied impacts on the economy as a whole, extraordinary opportunities, and significant challenges for businesses. Given digitization’s characteristics and impacts, digitalization is no longer a choice but an imperative; for all businesses across all industries and regions the motto is digitalize or drown. The digital innovation and transformation framework introduced in this chapter—which is comprised of the eight dimensions of customer centricity; leadership and strategy; business models, including offerings (products and services); processes; structure and governance; people and skills; culture; and technology foundation—can serve as an orientation to digitalization.

## 1 Digitization: Drivers, Objects, and Impacts

As we write this chapter, the participants in the Annual Meeting of the World Economic Forum in Davos are discussing whether we are on the cusp of a fourth industrial revolution (Parker and Thomson 2016).<sup>1</sup> Most of the Davos participants think so.

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<sup>1</sup>The founder and executive chairman of the World Economic Forum, Klaus Schwab, characterizes the first three industrial revolutions as follows (Schwab 2016a, b):

1st (1760–1840): railroads, steam engine, water, mechanical production equipment.

2nd (late nineteenth century–early twentieth century): division of labor, electricity, assembly line, mass production.

3rd (1960s—present): electronics, IT, automated production, catalyzed by the development of semiconductors, mainframe computing in the 1960s, personal computing in the 1970s and 1980s, and the internet in the 1990s.

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The same view can be derived from the answers of about eight hundred leading experts and executives from the information and communications technology (ICT) sector to the World Economic Forum's Global Agenda Council on the Future of Software & Society's request for their views on 21 tipping points (Thomson 2016; World Economic Forum's Global Agenda Council on the Future of Software & Society 2015). The interviewees identified 13 signs that a fourth industrial revolution might be around the corner:

1. Implantable and wearable technologies.
2. Our digital presence.
3. Vision as the new interface.
4. Ubiquitous computing.
5. A supercomputer in your pocket.
6. Storage for all.
7. The internet of and for things.
8. Smart cities and smarter homes.
9. Big data for big insights.
10. Robots, decision-making and the world of work.
11. The rise of digital currencies.
12. The sharing economy.
13. 3D printing.

Schwab contends that these and other physical, digital, and biological megatrends will fundamentally alter the way we live, work, do business, and relate to one another: "In its scale, scope and complexity, what I consider to be the fourth industrial revolution is unlike anything humankind has experienced before." (Schwab 2016a, p. 1).

Independent of the questions concerning whether those megatrends indicate a fourth industrial revolution (or just a part of the third one) and when this revolution will occur, one thing is clear: 'digitization' or 'to digitize', defined as the process of changing from analog to digital form (Gartner n.d.a),<sup>2</sup> is not an entirely new phenomenon,<sup>3</sup> and it already significantly affects businesses, the economy, individuals, and society as a whole. According to a recent McKinsey study, digitization now touches most Americans and most of the US economy (Manyika et al. 2015a); in fact, "the effects of an increasingly digitized world are now reaching into every corner of our lives." (Friedrich et al. 2011, p. 3). (We explicitly differentiate between 'digitization' or 'to digitize' and 'digitalization' or 'to digitalize'.<sup>4</sup>)

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<sup>2</sup>An example of digitization in this sense is the conversion of an analog audio signal into digital music.

<sup>3</sup>Early examples include Electronic Data Interchange (EDI), which started in the 1960s; the Internet, used by the general population since the 1990s; and e-commerce, first promoted around the year 2000.

<sup>4</sup>See Sect. 2.

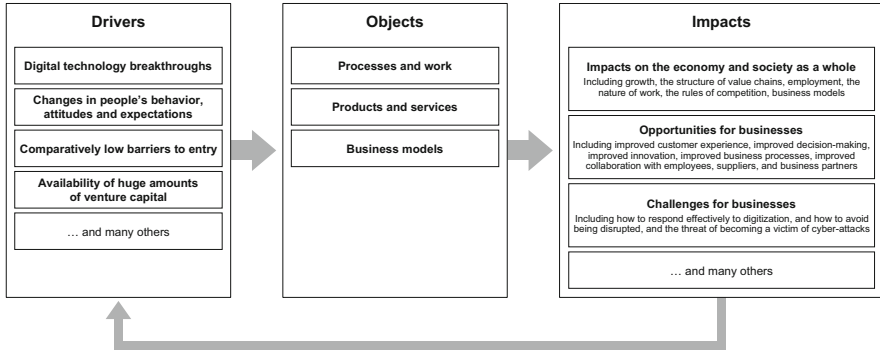


Fig. 1 Drivers, objects, and impacts of digitization

However, from the perspective of businesses, which have been digitizing for decades (by for instance, implementing standard software to digitize business processes), the question arises concerning why the current wave of digitization is new or different from those before. To answer this question, it is helpful to cast a glance at the drivers, objects, and impacts of digitization, and how they relate to each other (see Fig. 1).

### 1.1 Drivers of Digitization

Drivers of digitization include digital technology breakthroughs; changes in people’s behavior, attitudes and expectations; comparatively low barriers to entry; and the availability of huge amounts of venture capital<sup>5</sup> (see left section of Fig. 1). These four driving forces act in concert and powerfully reinforce one another.

Digitization is mainly driven and enabled by digital technology breakthroughs like (s)ocial media, (m)obile computing, (a)nalytics/big data, (c)loud computing (SMAC; a.k.a. ‘third platform’), the Internet of Things (IoT), cyber-physical systems (CPS), cyber-human systems (CHS), and cyber-security (SAP 2015; Kowalkiewicz et al. 2016).<sup>6</sup> Digital technologies have a wide reach and their dissemination is increasingly fast (Dreischmeier et al. 2015; Ernst & Young 2011). The underlying causes of this increasing dissemination are Moore’s law<sup>7</sup> and Metcalfe’s law:<sup>8</sup> “Computing hardware becomes ever more powerful, small, and

<sup>5</sup>This enumeration of drivers is not exhaustive. For more drivers (e.g., demographic shifts, greater urbanization), see Toner et al. (2015), p. 2, Fig. 1, and Friedrich et al. (2011), p. 16, Exhibit 7.

<sup>6</sup>This enumeration of digital technologies is neither mutually exclusive nor exhaustive.

<sup>7</sup>Moore’s law is the observation that the number of transistors in a dense integrated circuit doubles approximately every two years; see [https://en.wikipedia.org/wiki/Moore%27s\\_law](https://en.wikipedia.org/wiki/Moore%27s_law)

<sup>8</sup>Metcalfe’s law states that the value of a telecommunications network is proportional to the square of the number of connected users of the system; see [https://en.wikipedia.org/wiki/Metcalfe%27s\\_law](https://en.wikipedia.org/wiki/Metcalfe%27s_law)

thus embedded and ubiquitous. Simultaneously, network effects lead to a superlinear [sic!] increase in value by connecting systems, processes, and users.” (Gimpel and Röglinger 2015, p. 6).

That digital technologies are evolving at an exponential, rather than linear, pace provides a first answer to the question concerning why the current wave of digitization differs from those that came before.

A breeding ground for the fast and wide diffusion of digital technologies are the changes in people’s behavior, attitudes, and expectations, particularly the speed with which people adopt new technologies, what we want our environments to be like, and how we communicate with one another, plan our actions, prepare our decisions, share our experience and impressions, buy and sell, and the way we want our work environment to be like. These changes act as a second driver of digitization (Berman and Bell 2011) and are closely related to the first driver of fast and wide dissemination. Today’s users adopt new technology much more quickly than ever before. For example, while it took 38 years for the radio to reach 50 million people, Angry Birds took just 35 days (Frey and Osborne 2015). WhatsApp gained more followers (700 million) in its 6 years of existence than Christianity did in its first nineteen centuries (Anders 2015).

Today, people who use technology expect to have access to everything all the time from any device anywhere in the world for all kinds of purposes. Google has identified four ‘micro-moments’ when we turn to a connected device—often a smart phone—to take action on whatever we need or want right now. These four kinds of micro-moments are loaded with intent, context, and immediacy (Adams et al. 2015):

1. I-want-to-know.
2. I-want-to-go.
3. I-want-to-do.
4. I-want-to-buy.

Eighty-seven percent of young people in the US say their smart phone never leaves their side, and 44 % use their camera function daily (Mitek & Zogby Analytics 2014). The number of connected devices will rise to 25 billion by 2020 (Gartner 2014) and will far exceed the number of people in the world. As of April 2016, there were 7.4 billion people on the planet, of whom 6 billion have access to mobile phones—while only 4.5 billion have access to working toilets (Wang 2013). IP-enabled sensors are projected to exceed 50 billion by 2020 (Evans and Forth 2015). Thirty billion WhatsApp messages are sent every day (Kokalitcheva 2015). Mobile broadband subscriptions reached 2.5 billion in 2014, five times the number in 2008 (Evans and Forth 2015). Mobile data traffic has grown by a factor of four thousand over the past 10 years and by a factor of almost 400 million over the past 15 years (Cisco 2016). The world’s stock of available data is expected to double every 2 years; 99 % of it is digitized, and over half has an IP address (Evans and

Forth 2015). One could easily agree with Jerry Dischler, VP of AdWords Product Management at Google, in saying, “We’re not going online, we’re living online.” (Kim 2015).

People’s insistence on being connected is transforming their personal lives, and their willingness to share everything is changing long-held attitudes about privacy (Friedrich et al. 2011). Consumers’ habits like seeking information and advice via digital devices and social networks before making a purchase mean that customers are ‘always on’, companies can interact with them at any time, and companies are constantly in the business of creating ‘content’ (information about products and services). Customers have been spoiled by companies like Amazon and Apple and now expect every organization to deliver products and services swiftly, with a seamless user experience that offers intuitive interfaces, around-the-clock availability, real-time fulfillment, personalized treatment, global consistency, and zero errors (Markovitch and Willmott 2014).

Changes in people’s behavior, attitudes, and expectations also force companies to rethink how to attract, treat, and retain their employees. Members of the new generations—call them Generation Y or Generation C—not only expect to live their digital lives at work but desire transparency, authenticity, personal engagement, and, above all, contemporary corporate and political models (Ernst & Young 2011; Friedrich et al. 2011). What they want is “transformational change, and where they cannot find it, they look to invent it themselves.” (Ernst & Young 2011, p. 5).

The concept of ‘inventing it themselves’ leads over to a third driver of digitization: the comparatively low barriers to entry that allow anyone with an internet connection and a great idea to become an entrepreneur, even with limited capital (Manyika et al. 2015a; Hirt and Willmott 2014). As a result, innovative competitors emerge from unexpected places and quickly overtake well-established incumbents by accessing global digital platforms for research, development, marketing, sales and distribution and by improving the quality, speed, and price at which they deliver value. Prominent examples include the largest taxi company in the world, which owns no vehicles; the most popular media owner in the world, which creates no content; the most valuable retailer in the world, which has no inventory; and the largest provider of overnight accommodations in the world, which owns no real estate—Uber, Facebook, Alibaba, and Airbnb (Goodwin 2015).

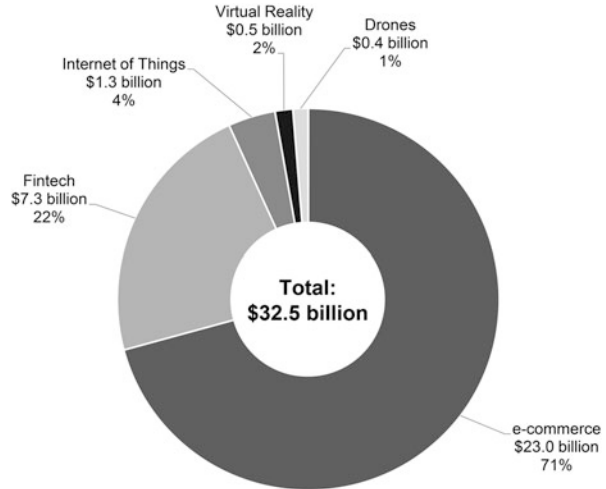
The start-up capital that is required to develop a great idea into an innovative product or service and bring it to market points to the fourth driver of digitization: the huge amount of venture capital that is available from investors who are looking for profitable opportunities outside the old economy (see Fig. 2).

In 2015 venture capital in the digital economy exceeded \$32 billion worldwide—\$23 billion in e-commerce, \$7.3 billion in financial technology, \$1.3 billion in the IoT, \$492 million in virtual reality, and \$418 million in drones (Raconteur n. d.).<sup>9</sup>

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<sup>9</sup>For digital investment predictions for 2016, see Raconteur (2016a).

**Fig. 2** Venture capital in the digital economy 2015 (Raconteur n.d.)



A startup has a 1.28 % chance of becoming a ‘unicorn’ company—a private company valued at \$1 billion or more based on fundraising (CB Insights 2016). Unicorns are increasing rapidly: in 2013 sixteen unicorns were born, while 38 emerged in 2014 and 68 in 2015 (CB Insights 2016). As of April 2016, there were 153 unicorn companies globally.<sup>10</sup>

## 1.2 Objects of Digitization

Objects of digitization are processes and work; products and services; and business models (see the middle section of Fig. 1).<sup>11</sup> To digitize in this context also means connecting people and things, including assets and material.

Processes and work have been the objects of digitization for decades. While digitization once mainly concerned data management and processing in companies’ IT departments, it now affects all departments and has moved from administrative and support tasks to core business processes (Gimpel and Röglinger 2015). Today, companies go far beyond simply automating existing processes. To meet the increased customer expectations, they often reinvent entire business processes, challenging everything related to an existing process and rebuilding it using cutting-edge digital technology (Markovitch and Willmott 2014). The grocery chain Tesco provides an example of the digitization of an entire business process:<sup>12</sup>

<sup>10</sup>For details, see <https://www.cbinsights.com/research-unicorn-companies> (updated in real time).

<sup>11</sup>This enumeration of objects of digitization is not mutually exclusive. For instance, products and services are part of the value proposition, which is a building block of a business model (Osterwalder and Pigneur 2010). Subsuming assets and materials under the category of processes and work renders the enumeration exhaustive.

<sup>12</sup>See the instructive video at <https://www.youtube.com/watch?v=fGaVFRzTTP4>

When Tesco wanted to expand its market share in South Korea, they imagined and realized a digitized process to sell their products without building new stores by using its subsidiary Homeplus to put up posters in subway stations with their range of products, accompanied by Quick Response (QR) codes. This approach is especially appropriate because many people in South Korea work long hours and commute. Once the posters were up, all customers had to do was scan the QR codes of the desired products with their smart phones, and the groceries were delivered to their doorsteps when they got home. Holland's government provides another example (Cisco 2012): to meet changed employee expectations, the City of Amsterdam provided a secure wireless network throughout and around government agency buildings that allowed its 1600 employees to use any device anywhere to access the data and information they needed to do their jobs. At the same time, the government reduced its IT costs by eliminating the use of external telecom providers.

Digitization of products and services is not binary—not just traditional/physical or digital; it moves on a continuum from primarily physical to primarily digital, mixing digital and physical along the way (Berman and Bell 2011, especially Fig. 2 on p. 4). Beginning in the 1990s, in a few industries, such as music, entertainment, and electronics (Berman and Bell 2011, especially Fig. 1 on p. 2), the drivers of digitization pushed all industries toward the digital end of the physical-digital continuum. Because of the availability of smaller, smarter, and cheaper sensors (i.e., transmitters and radio frequency identification (RFID) tags), almost any physical product, work piece, asset, package, pallet, container, transport vehicle, garment, accessory, and even human body can now be equipped with electronic tags, allowing a company to, for instance, track where a physical product is as it moves through the supply chain, how it is performing, and how it is being used. Similarly, customers can, for instance, track (almost in real time) the progress of a package they are expecting or the condition of a machine in a manufacturing process. In addition to (or instead of) so-called smart products, an integration of physical products with digital innovations allows companies to design 'smart' services that are based on or enabled through digital technologies, including "new solutions that extend existing service offerings, digital services that enrich physical products, [and] hybrid product-service bundles." (Gimpel and Röglinger 2015, p. 11). Three examples from different markets and industries illustrate this digitization of products and services.

Runtastic offers a combination heart-rate monitor and scale with which runners can transfer their data via Bluetooth to Runtastic's smartphone app and upload it via the internet to Runtastic's platform, where it can be analyzed and shared with other members of the fitness community.<sup>13</sup>

Hagleitner equipped its dispensers with an integrated radio frequency system that counts every soap, disinfectant, and towel release.<sup>14</sup> Information like the

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<sup>13</sup>For details, visit <https://www.runtastic.com>

<sup>14</sup>See the instructive video on <https://www.youtube.com/watch?v=kFuyzLF5Vew>

number of entrances into a washroom, dispenser fill levels, battery status, and the number of disposals is sent to a web-based central site, where it is available to the facility managers. Hagleitner's customers can analyze the data about user behavior in their washrooms (enabled by the SAP HANA® Cloud Platform), check the status of every dispenser with any web-enabled device (computer, tablet or smartphone) anywhere and at any time. Individualized cleaning schedules and routes for cleaning staff can be arranged, along with just-in-time deliveries, as the system facilitates predictive planning, thereby reducing inventory and storage costs.

SAP's Asset Intelligence Network (AIN),<sup>15</sup> a cloud-based central repository that OEMs, operators, and service providers can leverage to upload, collect, track, and trace equipment information, facilitates collaborative asset management and lets members take advantage of the IoT. Operators can access current maintenance strategies, manuals, and more from manufacturers, who upload 'digital twins' of their products. Operators benefit from complete asset information, tailored services, and fewer maintenance issues, while manufacturers can automatically receive data about asset usage and failure from operators to improve their products. According to IDC, 75% of the Global 2000 will have developed full information-based economic models, or 'digital twins', of their products/services, supply networks, sales channels, and operations by 2018 (Anderson et al. 2015). Clearly, digitization of products and services can increase their value.

The third object of digitization is business models. The examples given above show that the boundaries between the digitization of products and services and the digitization of business models are blurred. This blurring occurs because the bundle of products and services that create value for a specific customer segment describe the value proposition that is a building block of a business model (Osterwalder and Pigneur 2010).<sup>16</sup>

For example, a Runtastic premium membership includes free training plans, advanced statistics and analysis, a weekly fitness report, records and personal bests, personal cheers, premium support, and no ads. As for Hagleitner, it could switch from fixed pricing for their products to usage fees (pay per use or entry), thereby changing its business model (building block: revenue streams). Such business models, which sell solutions and results rather than just products and services, are typical for the 'outcome' economy, defined by companies' ability "to create value by delivering solutions to customers that ... lead to quantifiable results." (Daugherty et al. 2015, p. 37).

Another typical hotbed of new digital business models is the platform economy, where "others outside the company are creating value—in many cases enabling

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<sup>15</sup>See the instructive video on <https://www.youtube.com/watch?v=omKJmPpL6Zs>

<sup>16</sup>According to this concept, the other building blocks are customer segments, channels, customer relationships, key resources, key activities, key partners, revenue streams, and cost structure. For a description of the prominent (digital) business models of Amazon, Netflix, LinkedIn, and Airbnb according to this concept, enhanced with so-called digital value drivers (people, businesses, things, data, cloud), see SAP (2016). For more business models, see Gassmann et al. (2014).



entirely new digital models for the company.” (Daugherty et al. 2015, p. 53). Examples are Apple’s App Store, Alibaba, eBay, PayPal, Facebook, and SAP’s YAAS. YAAS, SAP hybris® service cloud platform, is a marketplace for utilities and services around customer engagement, commerce, and other businesses<sup>17</sup> that is open to businesses and developers. For instance, enterprises can quickly add new business capabilities to their existing applications by subscribing to application programming interfaces (APIs), the ‘secret sauce’ of the digital economy. Platform ecosystems play a strategic role in all types of businesses: asset-heavy businesses like GE and Philips, asset-light businesses like Google and Uber, and mixed systems like Apple and Amazon that have powerful platform ecosystems combined with asset-driven businesses (Daugherty et al. 2015).

These brief descriptions of the objects of digitization show that digital technologies have significantly expanded the possibilities for companies across all markets and industries to re-imagine their main levers, from processes and work via products and services to entire business models. Digitization now changes both ‘the how’ and ‘the what’, and there is no limit: everything that can be digitized will be digitized (Negroponte 1995),<sup>18</sup> and everything that can be connected will be connected (Morgan 2014).

The unparalleled increase in the breadth and depth of digitization is the second answer to why the current wave of digitization differs from those that preceded it.

### ***1.3 Impacts of Digitization***

The impacts of digitization include large and varied impacts on the economy and society as a whole, extraordinary opportunities, and significant challenges for businesses (see the right section of Fig. 1).<sup>19</sup>

Digitization heavily impacts the economy and society as a whole and in a variety of dimensions, including growth, business models, industry landscapes, the structure of value chains, investment, productivity, consumption, employment, skills, the nature of work, the rules of competition, and how business is conducted (Hirt and Willmott 2014; Schwab 2016a). We’ll highlight a few of these impacts in more detail.

According to Accenture’s Digital Economic Value Index, the growth of the digital economy has put it on course to account for 25 % of the world’s economy by 2020, up from 15 % in 2005 (Daugherty et al. 2016). According to a recent analysis by McKinsey’s Global Institute, by 2025 three effects of digitization alone—

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<sup>17</sup>For details, visit <https://www.yaas.io/>

<sup>18</sup>When redesigning its branding in the 1990s, Razorfish included the slogan, “Everything that can be digital will be.” See [https://en.wikipedia.org/wiki/Razorfish\\_\(company\)](https://en.wikipedia.org/wiki/Razorfish_(company))

<sup>19</sup>This enumeration of impacts of digitization is not exhaustive, as it focuses on impacts for businesses. Impacts on individuals and society as a whole are not less massive or less varied.

increased labor supply and productivity, improved asset efficiency, and multi-factor productivity, especially in operations and supply chain optimization—could boost the US’s annual GDP by up to \$2.2 trillion (Manyika et al. 2015a). The same institute estimates that the IoT has a potential annual economic impact of \$3.9–11.1 trillion in 2025 (Manyika et al. 2015b).

Digitization’s lowering of entry barriers, in addition to allowing competitors to emerge from unexpected places and paving the way for new business models to evolve quickly often causes value chains to disaggregate, long-established boundaries between sectors to tumble, and occasionally entirely new industries to emerge (Hirt and Willmott 2014). For example, the platform business models are a fast-increasing part of the digital economy. The top 15 public platform companies—Alibaba, Alphabet, Amazon.com, Apple, Baidu, eBay, Facebook, JD.com, LinkedIn, Netflix, Priceline.com, Salesforce, Tencent, Twitter, and Yahoo!—already represent \$2.6 trillion in market capitalization worldwide (Daugherty et al. 2016).

Further impacts of digitization include new pressure on prices and margins, winner-take-all dynamics, plug-and-play business models, talent mismatches, converging global supply and demand (Hirt and Willmott 2014), shifting customer expectations, increasing collaborative innovation (Schwab 2016a), and new institutional options with distinct economics (Evans and Forth 2015). An example of new business rules is the distribution power law, which relates to the platform business models’ enabling scale “by allowing others to generate profits in the ‘long tail’ of the distribution curve—avoiding diminishing returns associated with traditional (linear) value chain models.” (Daugherty et al. 2016, p. 41).

Digitization impacts all geographies, industries, and companies, although different geographies, industries, and companies experience digitization at different speeds (Opitz et al. 2015; Berman and Bell 2011; Friedrich et al. 2011; Daugherty et al. 2016). Every industry is going through a digital transformation, “some crisis-induced, some as part of their core strategy, and some as part of a more controlled transition process.” (Bonnet and Nandan 2011, p. 4). According to Daugherty et al., “Every business is now a digital business.” (Daugherty et al. 2013, p. 4).<sup>20</sup>

That the degree of digitization’s economic impact has developed from ‘limited’ to ‘pervasive’ is the third answer to why the current wave of digitization is different from those that came before.

The digital forces at work today bring huge opportunities, challenges—or both—to all businesses. Hence, digital capabilities increasingly determine whether a company creates or loses value (Hirt and Willmott 2014). Few companies need to be sold on the benefits of digitization (Desmet et al. 2015), as every business understands its transformational power (Daugherty et al. 2016). The opportunities digitization offers include improved customer experience and engagement, improved decision-making (based on big data and advanced analytics), improved innovation (of business models, products, and services), improved and/or

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<sup>20</sup>For examples, see SAP (2015).

automated business processes, and improved engagement by and collaboration with employees, suppliers, and business partners (McKinsey & Company 2015; Fitzgerald et al. 2013; Desmet et al. 2015; Kane et al. 2015; Catlin et al. 2015; Hirt and Willmott 2014).

Seizing these and other opportunities can benefit key performance indicators like cost, revenue, profit, return on invested capital, customer and employee satisfaction, and market valuation. For example, Spirit AeroSystems, one of the largest non-OEM designers and manufacturers of structures for commercial, military, and business/regional jets in the world, obtained more current information by implementing in-memory computing based on SAP HANA.<sup>21</sup> Spirit is now able to get real-time insight into costs, which allows them to improve how they allocate their human resources and has reduced overtime by 40 % in some areas. Once Spirit has implemented the technology in all of its assembly areas, it expects reductions of up to 25 % in production flow times and up to 30 % in assembly inventory levels.

McKinsey research shows that companies expect digital initiatives to deliver annual growth and cost efficiencies of 5–10 % or more in the next 3–5 years (Catlin et al. 2015). The 153 unicorn companies alone, which include companies like Uber, Xiaomi, Airbnb, Palantir Technologies, China Internet Plus Holding, Snapchat, and WeWork (CB Insights 2016), represent around \$500 billion in market capitalization worldwide (Daugherty et al. 2016). Almost a third of the European unicorns are financial technology companies (CB Insights 2016).

The other side of the coin is that digitization brings with it significant challenges for businesses. Most of these challenges can be subsumed under the overarching question concerning how to respond effectively to digitization or, with regard to digitization's biggest threat, how to avoid being disrupted.<sup>22</sup> As we will discuss these questions in more detail later,<sup>23</sup> it is sufficient to take a look at the challenges and the main threat in general here.

Digitization can impact all of a company's levers and change the entire business environment. Therefore, companies must address all implications of a digital change, re-imagine all aspects of their business, and develop coherent end-to-end responses and transform appropriately (Ernst & Young 2011). Companies that ignore digitization are likely to lose relevance and even to fail. This peril particularly concerns well-established companies that are not primarily structured around or operating in the digital economy (and so do not have native digital structures), yet whose future depends heavily on successful digital innovation and transformation (Gimpel and Röglinger 2015). The CEOs of these companies have an unambiguous choice: "invest now in the internal and external digital capabilities their

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<sup>21</sup>For details, see <https://ideas.sap.com/D16183>

<sup>22</sup>Christensen coined the term "disruptive innovation" to describe how new entrants target the bottom of a market and then relentlessly move up-market, eventually ousting established providers (Christensen 1997).

<sup>23</sup>See the nine dimensions of the digital innovation and transformation framework we propose below.

companies will need to differentiate themselves from the competition. Or sit back, watch the digital revolution unfold, and run the risk of being outflanked by more forward-thinking, faster-moving rivals.” (Friedrich et al. 2011, p. 3). These new intruders, often powerful, native digital companies, can either come from the incumbent’s industry or from other industries (IBM 2015). Recent history is replete with examples of organizations that have not been able to keep pace with new realities (Bonnet and Nandan 2011), such as the movie rental company Blockbuster, which went into bankruptcy with the rise of Netflix.<sup>24</sup> At the current rate, 75 % of S&P 500 incumbents will be gone by 2027 (Capozzi et al. 2014). Digitization can even disrupt entire industries when it changes the nature of supply, demand, or both (Dawson et al. 2016). Therefore, all industries and companies must no longer consider whether they are going to be disrupted but when, what it will look like, and how it will affect their organizations (Schwab 2016a).

Another challenge for businesses in the digital economy is the omnipresent threat of becoming a victim of cyber-attacks (Raconteur 2016b).

The impacts of digitization—enormous and varied impacts on the economy as a whole, extraordinary opportunities, and significant challenges for businesses—retroact on digitization as drivers (see Fig. 1). Thus, digitization becomes a self-perpetuating process.

The answers to the question concerning why the current wave of digitization different from previous changes relate to its historic size, speed, and scope (Schwab 2016a, with regard to the fourth industrial revolution), its inevitability, irreversibility, uncertainty in execution (Krcmar 2015), and ubiquity.

## 2 Digitalization: Digital Innovation and Transformation

For businesses the only reasonable reaction to persistent digitization is digitalization. ‘Digitalization’ or ‘to digitalize’ can be defined as “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.” (Gartner n.d.b). A digital business can be defined as one that creates “new business designs by blurring the digital and physical worlds.” (Lopez 2014) or as a business in which value creation is significantly based on digital technologies. In the course of digitalization, companies might even have to disrupt their own business models and markets before others do by coming up with the digital innovations necessary to survive in the digital race (Daugherty et al. 2016; Ernst & Young 2011; Desmet et al. 2015). Digitalization in this sense is often referred to as ‘digital transformation’, wording that we contend falls short of the mark because it only implicitly reflects the key innovation part; innovation and transformation are both required to generate value

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<sup>24</sup>For a brief review, see Satell (2014).

in the digital economy. Therefore, we refer to ‘digital innovation and transformation’ or ‘digitalization’.

Given digitization’s characteristics and impacts, digitalization is no longer a choice but an imperative (Dreischmeier et al. 2015); for all businesses across all industries and regions the motto is digitalize or drown.

## ***2.1 Strategic Questions and Mistakes***

When embarking on a journey of digitalization, business executives have strategic questions like:

1. Who are our competitors in the digital economy?
2. How fast must we act?
3. What is the value of digitalization for our business?
4. What capabilities do we need in the digital age?
5. How does digitalization affect my existing customers?

At the same time, we see widespread strategic mistakes that business executives make in the digital economy, including:

1. Confusing digital business with online selling.
2. Digitizing the as-is state but failing to re-imagine their existing business model (s).
3. Refraining from leveraging data to improve their understanding of their customers’ needs.
4. Waiting instead of acting.

Our general strategic advice for business executives includes:

1. Understand and evaluate digital opportunities, select the best choice, and allocate substantial resources.
2. Establish an agile culture (make quick decisions, establish a robust operating model).
3. Get the right digital capabilities in place, including:
  - (a) Leveraging big data and advanced analytics to improve customer insights and derive new offerings that meet the customer demand.
  - (b) Digitizing the core processes to accelerate and simplify business and reduce operating costs.
  - (c) Developing the ability to connect with customers, suppliers, and business partners easily.
  - (d) Establishing a two-speed IT to ensure that IT is both operated efficiently and capable of enabling innovation.
  - (e) Building strong alliances and partnerships (and, if necessary, even with competitors).

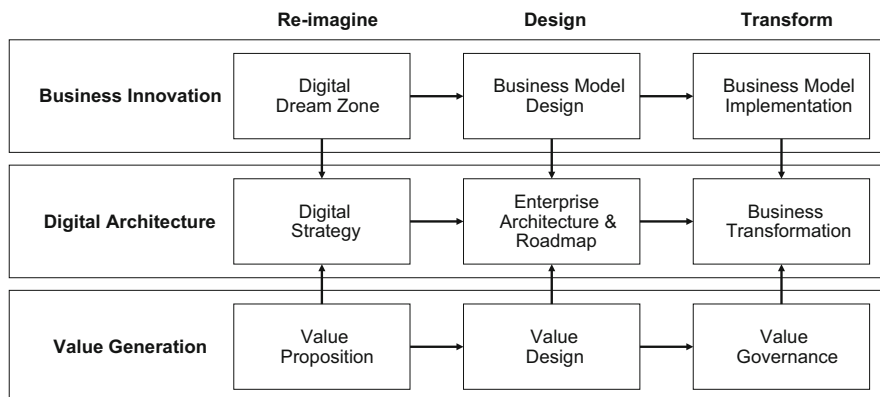


Fig. 3 Digital service portfolio

## 2.2 Digital Service Portfolio

Independent of where a business's customers stand and what they want to achieve, we can accompany them on their entire digitalization journey by providing them with appropriate services at every stage of the journey. Our digital service portfolio has three layers—business innovation, digital architecture, and value generation—and three phases—re-imagine, design, and transform. These layers and phases result in a matrix with nine boxes (see Fig. 3).

Each box is comprised of several services that build on a proven technique or methodology and that can be tailored to industry- and customer-specific features. The business innovation layer contains services with which our customers can re-imagine and implement new digital business models or digitize their processes and work environments, leveraging techniques and methodologies like Design Thinking<sup>25</sup> and Digital Business Modeling (SAP 2016). The services in the digital architecture layer focus on designing and realizing the appropriate technology foundation for the digital business, delivering outcomes like a target enterprise architecture, transformation roadmap, and an organizational change management concept. The complementary value generation layer is comprised of services like business cases and dashboards with value-related key performance indicators that ensure that our customers realize value from digitalization.

<sup>25</sup>For more information, visit <http://scn.sap.com/community/design-thinking>