Anshuman Khare · Brian Stewart
Rod Schatz *Editors*

Phantom Ex Machina

Digital Disruption's Role in Business Model Transformation

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Editors
Anshuman Khare
Athabasca University
Edmonton, AB, Canada

Brian Stewart
School of Computing
University of Eastern Finland
Joensuu, Finland

Rod Schatz
Alidade Strategies Inc.
St. Albert, AB, Canada

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Preface

Today's business ecosystem is bringing furious and frenetic change to existing business structures, operations and models. And just like the Greek Furies that drove their victims mad, the dislocating effects of technological change are disrupting the accepted norms of business. This book explores the pivotal role that technology plays in creating new dynamics to business operations and forcing business model changes. In particular, the operating environment in which businesses function today has, and will, changed to a greater degree and at a faster pace than any period in the past. The dynamic that enabled the television to gain critical mass over five decades has accelerated to allow Internet-based companies to reach the same critical mass within months.

Market convergence is reducing business barriers to entry, destabilising long established businesses and their underlying business models. The dynamic forces of unleashed technological advancements that new technically advanced businesses are using are rapidly and significantly disrupting long-established sustainable products, companies, industries and sectors. The creative adoption of technology is creating a strategic imbalance comprised of firms who understand how to use technology effectively and firms that have not yet realised that they are playing in an unstable ecosystem. The intent of this book is to explore the factors that make digital disruption possible, the effects this has on existing business models, the industries that are most susceptible to disruption and what executives can do to take advantage of disruption to reinvent their business model.

Adoption of digital technology has caused process disruptions in some industries (e.g. automotive and services) and led to new business models (e.g. Über, AirBnb) and new products (e.g. robots, 3D printing, etc.). While most of these examples are in front of us and we read and hear about them in media, this book targets not-so-obvious disruptions (e.g. in the education sector, in services and changing business models) along with some obvious ones (e.g. 3D printing and in addressing mobility issues).

In short, the digital disruptions are around us. If one has not experienced it, one can sense it. How we produce goods and services and how we deliver them are all under the digital disruption microscope. The goal of the book is to get a discussion started by gathering the perspectives from around the world.

The contributors to this book are consultants, academics, senior executives and business operators from North America and Europe. They present their views on technology disruptions they are facing and how they are reacting to it.

This book is targeted at business practitioners, entrepreneurs, senior leadership, managerial and administration teams and anyone interested in understanding how to guide corporate strategy and operate competitive businesses.

Edmonton, AB, Canada — Anshuman Khare
Joensuu, Finland — Brian Stewart
St. Albert, AB, Canada — Rod Schatz

Editor Bios

Anshuman Khare is professor in operations management at Athabasca University, Canada. He joined Athabasca University in January 2000. He is an Alexander von Humboldt fellow and has completed two postdoctoral terms at Johannes Gutenberg University of Mainz, Germany. He is also a former Monbusho scholar, having completed a postdoctoral assignment at Ryukoku University in Kyoto, Japan. He has published a number of books and research papers on a wide range of topics. His research focuses on environmental regulation impacts on industry, just-in-time manufacturing, supply chain management, sustainability, cities and climate change, etc. As his commitment to the community, Anshuman also serves on the Board of Directors of Northern Alberta Business Incubator (NABI) and is the vice chair of Smart City Masterplan Steering Committee for the City of St. Albert. He is on the Steering Committee of Alexander von Humboldt Cities and Climate Change Network of research scientists and on the executive of Humboldt Association of Canada. Anshuman serves as associate editor of the *International Journal of Sustainability in Higher Education* published by Emerald.

Brian Stewart is the deputy CIO at the University of Alberta. His role is to provide strategic leadership, vision and direction for Information Services and Technology and to direct project, change and benefit management and lead a lean initiative for continuous operational improvement. Brian's background is in strategic operational and technology management in the printing industry and higher education, and he has written and spoken widely on these topics. Brian has an MA in Economics from University College Cork and an MBA from Athabasca University.

Rod Schatz is a senior executive with an information systems focus where he delivers business value to organisations through the use of systems in unique and creative ways. Rod holds a Master of Science degree in geospatial technologies from the University of Alberta. During his graduate studies, he focused on the application of location-allocation studies with geospatial technologies (GIS). Rod has presented over 20 conference presentations dealing with the applied use of geospatial technologies to municipalities for infrastructure asset management, sustainable development and land management. More recently, Rod has specialised in implementing cloud technologies, dealing with large data management problems, service-oriented architecture (SOA) and business process management (BPM) solutions to organisations to assist them with their journey into truly digital businesses.

Editorial Board[1]

Andreas Krämer* is a marketing and strategy consultant, living in Bonn, Germany, and professor of Customer Value Management and Pricing at BiTS Business and Information Technology School, Iserlohn. He studied Agricultural Economics and earned his PhD at the University of Bonn. After working for two strategy consultancies, he founded his own consulting firm in 2000: exeo Strategic Consulting AG is focused on data-driven decision support in marketing—especially pricing and customer value management. He is author of several books and numerous publications and speaker at international conferences and meetings.

Dwight R. Thomas* is professor emeritus with the Athabasca University Faculty of Business and has been engaged in design of innovative technology and its applications to online and distance education since the late 1970s. Professor Thomas was one of the "innovators" who launched the Athabasca University online executive MBA programme in 1993 and has most recently served as a course developer and facilitator for a new MBA advanced elective course in the management of technology and innovation. He has also been commissioned to serve as an external reviewer for a variety of academic texts and scholarly articles in marketing and management.

Iain Reid* is a senior lecturer at the University of Huddersfield Business School. Iain has numerous publications in the areas of engineer-to-order, supply chain integration, agility, and mass customisation. Iain's PhD from Sheffield Hallam University, UK, centred on knowledge transfer engineer-to-order. Iain has over 15 years of experience working in the manufacturing sector, specialising in make to order and engineer-to-order (MTO/ETO) manufacture. Prior to embarking upon an academic career, Iain worked as a project manager on an European Regional Development Fund (ERDF) project supporting over 80 manufacturing small-to-medium enterprises (SMEs) on manufacturing operations and other process improvement initiatives, a number of which became knowledge transfer partnerships (KTPs).

[1] Editorial Board members who also authored a chapter are identified with a *.

After joining IBM's Strategy Consulting practice in 1996, **Jean-François Barsoum** began developing technology business plans and strategies for businesses and diverse organisations, such as financial institutions, higher education institutions, professional associations, pharmaceutical companies and telecommunications companies. His specific focus has been on developing business plans of new and disruptive technologies, for which he developed IBM's method. He subsequently trained several hundred IBM consultants in the use of that method. He has been a keynote speaker on the topics of smart cities, innovation, corporate responsibility and climate change in Canada, the United States, South America, Europe and Asia. In 2008, selected by Al Gore's Climate Project, he was one of the few Canadians to receive training from the Nobel Peace Prize laureate. Since then, he has presented the science of climate change dozens of times to diverse audiences, from high schools, universities and public sector organisations to banks and telecommunications firms. In 2011, he joined the board of directors of Al Gore's foundation, since renamed "the Climate Reality Project Canada", and acts as a mentor to the other presenters in the business community and in the province of Quebec. He is a member of the steering committee of the David Suzuki Foundation (Québec), a director at the Canadian Water Network (a federally funded research granting organisation) and the leader of IBMs Green Community, founded in 1999 and has over 1000 members worldwide.

Kam Jugdev is a professor in Project Management and Strategy at Athabasca University, Canada. She joined the University in April 2003. Kam holds undergraduate degrees from the University of Calgary, a Masters in Health Services Administration from the University of Alberta, a Masters in Engineering from the University of Calgary and a PhD in Engineering (Project Management) from the University of Calgary. Kam's research programme spans project management lessons learned and communities of practice, project management tools and techniques, project success/failure, project management as a source of competitive advantage using the resource-based view of the firm, burnout in project managers and the free rider problem on project teams. Kam enjoys being able to relate theory to practice with students and through her research.

Oliver Mack* is a researcher, entrepreneur, coach and consultant located in Salzburg and Vienna, Austria. He studied Business Administration and Law at the University of Mannheim and got his PhD in Political Science at Johannes Gutenberg University of Mainz, Germany. He is author of several publications and speaker at international conferences and meetings, and he is an academic teacher in international organisations. Mack is founder of Mack Consulting, a consulting company helping companies and organisations in the "3rd mode of consulting", combination of traditional top management consulting and systemic change consulting in the main areas of project orientation, new organizational design, change and complexity. Oliver Mack is network partner of Osb International, Vienna, a leading systemic consulting company in Europe. He is also founder of the xm:institute, an organisation doing applied research and application of *Ideas for Management and Leadership in the Next Society*. He is also active in various associations.

Peter Carr* is a lecturer in the Department of Management Sciences at the University of Waterloo and an adjunct faculty member in the Conrad Centre for Business, Entrepreneurship and Technology, also at the University of Waterloo. He is the director of Waterloo's online Certificate in Social Media for Business Performance and the online Certificate in Project Leadership. Over the past 8 years, Peter has worked with NetHope on the application of information technology in third-world development, undertaking over 20 research projects. The most recent project was on the use of information technology to improve the lives of refugees and involved 45 student participants. His Social Media for Business Performance online archive contains over 600 case studies. He is currently creating an online certificate programme in Technology Entrepreneurship, which will be offered in January 2016. Peter lives in Toronto with his wife Lynn.

R. Andreas Kraemer* is founder and director emeritus of Ecologic Institute in Berlin, Germany, and founding chairman (pro bono) of Ecologic Institute US in Washington DC. He is currently senior fellow at the Institute for Advanced Sustainability Studies (IASS) in Potsdam, Germany; visiting scholar at the Massachusetts Institute of Technology (MIT), Center for Energy and Environmental Policy Research (CEEPR); and visiting assistant professor of Political Science and adjunct professor of German Studies at Duke University. His research focuses on the role and functions of science-based policy institutes or "think tanks" in theory and the practice in different political systems, the interactions among policy domains and international relations and global governance on environment, resources, climate and energy.

Stephen Murgatroyd*, PhD FBPsS FRSA is a former dean of the School of Administrative Studies and executive director of the Centre for Innovative Management at Athabasca University, Canada. He is now CEO of the Collaborative Media Group and has consulted for 40 of the Fortune 100 companies. Author of over 40 books and six hundred papers, chapters and articles, he is a frequent contributor to news, journals and other media on future-focused issues. His most recent book *How to Rethink the Future—Making Use of Strategic Foresight* (New York: Lulu Press/Kindle) builds on his previous work in strategic foresight.

Terry Beckman* received his PhD in Marketing from Queen's University and his MBA in International Business from the University of Victoria. He teaches Marketing Management, Global Marketing and International Business Management. Prior to Athabasca University, he taught at Queen's University, The Royal Military College of Canada and the University of Victoria. His background includes over 12 years of industry experience, including work with IBM Canada Ltd and the Canadian High Commission in Malaysia and business consulting. His research interests are primarily in marketing strategy, corporate branding, international business and corporate social responsibility. He has published one edited book and a variety of articles in his areas of research interest. Terry has a keen interest in the changing of management practices and processes due to the emergence of digital technologies that have forced transformation of businesses in every walk of life.

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About the Authors

Robert Bongaerts is a CRM and strategy consultant, living in Frankfurt, Germany, and lecturer of Customer Value Management and Pricing at BiTS Business and Information Technology School, Iserlohn. He studied Agricultural Economics and earned his PhD at the University of Bonn. He is partner at exeo Strategic Consulting AG, a consultancy focused on data-driven decision support in marketing—especially pricing and customer value management.

Senana L. Brugger is a consultant, researcher and trainer located in Hamburg, Germany. She studied Cultural Anthropology and Computer Science at the University of Hamburg. She has specialised on human-technology interaction, especially in computer-supported cooperative work, and intercultural communication and developed a mapping method for complex context analysis using visual methods of ethnography. Her project experience includes software design and technical aid. She is also founder of "Drei Wellen", designing "brain-friendly" learning landscapes for various topics.

Christoph Buck is a doctoral candidate at the Faculty of Business and Law at the chair for Information Systems Management at University of Bayreuth, Germany. He is a visiting scholar at KIT Karlsruhe Institute of Technology and University of Southern Denmark. Christoph is an expert in and teaches Lean StartUp, Business Model Innovation, Process Innovation, Entrepreneurial Thinking and Business Design, Turnaround Management and Information Systems Management. Christoph is an Entrepreneur and worked on several strategy-related consulting projects in Business Development and Business Model Innovation. Within his research, he focuses on Privacy and Personal Data, Digital Business Models, Digital Ecosystems and Principles of Value Creation in Digital Environments.

Abubaker Haddud is a visiting scholar at Eastern Michigan University. He is also an honorary lecturer, lead faculty and a dissertation advisor for the Operations and Supply Chain Management Online Master's Programme at the University of Liverpool in England. He has a PhD in Engineering Management from Eastern

Michigan University (USA) where he was a Fulbright Scholar and an MBA with Distinction from Coventry University (UK). Abubaker has several years of university teaching experience within business and management domain at undergraduate and postgraduate. He has more than 10 years of industrial work experience working for private, public and governmental organisations. His teaching and research interests focus on lean thinking, strategic operations management and supply chain and operations management.

Mervi Hämäläinen is a doctoral student in the Department of Computer Science and Information Systems at the University of Jyväskylä, Finland. Her research interests cover disruptive technologies business models, stakeholder and value networks and value co-creation. Mrs. Hämäläinen holds MSc in economics (Information Sciences) from the University of Jyväskylä. Her Master's thesis discussed 3D printing technology´s impacts on company business models and value creation.

Harald Henn is a customer service and call centre consultant, living close to Mainz, Germany. He is a recognised speaker at customer service and call centre events and regularly contributes articles to leading blogs and magazines. He studied business administration at VWA in Koblenz, Germany. In 2002 he founded Marketing Resultant, a consulting company focusing on call centre and customer service strategy and operational excellence.

Regine Kalka is a professor for Marketing and Communication at the University of Applied Science Düsseldorf and a freelance consultant with the focus on strategy, brand management and coaching of small- and medium-sized companies. Before that she worked for a strategy consultancy and as vice president for a trade fair company. She studied Business Economics at the University of Trier and earned her PhD at the Vienna University of Economics and Business Administration.

Tim Kessler is the junior professor for International Management of Technology and Industrial Services at University of Bayreuth, Germany. He is a visiting scholar at Columbia Business School, NYC, USA Asian Institute of Technology, Bangkok, Thailand and Humboldt University in Berlin. Tim is an expert in and teaches turnaround management, innovation management, business model innovation and entrepreneurial thinking and business design. He is an entrepreneur and worked on several strategy-related consulting projects in business development and business model innovation. Within his research, Tim focuses on business design, innovation management, digitisation and digital ecosystems, value co-creation, product-service systems, corporate renewal and diversification.

Tatjana König is a professor of Marketing at HTW Saarland Business School, Saarbrücken, Germany, and teaches also at the University of Luxemburg. She earned a diploma degree at the Johannes Gutenberg University of Mainz and a PhD from the University of Mannheim. After working for a strategy consultancy and for Deutsche Lufthansa, she was appointed marketing professor at HTW. She focuses on consumer behaviour, pricing and multivariate analysis. She is author of numerous publications and speaker at international conferences.

Marta Kwiatkowski is a senior researcher and advisor at the GDI Gottlieb Duttweiler Institute and analyses social, economic and technological trends. At the Zurich University of Applied Sciences and the Zurich University of the Arts, she took Master's degrees in Advanced Studies in Customer Relationship Management (CRM) and Curating. She had various leading positions in Marketing at the Swiss Federal Railways SBB and, prior to that, in the software industry. Before joining the GDI, she was head of Group Marketing at the SBB. In these positions, she focused on customer-centred topics as needs, behaviour preferences and loyalty, trust and incentive models. She leads various customer orientation projects in marketing, distribution and communication.

Helen Lam is a professor of human resource management in the Faculty of Business, Athabasca University, and a certified human resources professional. She has published one book and a number of journal articles. Her research has covered a broad range of topics, including business ethics, management education, employee rights and representation, organisational restructuring, labour relations strategies and legal concerns in human resource management. Her work usually involves significant practical or policy implications.

Rob Llewellyn is the founder of CXO Transform. Before he turned 26, he had bought one company, built another from scratch and sold them both. He became European director of a Singapore-based trading company at 27 and entered independent consulting 3 years later. Providing independent consultancy across Europe, the Middle East and Australia, Rob has spent almost two decades helping executives at some of the world's largest corporations. As one of the world's few certified Global Business Transformation Masters who operates as an independent consultant, Rob provides world-class consultancy to a small portfolio of clients and helps other independent consultants leverage innovative digital solutions and grow their business.

Arto Ojala is working as a senior researcher in the Department of Computer Science and Information Systems at the University of Jyväskylä, Finland. He is also adjunct professor in Software Business at the Tampere University of Technology. His research interests include software business, software entrepreneurship, cloud computing and the internationalisation of software firms. Ojala has a PhD in economics from the University of Jyväskylä.

Chad Pankewitz is a serial entrepreneur, interim C level executive and management consultant with more than 20 years of experience building companies and bringing new products to market. Having worked in over 20 countries including 5 years in Europe, 5 years in North America and 10 years in China, he brings an international perspective and advantage to the companies he builds and clients he works with. He is passionate about implementing innovation capabilities and digital business transformation. This allows organisations to grow the business and delight customers. This focus has given him the privilege to be able to help a wide range of clients in a diverse range of industries and verticals. He has founded multiple technology companies and helped start-ups, the public sector and large multinationals including BMW, Citigroup, Starbucks, Coca-Cola and more. He can be reached at innovationmaven.com.

Marina Papalexi is a research assistant at the University of Huddersfield Business School, UK. Her research area is related to the application of operations management concepts and theories in supply chain, services and sport. She participates in BSc, MSc and MBA lectures in operations management. Prior to joining the university, Marina worked as a mechanical engineer at her own technical office operating in Greece. She was responsible for managing projects by using engineering principles and techniques. She also worked for the OAED Institute of Vocational Training as a mechanical engineering tutor. After graduating in Production and Management Engineering, in 2010 she completed an MSc in Health Management and in 2012 she started her PhD, focusing on the application of reverse logistics in the pharmaceutical supply chain.

Shonelle Ramserran is a digital marketing specialist at Toys R Us (Canada) Ltd. and has been working in the online marketing communication field since 2007. She has recently completed her Master's of Science in Project Management at the University of Liverpool, UK. Previously employed at Pearson Education Canada as a digital project manager, she has been involved with managing virtual teams and online communication for the majority of her career. Shonelle is looking forward to completing a PhD in Marketing in order to teach these acute online team communication skills at a university level.

Neil Slater works at the EUMETSAT, a global operational satellite agency at the heart of Europe, and the European Space Agency's site in Germany and has been an engineering manager for the past 26 years. Neil studied an MSc with Liverpool University via this programme some years ago, attained a BEng (Hons) from Cranfield University (UK) in 1994 and is a chartered engineer (UK registered) along with being a member of the Institution of Engineering and Technology. His job and aspirations for future career require a balanced mixture of both business/managerial skills and an underlying broad grasp of engineering expertise.

Thomas Tachilzik is a digital marketing consultant, living in Bonn, Germany, and speaker for social CRM. He studied economics and mechanical engineering and earned his degree at the University of Bochum. After working for a strategy and process consultancy Icarus and Lufthansa in product development, he founded his own consulting firm in 2004: Tachilzik Consulting GmbH is focused on customer data-driven sales and marketing—especially social CRM and customer value management. He is author of numerous publications and speaker at digital transformation conferences and meetings.

Peter Veil has more than 15 years of experience in telco, automotive and Internet industries. He draws on broad financial and business competencies from his role as vice president for Subsidiaries Controlling of a 12bn EUR telco company and formerly as CFO of Telematics Start Up. Peter has proven very strong strategic and business development skills in the Internet and the automotive industry. He has a track record in end-2-end complexity management and efficiency improvement as well as in successfully leading international teams especially in SEE Region. In addition to his role in business, he frequently gives lectures on business management. He studied Business Engineering at the University of Karlsruhe, holds an MBA from Portland State University and got his PhD in Political Science at the University of Stuttgart.

Jochen Wittmann is former director of Dr. Ing. h.c. F. Porsche AG, Weissach, Germany.

Part I
Introduction

Chapter 1
Making Sense of Digital Disruption Using a Conceptual Two-Order Model

Brian Stewart, Rod Schatz, and Anshuman Khare

Abstract The ability of digital technology to substantially alter how organisations operate has been amply evidenced over the past several decades. Digitisation is now moving beyond improving how organisations work, to challenging why organisations exist and what fundamental value they provide. This phenomenon of "digital disruption" is accelerating and becoming a real threat facing most organisations, forcing business leaders to gain a critical understanding of digital disruption to ensure organisational survival.

This paper reviews some of the characteristics of digital disruption. Listing existing barriers to exit and entry and recent industrial disruptions, we determine that low complexity industries with low levels of digitisation are likely to be the initial targets for disruption. In addition, digital disruption can be categorised into stages where initial sustaining productivity gains are subsequently undermined by continued digitisation that destabilises the pre-existing value proposition and thereby establishes a new product or service. These we term as first-order and second-order disruptions.

The paper concludes with a proposed model to assess digital disruptions, and while conceding that digital disruption is a disaggregated force with no clear unifying theory currently available, we build on existing business planning theories and tools to provide additional insights into potentially destabilising disruptions.

Keywords Digitisation • Disruption assessment model • Digitisation impact evaluation • First-order disruption • Second-order disruption

B. Stewart (✉)
University of Eastern Finland, Joensuu, Finland
e-mail: brianstewart3@gmail.com

R. Schatz
Alidade Strategies Inc, 12 White Oak Place, St. Albert, AB, Canada T8N 3H4
e-mail: rod.schatz@shaw.ca

A. Khare
Athabasca University, Edmonton, AB, Canada T5L 4W1
e-mail: anshuman.khare@fb.athabascau.ca

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1.1 Introduction

It appears almost redundant to describe the term digital disruption, as it is without doubt a truth and not a theory or hypothesis looking for evidence-based verification (Lopez, 2015). The speed and scope of development are beyond any single individual's comprehension, and ever-greater specialisation is required to understand the impacts in ever-narrowing fields. In Dickensian terms it is the best of times and it is the worst of times for business leaders with so much opportunity accompanied by so much threat. The next decade is not for the faint of heart. Those on the more risk, averse side of the ledger will find the period very challenging, while the risk takers will also find it difficult to navigate towards business survival and success.

The concept of digital disruption is likely better understood as an aggregation of many components that collectively form a series of waves rather than seeing it as a single tsunami sweeping over all industries and economic life. While many of the changes come from a common source, the exact nature and nuance of the application of any given technological innovation play out within a cultural and historical context unique to each industry and subindustry. Trying to find a unified theory of disruption is likely to prove a difficult if not an endless task. It will serve us better then to seek themes or chords of disruption. The musical metaphor provides a very useful way to think of the changes as music is similarly subject to melodic flow punctuated by rapid discordant passages that are resolved into new melodies. And harmonies can be seen as a descriptor where technology provides similar changes in several industries at the same time. Indeed, it will be very useful to come up with a new language that helps to lower the hyperbole surrounding technological change and to see it as a constant moderato rather than a staccato allegro. Digital disruption is here, and over the next period of as yet indeterminate length, we will have to get used to the constantly shifting realities it brings. We cannot see it as a brief passage awaiting a return to a more stable rhythm. The first industrial revolution may be closer to the sense of disconnection and incomprehension that we are likely to experience than the more recent electrical and, until recently, computer-driven evolutions.

If we accept that the digital wave is an aggregation of small eddies, it is best to then disaggregate our analysis to look at local impacts first and then to seek more broad themes that form these. An inductive reasoning or bottom-up analysis enables the identification of individual cases that can be used to induce broader theories, thereby going from the specific to the general. While such an approach will not be as defined or as provable as a deductive approach, it is the only practical method to adopt at this time. And it is quite probable that as patterns emerge in the impacts of digital disruption, more broadly generalisable theories gained through deductive approaches will become available. For the moment, we must content ourselves with developing approaches to provide actionable insights into coping with and taking advantage of the coming digital era.

The question for business leaders then becomes one of how best to take advantage of the disruption. What business models, analytical frameworks and guiding principles, if any, are available to assist with this task? Can we rely on what we have learned and are learning in business schools, or must we jettison all that conventional wisdom for as yet undeveloped theories? Do we adopt extensive empiricism to identify disruptors? How can we know which of these will apply? Which of these won't make matters worse?

In response to these questions, this paper seeks to draw out some of the threads of the disruption nexus and to introduce a broad conceptual framework that integrates with existing business strategy models. It is not the intention here to prove or test the framework, which will be the output of subsequent research.

1.2 The Nature of the Firm

At the very core of every firm is the acceptance of the concept of the need for the organising of activities to produce goods and services. It is seen as the prerogative of a firm, enterprise and organisation, whether for-profit or not-for-profit, to effectively service a section of a market by internally managing and effecting operations. It is considered impractical, inefficient, ineffective or uneconomic to produce a product or service any other way. This baseline assumption that underlies our understanding of the essence of the nature of a firm is being undermined by digital technology.

The economist Coase (1937) first brought the relatively simple but hugely insightful description of the firm as a nexus of transactions into the discipline of economics. Coase's insight was that a firm is constructed to internally manage transactions and thereby reduce time and cost, which has particular relevance to firms in the digital era. In particular, if the cost of internally organising operations in a firm is now becoming higher than accessing services from the market, the gains of organisation are reversed, and the cohesion of a firm-based structure is not just suboptimal but more importantly unsustainable. For example, accessing cloud-based computing services invalidates the need for firms to create their own computing environments. While it was essential for even small firms to incorporate computing departments into their operations to gain access to computing services, this is increasingly becoming obsolescent as market transactions have been lowered below the cost of internally providing the services. The result is that internal computer departments are coming under increasing threat as Moore's Law and Metcalfe's Law work to continually drive down the cost of network-accessed computing.

To attempt any forecast regarding the optimal balance as to when to insource or outsource is not possible as the environment is constantly changing, and there are few, if any, indications of the nature of the eventual steady state. It is therefore very difficult to predict the degree of disaggregation firms will undergo and at what size organisations will settle at. Trial and error will initially determine what is optimal as entrepreneurs experiment with various levels and try to overturn the diseconomies of scale with the economies of vanishing cost transactions. Not all industries will be affected equally as each has its own value stream that will benefit from lower transaction costs to varying degrees.

1.3 Disrupted Industries

A very relevant example of digital disruption is that of the printing and publishing industry, which underwent substantial disruption in the nineties and noughties. Digital technology, labelled the desktop revolution, essentially eliminated several skill sets from the industry. Pre-existing highly valued elements of the value chain were compressed, simplified and removed from the industry's value-adding services and were transferred or externalised to consumers. Careers were shortened, traditions were ended, business models were altered and a new reality had to be confronted.

The reduction in revenues in the US printing industry varied by the degree, speed and purpose of digitisation. Prepress Services were the earliest adopters of digital technologies. These were simplified by the "desktop revolution" and were undertaken by prosumers;[1] after peaking in 1993 at $5.4 billion, they declined to $3.5 billion in 2008. Manifold Forms, used as an output by computers to print customer bills, employee paycheques, etc., was displaced by e-commerce and digital outputs with revenues moving from a peak of $8.3 billion in 1997 to $4 billion in 2008 (Hayes, 2010).

The disruption further continued from production to product as the printing and shipping of physical media gave way to online distribution, unravelling advertising-funded business models in the process. The decline of the newspaper industry is a case study in the lifecycle of digital disruption as it first improved the production economics of quality, speed and cost and then eroded the economic basis of the industry itself. Newspaper Association of America reported that newspaper revenues peaked at $65 billion in 2000 and declined to $17.3 billion in 2013, or $23.6 billion, if digital revenues are included (Perry, 2012). This theme is repeated consistently in disruptive technological adoption where an initial improvement of existing operations is subsequently undermined by a more complete overhaul of the nature of the product or service. A concomitant downstream impact of the decline in printing is the decrease in mail volumes. The US Postal Service has experienced an average reduction of 65 % between 1995 and 2013, albeit with significant variation across regions (USPSOIG, 2015).

The lessons from this transition provide very useful guides to other industries awaiting their turn at the digital disruption roulette wheel. The printing industry survived, although significantly changed, less profitable and smaller. And those that did well were those that identified, accepted and sought to understand and accommodate the disruptive forces into their business models and operating structures earlier and more deeply. Vistaprint started in Paris in 1995 is an example of a nontraditional entrant using digital technology to develop an e-printing firm. It has grown to over a US$ 1.5 billion and 5000 employees by 2015 (Yahoo Finance, 2015).

Such actions involved considerable risk as it wasn't clear how the technologies could best be used and what the appropriate level of technologically driven disintermediation would be, if the revenue and operating margins would be sufficient for sustainable operation. The uncertainty and risk provided a charge of derring-do to

[1] Toffler (1981) developed the term "prosumer" in his book the *Third Wave*. It describes the dual role that a person my play being both a consumer and a part producer of a product.

certain sections of the industry, while bringing concern and crisis to others. But only hindsight would provide the roadmap to best adoption. This brings into view a very telling truth that the determination of the best adoption path of new technology can only be understood retrospectively. It can only be guessed at beforehand. Those that have appeared to have worked it out ahead of the market are more often the beneficiaries of chance than prediction. In our search for understanding and control, as with all random event winners, we tend to attribute a prior knowledge to actions that was never really there. It is a quirk of our nature that we seek to attribute meaning, even where none exists, as we don't take well to events that are not ordered or do not have a predetermined cause.

Another well-established industry, the automotive industry, with its manufacturing complexity will be unlikely to yield significantly to lower transaction costs in the production phase; however, inventory and selling methods are likely to undergo significant change. The traditional model of huge lots of inventory may yield to a hub and spoke model where cars will be stocked in centralised yards where they can be shipped quickly to customers that have selected their choice by a virtual reality drive of the car reinforced by a visit to the dealer for a drive in a similar model. This will drive huge waste out of the automotive chain while increasing customer value. There are potentially larger impacts to the automotive sector coming to the fundamental product design in the form of electric and driverless cars. Any such major disruption to one of the anchor industries of the modern industrialised landscape will have major disrupting impacts on the support industries that feed them. Firms in the automotive supply chain face a period of significant uncertainty, one that they have little control over or knowledge of, and can only respond to retroactively when downstream effects become clear as the impact moves throughout the chain.

Low complexity industries that currently have low levels of digitisation would be the initial favourites to be disrupted. This is due to their value chain components being disintegrated and existing separately from each other thereby lacking interconnected information gathering. An interesting projection in this vein is provided by Deloitte's Building the Lucky Country, which demonstrates estimated current and potential degrees of digitisation of a broad range of industry classifications (Deloitte, 2012, p. 8). This study shows that the higher prospects for digital disruption are lower complexity sectors with services provided by the private sector. An example of low complexity industry digitisation is Airbnb which is disrupting hotels by offering community-owned surplus space to users at rates below traditional hotels' offering. Through the digitisation and aggregation of information, they bring prosumers into the market allowing homeowners with available space to monetise their underutilised assets. It is possible for hotels to compete by adopting many of the tenets of the new service. For example by viewing their service as finding a customer a required event location, rather than room inventory utilisation, they can provide a more varied service. In addition, they can adopt more sophisticated yield management strategies for rooms in their own hotels. Big data will provide them enhanced knowledge of market conditions and customer preference patterns enabling them to better fit availability with optimal customer profiles. This requires major hotelling organisations to adopt a radically different strategy and business model, but they can do it if they choose, just as Blockbuster could have chosen, but declined the offer.

Another example of a low complexity industry is the taxi business. Traditional taxi firms are facing increasing disruption from digital innovations that provide enhanced customer value. While it is the case that traditional firms have natural advantages over the disruptive competitor (e.g. insurance, quality, reliability and professionalism), they are not as highly valued by the customer as convenience, availability and ease of access. The traditional taxi firms can compete with Uber or Lyft and like disruptors by adopting elements of its service. But they must cannibalise their own operating norms and move to a more customer-responsive model. By matching these higher valued services, the natural advantages of traditional firms will reassert their importance to the customer as "all things being equal"; they will chose to have these service components. Business insurance, safety and trust will reassert themselves as important to customers, but only after they are made relevant in the buying decision. In the aforementioned second-order disruption of this service, driverless cars may eliminate the taxi industry with car manufacturers extending their product line to include this service (The Economist, 2016).

Of more importance is where a service can simply no longer provide any value. Travel agencies were a large and growing industry as cheaper travel suggested their future was assured. Unfortunately the disintermediation of the Internet eroded much of the value of search that they provided, allowing the digitisation and automation of much of their value. Their experience and knowledge was encased in silicone and could provide a faster and broader service that could also be improved more quickly. It is estimated that the number of travel agents in the USA went from over 34,000 in the mid-1990s to approximately 13,000 in 2013 (Weber, 2013).

In these examples, the disrupted service/product provided a substitute that increased quality with no price differential or negative switching costs. In the case of Uber and Airbnb, the threat comes from their crowdsourcing nature and their ability to respond to a perceived unmet demand without the fixed costs borne by the existing competitors. This allows them to skim and to profitably service a segment of the market, while relying on the existing service providers to service the remainder. In the case of the expert intermediary service provided by travel agents, this was shown to be of insufficient value once consumers had access to information through the Internet, previously only available through dedicated access to airline flight schedules. The desire of airlines to know their customer intimately and the consumer to self-serve effectively combined to remove travel agents from substantial sections of the value chain.

1.4 Barriers to Entry and Exit

The propensity for an industry to be disrupted very much depends on its performance and structure, particularly with regard to the degree of digital sophistication and the availability for information to flow. The availability of information to be shared digitally combined with value chain compression greatly increases the disruption potential quotient. When considering this potential for disruption, it is important to note the barriers that exist that essentially protect the incumbents and the status quo. Barriers to entry are recognised hurdles that firms face when they wish to enter, expand or leave an industry. These are seen as placing a drag on the competitiveness of an industrial sector as they prevent free movement of firms to enter and exit, providing existing firms with a protective barrier against disruptive innovations.

1.4.1 Structural Barriers

Structural barriers consist of a range of obstacles that include: regulation, access to capital (financial or intellectual), operating scale or the ability to access supply chains. The digital disruptive forces are eroding many of these traditional industrial barriers to entry.

Capital: An essential to any firm wishing to grow into a major supplier is access to financial capital. The efficiency of capital markets generally provides start-ups with the ability to obtain the funds they require to fast track their growth and attain the critical operating threshold to compete with existing suppliers. The cost of venture funds is generally relatively high, acting as a disincentive to the ownership and managerial teams of small but vibrant start-ups. The result is that many potentially disruptive firms remain smaller than they would otherwise. Innovations such as crowdsourcing are combining with low start-up costs due to sharing options such as cloud-based SaaS to allow digital start-ups to grow to competitive scales with significantly less drag time.

Operating Scale: Tied closely to access to capital is the ability to achieve competitive operating scale. The need to amortise costs over a sufficiently large sales volume can be critical when large investment costs in production, personnel or market development are required. The attainment of economies of scale is one of the primary requirements for initial capital investment. In the digital landscape, traditional economies of scale are quickly becoming diseconomies of scale as the accompanying lack of agility in terms of committed infrastructural supply chain investment or of product and/or market position creates a barrier to exit a given business model, product line or service provision. The rigidity of superstructure provides constraints to innovation by the firms in an industry who have adopted a self-validating and perpetuating isomorphism. Benchmarking performance against sluggish or poor-performing competitors often provides spurious evidence of vibrancy and well-being that occludes the dynamic disruption that is rapidly approaching to destabilise all firms.

Control of Resources: Access to specialised skills no longer presents as significant a hurdle as it once did. The ability to access contract services, subject matter experts and professionals has become almost seamless due to Internet search and collaborative capabilities. This further allows small companies to focus only on their core competencies and to contract whole functional areas that can include accounting, marketing, manufacturing, human resources, software development and project management.

Government Regulation and Legislation: These can present major hurdles as established interest groups lobby for government intervention to hold back the disruption of their industry. The most commonly referred to here is patent law which larger firms use not only to legitimately protect their intellectual property but to impede competitors and start-ups from challenging their lucrative revenue streams. The threat of litigation is more often a more significant impediment than the strength of the case relating to patent infringement. Indeed the use of litigation can be seen as a barrier to entry in its own right.

1.4.2 Customer-Centred Barriers

While these structural barriers are significant, they can lead to incumbents feeling a false sense of security, which ironically serve to make their industries increasingly vulnerable as they retreat into the safe havens of incrementalism. Indeed, many of the structural barriers are already eroding as firms find ways to innovate around them. The ability of digital technologies to continually disintermediate value chains and to repackage value will result in an increase in customer immediacy. This will lead to a growth in the importance of customer-centred barriers. It will be customers' increased ability to express demand for products and services that will drive the formation and growth of firms.

Switching Costs: The impacts here are more complex and relate to the context of the service or product. The more convenient the customer finds the use of a product or service, the greater the psychological switching costs they will undergo to change. The simplicity of use, ease of adoption and integration will prove critical to lowering switching costs. It is difficult to determine the value of first mover in creating initial switching. Often the initial switch product does not hold on to the market as first-mover theory holds, although it does serve to create the new market space and to open consumer consciousness to a new form of delivery. Blackberry is a case in point here: after their reinception of the business mobile phone market, their position gave way to the consumer avalanche initiated by Apple's iPhone, which in turn gave rise to the Android phone's dominance.

Branding: The expenditure on creating brand awareness and value is a significant deterrent to innovative companies. To gain a share of a consumer's mind is extremely expensive and requires continuous investment. This requirement will grow and become increasingly important as firms seek out market segments to service. Social networking provides a more cost-effective channel for less endowed firms using word of the mouth and network effects to get their message out. This may be short-lived as the advertising industry moves to occupy this space to protect their revenue streams. The sophistication and personalisation of advertising will put disruptors at a disadvantage for rapid expansion and may increase the drag on innovation.

Customer Loyalty: Perhaps the most significant barrier to entry in the digital age will be customer loyalty, or rather the lack of it. The ability to create customer advocacy will be the strongest determinant of success for any product or service. The delay of knowledge transfer in the digital era is approaching zero, if not there already. New services, products, prices, designs, functions and opinions are available within minutes of a market change. For example, the opening night of a new film now lasts no longer than the first show, if it hasn't been pirated before even that. Opinions, plot points, spectacular effects and spoilers are all available in real time as the first show is being presented. There is no ability to control the information to create suspense or mystery. PT Barnum's marketing scheme of paying to sate curiosity (Cook, 1999) is no longer possible. A film needs to have sufficient intrinsic appeal to attract audiences even when potential audiences know much of the detail.

Digital technology is perfectly positioned to develop customer loyalty due to its ability to capture customer information directly and indirectly. This need to understand and relate to customers will require increasing use of analytics and big data to develop business intelligence and inform customer intimacy. Algorithmic relationship building will be a key component of customer loyalty strategies in the digital era. The sophisticated and creative use of data will be a critical competence in the digital era. Indeed, the old adage that knowledge is power will be realised in a world where everything can be tracked, monitored, analysed and algorithmically optimised in real time (Lewis, 2014). Such capabilities are currently the preserve of large organisations with only some technologically specialised firms also partaking. This will become more generalised and will trickle down to medium and then small enterprises. The skill sets to use data as a constant in business planning and operations are not widely available and will stretch the leaders and managers of small- to medium-sized organisations to develop an understanding of how to best use the potential of large data sets.

1.4.3 Soft Barriers

In addition to the aforementioned barrier sets, there is a set of organisational, personal and managerial barriers or soft barriers that include culture, habit and heuristics and ability of manipulate digital know-how.

Adoption of Technology: Ability to adopt technology is related to the resource constraint. The need to understand highly complex technologies creates a knowledge barrier to entry as potential entrants require advancement along the learning curve to gain sufficient mastery. In the case of digital technologies, accessibility and adoption are widespread thanks mainly to the continuous cost reductions of computing and networking driven by Moore's and Metcalfe's laws, respectively. Nonetheless, a barrier still remains that of the ability to transform a business by using the enhanced knowledge capabilities that digital technologies enable. Early and successful uses of digital technology focus on improving productivity through automation; these applications are intuitive and tangible. The essence of digital disruption is that it is nonintuitive and intangible and requires significant acumen to wield its force successfully. Such ability is scarce as many senior executives are not currently proficient with information technology, thereby reducing their capacity to adapt and creating a significant barrier to digital adoption.

Ability to Change: The incapacity for an organisation to change represents a significant barrier to entry as the prevailing operating culture is inimical to being redefined digitally. The speed of disruption is the key attribute for firms to be cognisant of. Most firms, given a sufficient time, can adapt to new operating norms. One can make the case here for publicly funded organisations, education and health, for example, that have the luxury of time to adjust at a comparatively leisurely pace. Whereas the compressed timeframes of highly competitive environments provide little respite for firms, and a Darwinian process ensues to select the survivors.

1.5 Business Models, Strategies and Operations

Business models and frameworks are continuously being developed, particularly by academic researchers and consulting companies. They guide business leaders' thinking in how to frame problems and solutions. Appropriately used they are immensely beneficial to managers in running very complex and competitive organisations. When misapplied, however, they can have the opposite effect and seriously harm enterprise performance. In an environment of massive disruption, many of the most commonly used business planning frameworks will prove insufficient to deal with the challenges digital change will bring. They were developed in a less disruptive environment and reflect the business challenges at the time of their development.

The rapid and destabilising impacts of digital technologies require different approaches that take into account the dynamic nature of the forces of change. Operational models focussing on ever improving the efficiency of the value chain will not be sufficient as the value chain will become user not producer defined. And users may not simply respond to price signals as the largest element of their decisional milieu. Values and principles will grow in influencing customer decisions, similar to the no sweatshop or child labour consensus relating to clothing and consumer electronics, or the fair trade movement for agriproducts. In an increasingly open society that espouses access to information across all societal sectors, firms will be required to answer publicly for their actions and not just to their shareholders but also to all their stakeholders. Predatory behaviour will not be able to be hidden for long, and the consequences of public opprobrium are likely to be devastating. The Toyota faulty accelerator and Volkswagen emissions manipulation debacles represent the inability to protect corporate secrets for any length of time.

1.6 Digital Disruption Conceptual Framework

This section proposes a conceptual framework for identifying real and potential disruptions. It consists of three components that provide deepening analysis of disruptive factors. The first component introduces the concept of first- and second-order impacts related to the deepening disruption that at first assists the existing business structure, but then proceeds to undermine it. The second component is the disruption assessment matrix (DAM) designed to combine several existing strategic planning approaches to help identify the area of disruption. The third and final component is the disruption impact evaluation (DIE), a more detailed discovery tool to more clearly articulate the major impacts on four stakeholder groups key to business sustainability.

1.6.1 First- and Second-Order Disruptions

As demonstrated in the printing and publishing and tourism industries, digital disruption can happen in stages where initial gains to a firm or industry are subsequently undermined by continued digitisation which alters the nature of the pre-existing service or product to establish a new normal. These can be viewed as first-order and second-order disruptions. This concept of the order of impacts fit well with the five business model reinventions developed by Westerman, Bonnet and McAfee (2014, p. 78)—"reinventing industries, substituting products or services, creating new digital business, reconfiguring value delivery models and rethinking value propositions". These can be placed into the first- and second-order impacts frame as follows:

- First-order disruptions occur after digitisation of a product or service has provided enhanced producer value through reduced cost of operations, enhanced service to customers and improved performance by firms in the sector, characterised by substituting products or services, configuring value delivery models and rethinking value propositions.
- Second-order disruptions occur when the business model of a particular good or service is destabilised, and a new business model emerges to displace it. The impacts of digitisation are so profound that they substantially alter the nature of the sector's output rendering the existing infrastructure, networks, value chains and customer loyalty unsustainable, characterised by reinventing industries, creating new digital businesses and rethinking value propositions.

Figure 1.1 provides a graphical description of the method to assess the high-level characteristics of a potential change to a firm's position. The order impact grid is a 2 by 2 matrix that provides a framework for an initial categorisation of digital disruption. The *x*-axis measures the internal degree of digitisation, while the *y*-axis measures the external degree of digitisation. The contention here is that as the degree of digitisation increases, the likelihood of disruption increases pari passu with the relative change. Of note here is the additional point that for industries or firms to undergo a second-order disruption, it requires both internal and external digitisation to be high. In essence this is no more than a restatement of the effective supply and demand hypothesis, stating that both the availability and consumability of a service needs to be in effect before the service can become a viable business entity. The axes also relate well to the four groups discussed in Table 1.3 with internal

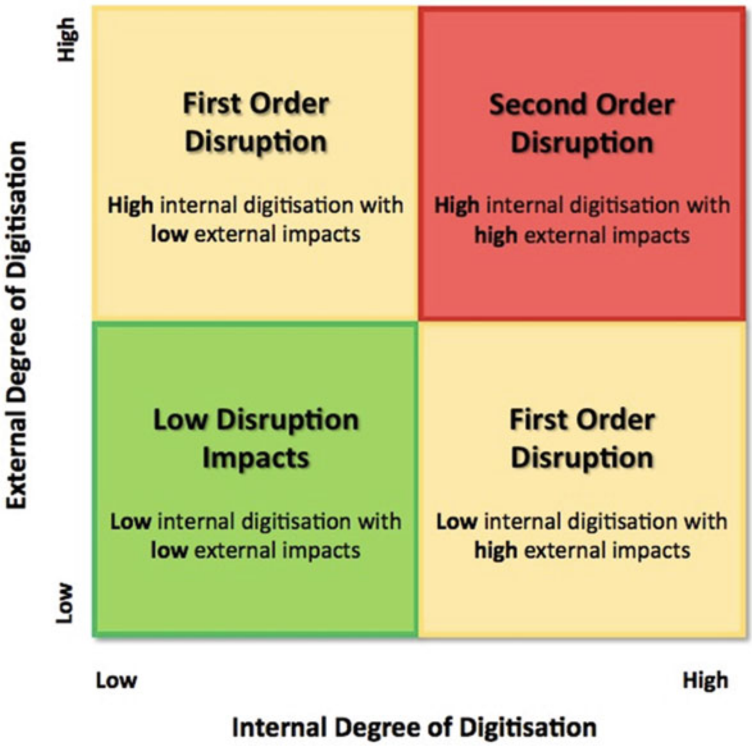

Fig. 1.1 Digital disruption order impact grid

factors covering investors and producers and external factors that are represented by consumers and the public. Table 1.1 provides examples of order disruptions, showing the order impacts and the impacts of digitisation on the firm or industry and on the business model.

1.6.2 Disruption Assessment

In an attempt to provide a deeper and current understanding of real and potential disruptions, the disruption assessment matrix (DAM) (Table 1.2) provides a means to view the various facets of organisational disruption. The grid can be seen as a combination of the standard PESTLE analysis, an environmental risk assessment, scenario planning and a subset of Porter's competitive analysis (Porter, 2008). Indeed, these tools may still all be used in conjunction with other strategic management models, particularly, Disruptive Innovation (Christensen, 2013), Core Competencies (Prahalad & Hamel, 1990) and Value Disciplines (Treacy & Wiersema, 1993), and the disruptive framework presented here, to provide additional elucidation.

Table 1.1 Examples of orders of disruption

Area of disruption	Low disruption	First-order internal	First-order external	Second order
Encyclopaedia Britannica (Evans and Wurster, 2000)				
Printing and publishing industry	Digitisation of content and printing production in proprietary formats	Desktop revolution digitisation of content into standardised formats	Availability of computers enabled the substitution of CD for the print version, e.g. Encarta	Internet connectivity enabled development of crowdsourced online encyclopaedia—Wikipedia
Digitisation impact	Gradual technological improvements in printing	Production efficiencies—elimination of manual origination	Production and distribution substitution	Content, production and distribution substitution
Value chain impacts	Substitution of manual skill sets by digitisation	Condensing of the value chain through elimination of steps	Customer-produced content erodes value of physical assets	Crowdsourced content into standardised self-serve digital platform collapses value chain
Business model impacts	Content, production and distribution owned/ controlled by publisher	Content, production and distribution owned/controlled by publisher increased profitability for publisher	Content sharing, production and distribution owned/ controlled by publisher	Content and production not owned/controlled, distribution owned/controlled by publisher, value of content approaches zero
Eastman Kodak (Anthony, 2012)				
Imaging and consumer electronics	Improvements in camera and film technology	Digitisation of cameras	Digitisation of reproduction and distribution	Image capture on multifunction devices, social media driven sharing
Digitisation impact	Gradual technological improvements in imaging	Elimination of use of film and developing services	Self-service editing and reproduction by customers	Capture and distribution digitally enabled end to end
Value chain impacts	Improved efficiencies in reproduction	Streamlining of imaging process and reduction in cost	Physical capture and distribution images erodes value of physical assets	User-created content published in standardised self-serve digital platform eliminates value chain
Business model impacts	Image capture and reproduction owned/ controlled by manufacturer	Image reproduction owned by customer lowering profitability for manufacturer	Content sharing, production and distribution erodes value of physical reproductive technologies	Image capture and reproduction owned/controlled by customer, value of imagery approaches zero

Table 1.2 Disruption assessment matrix

Domains stakeholder	Legal and regulatory, political	Economic and business	Health and wellness	Cultural/social/ethical and moral	Technological	Environmental
Owners						
Investors						
Investors						
Stock markets						
Financiers						
Producers						
Employees						
Managers						
Value chain affiliates						
Firms and organisations						
Consumers						
Clients						
Customers						
Purchasers						
Users						
Public						
Domestic and international governments						
Domestic and international publics						
Nonconsumers						

In the disruption assessment matrix (DAM), the domains represent the six areas that determine people's actions and behaviours. These are considered when viewing any product or service, whether publicly or privately provided. The Stakeholder classification is formed by their relationship to the provision or consumption of goods and services. These are seen as consisting of two categories, internal and external. The assumptions behind the internal and external categorisation relate to the degree of influence or control the subgroups have over their respective spheres. Firms can be seen to exert a greater degree of control and influence over their value chains and their customers than over investors and the general public. While producers are often owners, the model follows the view that they view these as separate domains when evaluating decisions in the respective areas. For example, when called upon to invest additional funds into their own firm, a business owner/manager will determine the likelihood of return versus risk just as an external investor would be likely to do.

The DAM framework (Table 1.2) provides a straightforward segmenting of the population to assess the impacts of each domain on each group. While the domains and categories are seen as relatively fixed, the stakeholders are seen as exemplars within the categories. The purpose is to enable a clearer and more open-ended analysis framework to consider any given digital development. A third axis can be used to demonstrate time horizons to allow a temporal analysis of impacts as they may unfold over time.

The Digitisation Impact Evaluation (DIE) is used in conjunction with the DAM as an initial step to determine the degree of impact a digital innovation will have on the different stakeholder groups. It provides a survey style checklist of relevant and focused questions that identify the degree and source of impact. The questions provided are seen as an initial set that can be added to or altered to fit the particular case. The determination of the impact ranking can be completed in various ways—web survey, Delphi group, focus group, etc. The participating populations can similarly be varied (employees, managers, customers). Even general population can be included as part of ongoing marketing activities.

The assessment can also be used in reverse to identify where a firm is at greatest risk to disruption and can be tied to a risk analysis viewing probability and impact of a given disruption. For example, by asking questions (as shown in Table 1.3) to determine the relative strengths and weaknesses of a firm's existing product/service catalogue, they can provide pointers to susceptible disruptive points. This can be used not only as a defensive strategy but also can open thinking to provide ideas as to where the firm could develop new products or services.

The framework reflects the breadth of digitisation's ability to transform goods, services, industries and sectors in terms of both space and time. And it can act as an initial or secondary filter to identify the major impact areas in combination with analysis from existing strategic planning tools.

The use of additional strategic and competitive analyses and planning tools are needed to augment the analysis yielded through the disruption assessment framework. It is a purposely designed open framework to facilitate an openness of thinking and to encourage a suspension of existing knowledge. The greatest difficulty in

Table 1.3 Digitisation impact evaluation

Impact on a firm	No impact	Impacts profitability	Impacts growth	Impacts existing scale	Severe disruption impacts survival
Owners and investors					
Reduce the risk of capital loss					
Improve portfolio performance					
Diversify portfolio					
Increase return on capital					
Reduce inventories and working capital					
Reduce cash cycle					
Lower portfolio risk					
Increase portfolio liquidity					
Does it address a regulatory gap					
Does it enable regulation to be effected					
Producers					
Increase profitability					
Enhance customer relationships					
Improve shareholder value					
Improve productivity					
Improve employee morale					
Can adopt existing infrastructure					
Improve employee performance					
Improve employee retention					
Brings unused capacity into use					
Lower the cost of operations					
Easier to gain and keep customers					
Improve value chain efficiency					
Lower the cost of goods sold					
Reduce inventories					
Customers					
Speed of delivery					
Increased convenience					

(continued)

Table 1.3 (continued)

Impact on a firm	No impact	Impacts profitability	Impacts growth	Impacts existing scale	Severe disruption impacts survival
Lower cost					
Increase of desired functionality					
Improves other products/ services					
Improves quality of life					
Ease of usability					
Address a long met need					
Requires access to private information					
Ease of use					
Public					
Improve environmental performance					
Reduces carbon output					
Requires legal sanction					
Requires regulation					
Challenges acceptable social norms					
Eliminates or reduces other desirable activities					
Improves the lives of the public					
Requires a new supply chain					
Require complex contracts					
Will require users to be legally contracted					
Challenges religious beliefs					
Requires regulatory changes, bylaws					
Requires government funding					

identifying disruptive threats is unburdening our cognitive capabilities of the thinking patterns that have proved successful in the past. Digital disruption is just that a disruptive force that challenges all existing norms, standards and beliefs. It can prove impossible to reconcile existing thinking to the new reality and many firms, such as Blockbuster or Kodak, who could not jump the chasm.

1.7 Conclusion

This paper has introduced a digital disruption assessment framework to assist in the identification of potential disrupting innovations. Alternately the framework can be used to highlight areas where a firm can be considered at risk of destabilising disruption. In contrast to the more recent technological innovations or first-order disruptions, which benefited established firms, sectors and industries by improving operational and market performance in generally predictable paths, second-order digital disruption undermines firms' core business models and ultimately the raison d'etre of the business itself. Incremental improvements, competitive strategies, focus on-core competencies and reduction of value chain complexity and cost are insufficient responses to the decline of the basic value proposition. Most sectors and industries have or are undergoing a digital disruption shift with profound consequences for their owners, leaders and employees. While avoidance is not a real option, by better preparing for disruption organisations will at least be able to have additional time to develop coping strategies to best deal with the evolving situation. Our intention here has been to assist in providing such awareness. It should be remembered when thinking about digital disruption that the primary issue is not to determine the correct solution but to ask the correct questions.

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Part II
Business Strategy

Chapter 2
Whole Enterprise Social Media for Business Performance

Peter Carr

Abstract Whole Enterprise Social Media can be used to achieve substantial business performance improvements. While most organisations have begun their use of social media in marketing and sales, its application elsewhere in the organisation is also of value. The use of social media in other organisational areas is discussed, and examples of successful application are provided in employee involvement, customer engagement, product development and design and supply chain management. The use of performance metrics and their relationship to overall business objectives is described, and guidance is given on its application. The examples are derived from case studies written by participants in the University of Waterloo's Social Media for Business Performance online certificate programme and contained in the publically accessible online case study archive.

Keywords Social media • University of Waterloo • Business performance

2.1 Introduction

This chapter discusses the impact that social media can have in the whole enterprise. Thus far, many organisations have utilised social media in their sales and marketing activities, and some are recognising its value elsewhere in the organisation and realising the benefits. This chapter is intended to help more organisations do that.

The concept of Whole Enterprise Social Media is explained first, and then the Social Media for Business Performance programme and archive (which this chapter references frequently) is introduced. The application of social media in a range of organisational areas is then considered, with examples of this application included.

P. Carr (✉)
University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada N2L 3G1
e-mail: pdcarr@engmail.uwaterloo.ca

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Measurement and management of Whole Enterprise Social Media performance is considered, and some guidance is provided on the strategic management of implementation.

2.2 Whole Enterprise Social Media

To date, social media activity in organisations has largely been focussed on marketing and sales, especially in the relationship between retailers and their customers. Some organisations have been using social media in other areas, some of which are described in further detail in this article. There is growing understanding that social media has a contribution to make to organisational performance more widely. This wider contribution is known as Whole Enterprise Social Media.

The application of social media within organisations requires an understanding of the key performance factors in various organisational functions (and these will vary between organisations) and the activities which will lead to improved factor performance. Only then is it useful to consider the impact that social media can have and how this can be realised.

In future sections the factors that are commonly important in organisational performance in selected organisational areas are outlined, and the role that social media can play here is considered. It is not intended that this be a blueprint for others—conditions will vary—but it is hoped that it will help others consider appropriate use of social media to improve performance in their own organisation.

This chapter draws on the Social Media for Business Performance archive which provides many examples of the application of social media in the areas discussed here.

2.3 The Social Media for Business Performance Programme and Archive

In 2011 the University of Waterloo began offering its online Social Media for Business Performance Certificate programme. The programme is intended to develop skills and knowledge in the use of Whole Enterprise Social Media. Participants develop understanding of the use of social media in the whole enterprise through the course content and through course-based research on and engagement with organisations that are using social media beyond the sales and marketing functions. The participants have now developed over 1000 case studies for the Social Media for Business Performance archive which is publically accessible on the internet and has received over 250,000 views to date.

References to the archive are included in this chapter. The archive is accessible at http://smbp.uwaterloo.ca/.

In the following sections, we consider the impact of social media in a range of organisational areas.

2.4 Employee Involvement

2.4.1 Social Media Application

Human resources theory on employee motivation has discussed the value of employee involvement in organisations for many years. The human relations school of researchers (e.g. see McGregor, 1960) argued that employee involvement in their organisations could contribute to organisational performance. This is well established today in the curriculums of business schools and features in most teaching of human resource management.

The role that social media might play in employee involvement is suggested by the human resources literature, which emphasises various aspects of employee involvement which may contribute to performance. Recent research looks at a number of areas that may indicate areas of fruitful application for organisations. Kattenbach and O'Reilly (2011) suggest that globalisation has made it more difficult for organisations to involve employees as competition has intensified, and organisations have become larger and more complex. Kleinknecht (2015) looks at the value of employee involvement in corporate governance, while Booth (1988) argues that there is a positive relationship between employee involvement and company share prices. Involvement in work-centred teams and in corporate decisions has a greater impact on job satisfaction than pay according to Carr and Mellizo (2013), while Kim, MacDuffie and Pil (2010) provide evidence that suggests involvement at all company levels can benefit corporate performance.

The evidence for employee involvement resulting in improved performance is strong. Social media has been used to enable participation in many aspects of modern life, including as consumers and citizens, where increased access to organisations that provide products or services is common and where political participation has been enabled. Social media has also been used in organisations to enable greater employee participation. Case studies that illustrate this are cited in the next section. This activity is consistent with, and sometimes inspired by, the human relations research. Researchers continue to create better understanding of this area and provide guidance on areas where involvement may be especially beneficial in organisations.

2.4.2 Examples from the Archive

Belu (2015) describes activity at Christie Digital where an internal blog called the Innovation Café is used to encourage employee participation and develop a community of innovative thinkers. The site is accessible in all of Christie's 18 offices worldwide. Employees submit ideas and comment on ideas submitted by others. The blog activity is integrated with physical activity in Christie's locations to encourage participation.

Gardiner (2015a) describes employee involvement utilising the Igloo internal social platform. Social media is used for internal collaboration, where internal news and information are shared, project collaboration takes place and resources are shared by employee teams. Opinions, ideas and concerns are expressed, and the organisation believes that boundaries created by organisational silos are challenged.

SAP's use of internal consultation is discussed by Chatterjee (2015). He describes how a cloud-based portal, SAP Jam, enables employees to collaborate on a range of topics that focus on SAP products. The portal is used for departmental collaboration and is available on employees' mobile devices.

2.5 Customer Engagement

2.5.1 Social Media Application

Customer engagement exploits the long-term value of customers. It is based on the idea that focusing efforts on an immediate sale may not be the best way to create an ongoing sales relationship with the customer. Rather, engagement over time may create a stronger relationship with greater organisational benefits. For most businesses today, creating this ongoing relationship, in which multiple sales are made, is part of their business strategy.

The Marketing Science Institute (MSI), which supports research in marketing and customer engagement, defines customer engagement as "Customers' behavioural manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers". Thus customer engagement is not how customers feel about the brand but rather it is about what they do, or how they act (customer behavioural manifestations), not limited to the immediate purchasing process (beyond purchase), as a result of the benefits they expect to receive in return (motivational drivers).

Customer engagement recognises that buyers' actions related to the organisation are important that they will influence business performance. For example, customers who are loyal to a brand may advocate for the brand within their network. "Word of mouth" (telling other people) is a well-known benefit of customer engagement, and one used well before the onset of social media. It is possible to influence customer engagement with effective social media management. Customer behaviour has changed significantly in the past decade. Traditional advertising is less effective, organisations find it harder to control their messages, consumers have a stronger voice and presence in the market and the Internet has led to greater competition and weaker brand loyalty.

However, more opportunities exist today to create positive engagement activities using social media than have existed in the past. Using social media for customer engagement allows organisations to communicate with customers inside the market, enabling the organisations to participate in and influence the conversation around their brand. Effective customer engagement strengthens brand loyalty and influences the actions of consumers in their marketplace discussions and purchasing behaviour.

2.5.2 Examples from the Archive

The use of social media for customer engagement by Frank and Oak is discussed by Landry (2015). Frank and Oak are a Montreal-based menswear brand that is popular with those aged 20–35. In a novel campaign, they encouraged customers to vote on the location of new pop-up stores. Then, the most popular selections became the locations of actual stores. Their campaign generated 500,000 viewers, 2200 new followers and 15,000 participants in the store location selection process.

Customer engagement is valuable in establishing a continuing relationship between organisations and their clients or customers. Vaishnav (2015) discusses the value of the data that will be generated by this engagement and how organisations can use that data to improve their organisational performance. Julie's case study of the social media activity at Oracle will be useful for other organisations.

Starbucks are known for their customer engagement activity, and there are numerous examples of their campaigns on the SMBP website. Marquis (2016) argues that they have created an extraordinary customer experience with their My Starbucks Idea website. The site receives product ideas from customers, and customers share, discuss and vote for their favourite products.

2.6 Product Development and Design

2.6.1 Social Media Application

The Product Development and Management Association defines product development as "The overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product" (Kahn, 2013, p. 462).

Social media is impacting product development in each of the areas described above through the following factors:

- Product development speed is impacted by the ease of connectivity between organisations and consumers. Identifying potential customers and engaging with them is easier and faster than it ever has been before, which can dramatically accelerate the product development process.

- The cost of product development can also be significantly reduced through the use of social media. In the past, physical surveys (e.g. through phone calls or focus groups) were time-consuming and expensive. Online survey tools and conference technology make surveying customers much cheaper. Social media also enables more effective group working, both internally and with external partners, which can improve the collaboration needed to develop designs and create products or services.
- The quality of products, based on knowledge of customer requirements, can also be improved. Knowledge of customer requirements can come from online customer engagement, and it is increasingly benefitting from social media data analysis. Organisations hold large volumes of social media data internally, based on their own social media activity, and can also obtain data from other organisations, including social media providers such as Facebook, Google, Twitter, etc. Analysing these data allows products to be based on more intensive market research than was possible before.
- Product introductions can also be better managed with social media. Social media data analysis can assist the design of marketing campaigns to better identify target markets and craft messages that will appeal to them. It can also provide rapid feedback on market response, allow marketing messages to be changed where needed and minimise the brand impact of a negative new product perception.

Social media is having a profound impact on product development and design, and it offers the potential to significantly improve organisational performance across the range of product development performance factors.

2.6.2 Examples from the Archive

Pearson's (2015) case study looks at NASA's use of crowdsourcing to generate ideas for their work, such as designs for a 3-D printable container that could be used in zero gravity for astronauts at the International Space Station. NASA have created a concept that they call SOLVE which uses their website, Facebook and Twitter to challenge academics, enthusiasts and the scientific community to suggest ideas that they feel will be useful. SOLVE provides ideas for NASA and also creates a continuing relationship with NASA's target supporter community.

Dell's use of social media listening and how it drives their product development is described by Capling (2015). Dell's Social Media Listening and Command Centre is used to undertake their social media listening activity which has influenced almost 500 products so far. These have included the backlit keyboard, rack mounted blade workstations and the option to include Linux in their software pre-installation.

Diesbourg (2015) describes how Banana Republic developed their Vision Critical community of 50,000 customers who provide feedback about products, stores and marketing. Questionnaires are sent to the community on a monthly basis, and the information gathered is then incorporated in Banana Republic's marketing campaigns and product offerings.

2.7 Supply Chain Management

2.7.1 Social Media Application

Supply chains are all of the organisations, people and processes involved in the sourcing, creation, distribution and consumption of a product or service. Supply chain management (SCM) is the effective design, operation and improvement of this network of organisations and people that can exist on a global basis.

Social media can be used in many aspects of the supply chain. The main areas are in data mining (gathering data that can be used for better supply chain planning and control), data sharing (sharing internal supply chain data amongst supply chain partners to enable better decision-making and improvements activity) and supply chain collaboration (enabling supply chain partners to work together more effectively).

Data mining is the process of accessing and analysing usually large volumes of data. Social media has created high volumes of data on customers and also on matters related to your supply chain. Early knowledge of customer product or service perceptions can allow you to address issues or take advantage of opportunities more quickly. Knowledge of potential supply disruptions due to global political, environmental or economic events can be gained earlier and enable responses to be better planned and more effective.

Data sharing between supply chain partners is now easier than it has ever been. Organisational information systems often collect extensive amounts of data that can be used throughout the supply chain. For example, sharing of inventory data can improve scheduling of downstream operations and enable better coordination of transportation and distribution.

Collaboration using social communication technologies enables members of the supply chain to work better together, coordinating their operational activities and making improvements. This collaboration can involve people at all levels of the organisations involved. Organisational leaders can work together at a strategic level, while employees at lower levels can coordinate their efforts to achieve supply chain performance goals.

2.7.2 Examples from the Archive

Lau (2016) discusses Ikea's use of social media in their supply chain. Ikea is known for their supply chain management—it is widely seen as having been a critical factor in their international success in the furniture and homeware market. Ikea's Listening Hub is focussed on listening to customers who are talking about Ikea online and using this intelligence to guide their supply chain activity. It provides valuable information on future trends in product demand and so enables Ikea to better plan production and delivery schedules.

Taylor (2015) describes the use of social media in Dairy Queen's supply chain. This ice cream vendor with locations across North America uses social media to integrate sales and marketing activities with their supply chain management. Alignment of sales and marketing information with the supply of product to their stores is undertaken using two systems (Instill and ITrade). This system connects suppliers with franchisees, suppliers and their head office. Their system is mobile enabled to allow users to access information and communicate with others via their smartphone.

General Electric use social media extensively in their manufacturing supply chain as described by Montpetit (2015). Helene describes a number of GE initiatives, including GE Colab which links together GE's 115,000 employees.

2.8 Metrics for Enterprise-Wide Social Media

2.8.1 Social Media Application

Organisations use performance measurement to understand how their organisation is performing and to provide information that will guide activity in order to improve it. These measures should be related to the overall goals and objectives of the organisation. For example, a car company may have a target of producing a high-quality car and so wish to measure the number of defects that are found when the customer receives their new car. This would then inform efforts to reduce these. Often, organisations will have many measures that will be used in many parts of the organisation which are aligned with the overall organisational objectives.

As we consider the metrics that will be used in social media activities in organisations, it will be important to apply these metrics in ways that will best guide the progress towards organisational goals. That means that there will be a need to carefully consider the metrics that will measure the social media usage in each area.

The starting point for all metrics is the goals of the organisation. The metrics that are identified for each area of the organisation stem from these goals. Social media metrics should be carefully aligned with the organisational goals, driving social media behaviour that will contribute to these goals' achievement.

Most of the work that has been done on social media metrics is focussed on their use in pursuit of an organisation's marketing goals as that has been the most popular area for social media usage. The term "vanity metrics" is used to refer to metrics that are not useful—that do not aid decisions on what should be done in the future—and many metrics used in organisations today can be described as vanity metrics.

In an enterprise-wide social media strategy, there should be a link between the business objectives and the organisational metrics that are used for improving organisational performance. The social media tactics should be designed to support these business objectives, and social media metrics should assist with the management of the social media tactics. Over time the social media tactics can be tracked and reviewed alongside the organisational metrics to better understand the relationship between them. Once this link is understood, greater confidence can be put in the influence that the social media metrics indicate that the social media tactics are having on business objectives.

In addition to understanding the impact that social media is having internally, social media metrics can also include tracking of social media activity externally. For example, supply chain activity may be intended to get an organisation's product to market more quickly and at a lower cost, but what is the impact in terms of how customers now perceive the product? Has the increased speed been recognised by the customer as something that they value, which is creating a higher level of customer engagement and resulting in increased sales? There are a number of tools which allow organisations to track the impact of their social media activity and more are appearing all of the time.

2.8.2 *Examples from the Archive*

Lupton (2015) discusses Tripcentral's use of social media performance measurement in their customer engagement activity. Tripcentral is a travel company located in Southern Ontario, and their social media activity is designed to encourage customers to blog about their holidays on the Tripcentral blog. Metrics analysing the new traffic that the blog posts bring to the site as well as the new engagements with customers that result are used to assess the impact that this activity is having on the business.

Motorola's use of social media metrics is the subject of Gardiner's (2015b) case study. She describes how social media is used by Motorola to improve performance in their supply chain which they say has reduced sourcing lead time by 40 %, release of orders to customers by 67 %, time to market by 35 % and reduced the company's supply chain carbon footprint by 60 %.

British retailer Marks and Spencer uses social media extensively in their employee involvement. Cress (2015) reports that metrics have been used to monitor the success of this activity and that in February of 2015, it was reported that there were now 15,000 people using their internal social media network, who had posted 63,000 messages, and had generated 112,000 likes and uploaded 18,000 pictures.

2.9 Strategy Formulation and Integration

Applying social media on an enterprise-wide basis requires careful planning to ensure that it is aligned with overall organisational objectives. It is important that the activities that are undertaken in each organisational area are aligned with each other and designed to contribute to organisational goals. A careful planning process is necessary to develop this.

The starting point for planning of social media strategy is the organisational goals. These enable organisational social media objectives for each organisational area to be established—goals that are based on an understanding of how social media can contribute to organisational performance. Once these goals are established, social media tactics can be determined which contribute to the achievement of the goals. Finally, metrics can be identified which monitor progress (as described above).

The planning process should involve people throughout the organisation. The value of this involvement was introduced in this article, and social media will facilitate this involvement—it will enable plans to be shared throughout the organisation and comment to be made from everyone. Managers should remain responsible for development of plans and their implementation and accountable to organisational leaders for their delivery.

2.10 Conclusion

This chapter has discussed the impact that social media can have on whole enterprise performance. It has been supported by examples from the Social Media for Business Performance archive that provides publically accessible case studies on how organisations are using social media in many aspects of their work and achieving substantial performance benefits.

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Chapter 3
Cultural Communication Patterns: A Way How Management and Engineering Can Improve Their Mutual Understanding

Senana Brugger and Oliver Mack

Abstract In the age of digital disruption, technology is no longer only a tool to improve organizational efficiency. Technology becomes a key success factor and enabler for radically new and innovative products and services, new organizational processes, as well as totally new business models. With the emergence of ubiquitous information technologies, organizations no longer just use technologies as tools or sell them as products, but increasingly depend on certain technology as the backbones and lifeblood of key organizational processes. The sciences as well have been disrupted, new tools enable advances in theory, and the scope of what science can do as well as the time it can do it in has changed beyond recognition. New branches of sciences and a tighter feedback loop between scientific advances, technological innovation as a result of applied science, as well as business innovation have been the result. To be able to develop innovations on a global scale on all those levels, good communication across disciplines, like IT, Engineering and Management and across countries and cultures becomes more and more a key success factor. In this article we want to elaborate both on the importance and the problems of interdisciplinary communication. Since the discussion cannot be exhaustive, we want instead to focus on three important aspects of communication which are often neglected: embodiment, process orientation, and the importance of motives and motivation. In a second step, we propose the concept of pattern language as an idea to think about a framework for creating understanding and fostering cooperation where translation and control are impossible.

Keywords Communication • Cooperation • Interdisciplinary teams • Pattern language

S. Brugger (✉)
Hamburg, Germany
e-mail: senana@dreiwellen.org

O. Mack
xm:institute, Hyegasse 3/51, 1030 Wien, Austria
e-mail: oliver.mack@mack-consulting.at

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3.1 The Problem: The Disruption of Communication

Over the last 20 years, there was more technological development than ever before since the birth of mankind. During the industrial revolution of the eighteenth and nineteenth century, power, electricity, and engineering were the key drivers for developments in new inventions, product variety, business effectiveness, and efficiency; today it is the computerization and virtualization that drives business, societal transformation, and also innovation (Boes & Pfeiffer, 2006). The speed of innovation is significantly increasing on an exponential basis and also broadly underestimated (Kurzweil, 2005).

While during the industrial revolution, the focus of management was more on exploitation and production, than on the formation and accomplishment of innovation. Always innovation was linked to the individual personality of a genius inventor or entrepreneur. In the next phase, the focus was on enthusiastically transferring concepts of formalization, like project and process management from the operations to the innovation field.

Today we see the limitations of this mechanistic approach: Innovation needs to be open in result, combining existing knowns with unknowns. It also doesn't follow linear paths, but is context dependent and iterative in nature (Böhle & Bürgermeister, 2012). The more comprehensive and the more complex technologies are, the more there is a need for integration of a wide range of people inside and outside the organization to create new innovations (Chesbrough, 2003). Kurzweil (2005) even sees the digital disruption today as an evolutionary step into a next stage of merger between technology and human intelligence, where innovation is driven by interaction of humans and machines where at the end innovation ultimately is done best by intelligent machines only. The sciences today can work with tools beyond imagination only decades ago. FMRI allows us to visualize brain activity (Wikipedia, 2016), computer simulation models help us to understand complex systems like the weather or even tools tracking and analyzing data about human behavior, and communication helps us to understand better social interactions (Pentland, 2014).

This increase of technology, however, has led to an increase in specialization of disciplines, as well as a "digital divide" (Norris, 2001) separating those without access. Specialization of disciplines has led to specialization of languages. In the sciences, it has become close to impossible to understand what is going on in the discourse of one field being trained in another. Understanding and using the tools available takes time and training, and the methods and standards are moving as fast as is technology. The means for almost ubiquitous communication on the one hand, however, go hand in hand with an almost Babylonian confusion on the other.

More people than ever are able to communicate and cooperate over ever greater distances. This aggravates intercultural challenges. Before, cooperation implied proximity and thus cultural compatibility. Proximity loses importance. Especially large corporations draw in heterogeneous staff from all over the world. The work process itself, however, becomes more distributed, with collaboration happening in virtual spaces more than physical places.

Technology is moving at the center of businesses whose business might be non-technical, like selling books or providing logistics. From being a tool, it has evolved into the nervous system of business and increasingly also social life. Specifically, companies dealing in digital technology face the additional challenge that software is more malleable than anything else created before. It can be what its creators want it to be—a space to be in, a tool to use, or an interaction partner or agent.

For a long time, the importance of communication as a critical success factor for projects is well documented in research. Especially in research on product development, interdisciplinary team communication is seen as one critical success factor for the successful development process (e.g., Pinto & Pinto, 1990; Brown & Eisenhardt, 1995). While there is no doubt on the importance of communication in this context, many practical challenges arise in multidisciplinary communication. Different professions might have different expectations and views on how communication needs to be done correctly, like frequency of communication, involved parties, or the degree of formalization. Also each profession can have its own professional language with different meanings of certain words. The behavior in situations of team communication can be different as well, as some professions focus more on power relations and positioning in the team dynamics while others focus more on the content.

While those differences on how communication works in different disciplines are already potentially disruptive, subtler cultural factors influence the why, in what media, and to what end of communication. World views, the mental maps of how the world works as well as one's place in it, determine the frame, but also things like moral conduct and proper motives. Culture, in short, plays an important and invisible role in content and context of what is communicated, how, by whom, and to what end.

This topic cannot be exhaustively discussed here; it creates however a recursive problematic: If world views and practices separate the communicative realms of various disciplines, any attempt to mediate has the same problem—it is like trying to translate unknown languages without a "Rosetta Stone." Resulting problems in communication are seldom traced back to culture, rather to individual people, the organization in general, or the content discussed. As miscommunication costs time, money, and nerves, it is worth analyzing this deeper as an important success factor for organizations in digital age.

We see digital disruption not as an activity, but as a time period, we are currently confronted with. As in this period technology seems to develop faster than humans can adapt socially, we have to think about how to deal with this situation in the time of transition taking benefit out of it. To deal with change and develop creative new solutions, it needs interdisciplinary teams that are able to work together in a highly productive and effective way. More than ever, individuals with different backgrounds are the basis for new innovation and further development. Good communication across various disciplines is key for the purpose of good cooperation in mixed teams. This article suggests a framework for better understanding and organizing interdisciplinary communication for better cooperation.

3.2 The Complexity of Communication and Cognition

The term communication comes from the Latin word commūnicāre = to share (Harper, 2015). Communication is more than exchange of information. In its broadest sense, Stevens defines communication as "the discriminatory response of an organism to a stimulus" (Stevens, 1950, p. 689). Most of modern communication theory was inspired by the "The Mathematical Theory of Communication" by Shannon and Weaver (1949), although it was not originally intended for modeling human communication (Storch & Tschacher, 2014). Resulting models (i.e., Watzlawick, Beavin, & Jackson, 1969; Schulz von Thun, 1981) use variations of the elements: forming of communicative intent, message composition, message encoding, transmission of signal, reception of signal, message decoding, and finally interpretation of the message by the recipient. Those technical terms stem from a technical context, yet they fall short on three accounts:

- Embodiment: Human communication as well as cognition is embodied and situated.
- Communication as a process: Messages are not defined, disembodied entities, and there is no one true meaning to acts of communication—mutual understanding is not the decoding of a predefined and precise meaning, it is the co-constructing of a state of understanding between actors in a situation.
- Subconscious motives: Communication is not reduced to a clear communicative intent, motives, and motivation works largely subconsciously, so subconscious communication can make up a large part of the conversation, and several conflicting motives might be at play contrary to stated communicative intent.

As we are looking at communication for the purpose of cooperation, we use the Theory of Embodied Communication (Storch & Tschacher, 2014) as a starting point.

3.2.1 Embodiment

Human cognition and its organ, the brain, are embedded in the body and the body in its context. "Embedded" means feedback, interaction, and mutual influence in both directions. Embedding of the brain in the body is called embodiment, embedding in the environment situatedness (Tschacher, 2010; Storch, Cantieni, Hüther, & Tschacher, 2010).

While human communication can involve the transfer of symbols, e.g., words, it is in the body that those symbols are imbued with meaning (for several others Tschacher, 2010; Harnad, 1990). "Understanding," between humans, is not determined by correct transfer, decoding, and processing of symbols; its signal is an embodied sense of understanding, what Storch and Tschacher (2014) call synchrony. In Searle's (1980) famous example of the Chinese room, he points out that if he had all Chinese symbols and all rules of processing them, using both to answer questions posed in Chinese, even though it would appear Chinese to an observer, he would not in fact understand anything.

Misunderstandings in team communication are often due to the fact that words, sentences, and gestures have a different meaning to different people in different contexts. Like in the Chinese room, for example, those differences might pass unnoticed and show up later where their source has become untraceable. People do understand Chinese. How to see things, as well as how to communicate them, is learned. This learning is embodied and situated, but also cultural. Babies do not have the ability to read, let alone understand this sentence. Before words, children acquire proto-terms; they learn how to name situations instead of things. The child of three might say "jacket" when really it means "let's go out and play, this was fun, and I feel the tingling again that I learned means lack of movement or play. Playing always starts with you telling me to get dressed, and first give me the jacket." It does not, of course, verbally think that. The physical memory of a cluster of similar experiences gets wrapped up in the preverbal, embodied proto-category "jacket" (Kuhl, 2001).

Learning actual words works in steps. It has been shown that across cultures, people first learn what are called base-level categories (Lakoff, 1987, pp. 39–52). When walking through a kitchen, the items found can be categorized by any number of properties. Color, shape, use, storage place among others could be classifying cues. Basic-level categorization uses the general shape, or gestalt, and embodied interaction to form "things" out of "data." All jackets look alike, more alike than jackets and, say, trousers or kittens. There are also a limited number of typical interactions with jackets. All experiences with jacket-shaped objects cluster around a mental image of a prototype jacket, a cognitive reference point which organizes the category "jacket" along a gradient of membership (Lakoff, 1987). Base levels are, independent of language and culture, learned first, named with shorter words, and processed with more cognitive ease. Later, categories form hierarchies. Base-level categories remain in the middle (Lakoff, 1987). "Perhaps the best way of thinking about basic-level categories is that they are "human sized." They depend not on the objects themselves, independent of people, but on the way people interact with objects, the way they perceive them, imagine them, organize information about them, and behave toward them with their bodies. The relevant properties clustering together to define such categories are not inherent to the objects, but are interactional properties, having to do with the way people interact with objects" (Lakoff, 1987, p. 51).

Preverbal clusters of experiences remain a relevant factor of cognition and meaning, working parallel to symbol or abstract cognition and communication (Kuhl, 2001). Polanyi (1985) speaks of tacit knowing-how and suggests that it forms a parallel process to the conscious explicit knowledge. Neurologically, an adult has several systems with different functionalities. All of those, however, remain one embodied, situated entity; the mind has "one currency" (Tschacher, 2010, p. 33). An image with more practical application could be to think of both differentiated and interconnected webs of processes or a cognitive ecology (Hutchins, 2010).

For the practice of interdisciplinary communication, there are several relevant conclusions:

- Base-level categories are similar, more abstract, and more detailed categories tend to be highly culturally specific. Since experiences only motivate and not determine categories, same experiences can still form different categorization (Lakoff, 1987). There are potentially unlimited valid categorization schemes in any situation.
- Once learned, categorization schemes become embodied, which makes both hard to change and ever harder to share verbally. Especially the fundamental experiences that form the frame for cultural cognition, which are learned in infancy (due to environmental differences, like ubiquitous mountains vs. large city vs. fishing village, structure of the school system, profession of parents), are part of a cultural world view within which communication occurs. Categories extend to rules of inference, views of right and wrong, and behavioral patterns. This system forms an integrated cultural logic. Any cultural logic can only be understood in its own terms. Trying to grasp it with the terms of another inevitably leads to distortion and misunderstanding.
- There are two modes of understanding foreign organization schemes of cognitive categories: First, symbolic representations can be mapped against one's own category map. Since schemes differ, this can only go so far or else the two systems would be equal. Second, through understanding. "Understanding is something that is internal to a person. It has to do with his ability to conceptualize and to match those concepts to his experiences, on the one hand, and to the expressions of the new language on the other. Translation can occur without understanding, and understanding can occur without the possibility of translation" (Lakoff, 1987, p. 312).

3.2.2 Communication as a Process

Processes are what turn things into scenes. At the level of making sense of the environment, cognitive structures are the mental tools that tell us where we are and what we can do in this situation. In any communicative situation, many processes are active on different levels, including the level of active "sending of messages." Its role and relevance however can be overshadowed by context-producing processes, which are active all the time and parallel to intent and messages. They are crucial in deciding, which message is heard. Three processes in particular are relevant when looking at communication for cooperation: synchrony, mutuality, and professional vision.

Synchrony means that actors synchronize their actions to a point that they get in a joint "flow" together, like dancing to the same beat (Storch & Tschacher, 2014). It is especially visible in body language, but synchronizing intent or content however is just as relevant. It is created via embodied processes that are part of our biological makeup. In infancy, before verbal communication is learned, understanding occurs.

Synchrony also allows functioning cooperation between human and nonhuman (animal) actors, even though no language is shared. This only works, however, if it is spontaneous and non-intentional (Storch & Tschacher, 2014). Influential thinkers on communication, like Watzlawick et al. (1969), have stated that communication of content relies on a good relationship. It is important to note here that a relationship is not a thing but a process—which leads, ultimately, to synchrony.

In team cooperation, a lot of the processes parallel to language and intent focus on communicating actions and the state of work products within a team. The result can be broader than just synchrony; it revolves around creating a shared understanding of the situation and what needs to be done. Synchronization of the “awareness of people, spaces and resources” (Fitzpatrick, 2003, p. 130) leads to a sense of mutuality. “Mutuality is the catalyst then for cooperative work” (Fitzpatrick, 2003, p. 130).

Mutuality does not require sharing the whole awareness of each person. Especially in interdisciplinary work, each actor will have its own expert view or “professional vision” (Goodwin, 1994): Each discipline has its style of active pattern recognition, which is acquired socially using coding schemes, highlighting of various cues, and typically the production of material representations or mappings of the work context, which helps reading the scene (Goodwin, 1994). The challenge for teams is to integrate those different visions and make them complimentary, so that the whole can become more than the sum of its parts. We cannot not communicate, as Watzlawick et al. (1969) famously said, but it is fully possible not to be understood or heard. Teams require well-adjusted processes of mutuality to integrate their expert visions into a coherent whole, which inspires and guides actions toward goals. Mutuality might work almost invisibly and effortlessly, but is the result of a complex web of highly interconnected learned, embodied processes which are both situated and cultural.

If you look, for instance, at “trust,” this is not a message which can be predefined, coded, sent, and decoded again into its precise meaning. It is a quality of understanding which might or might not be put into words at some point. At the level of the individual, some properties of the appearance and actions of the other are read as signals. What counts as a signal and what not is learned, just as the base-level categories for things mentioned above, through interaction. Based on the interplay between assumptions and cues, the assessed level of “trust” is put into action. Subsequently, actors go back and forth, reassessing in implicit questions and answers. Since there are abundant possible cues to choose from, a process of framing comes first. Is the situation a friendship encounter, a possible negotiation, a fight, or a tea party? Is the other a business partner, an expert, or an interesting acquaintance? Each of these frames has different expectations and ranges of behavior associated with it. Situated frames have been called settings (Rapoport, 1994), locales (Fitzpatrick, 2003), or simply place as opposed to the space the interaction is happening in (Harrison & Dourish, 1996). Social settings and roles work like base-level categories as they are learned via behavior, intuitively understandable, and nested in the middle of taxonomies of social life. In language, frames are sometimes communicated in the form of deep-seated metaphors (Lakoff & Johnson, 1980). Settings and frames are not mutually exclusive, even within one person.

They can overlap, intersect, parallel, or be in conflict. This is the "context" we mean when we say that any utterance only makes sense within its context.

A few conclusions for team cooperation:

- Experts literally see the world differently even when standing in the same place. In order to do their job well, their expert vision needs to be as effortless and as embodied as possible. Since expert vision needs a long training period to acquire, sharing one another's vision is inherently difficult.
- It is possible to create shared understanding—mutuality—necessary for team cooperation without sharing every detail or reading a scene. This only needs an additional set of common practices—shared processes—that allow not one person but the whole group interconnected with scene and tools to hold a map of what is going on, what needs to be done, and how to go about it.
- Since shared processes need synchrony to work effortlessly, alignment of team members under shared values and common goals is necessary. A common denominator which can change from situation to situation is enough; total alignment would create redundancy which diminishes the capacity of a team to respond to changing challenges. What that denominator is arises from the demands of the job at hand, or the situation, and can be dynamic as well as open for debate.
- Moving from product to process orientation in cooperative team communication helps actors to integrate their views into a shared mutuality. This multidimensional view is crucial in making decisions in complex and volatile contexts, where multiple goals and simultaneous challenges need to be met. As Taleb (2008, 2012) has pointed out, especially in the area of risk management, divergent views need to be taken into account regularly for teams to not only work successfully but also safely, resiliently, and sustainably.

3.2.3 Motives and Motivation

Motivation lies at the heart of communication. It is the reason to speak out. However, like the processes that produce meaning might produce several parallel layers of meaning, motivation is inherently multilayered.

Motivation is also learned. Basic needs are a biological imperative that precedes cognition. Needs are simply internal set-points defined by biology (Kuhl, 2001). What is learned is the path to satisfy them. Goals or concrete intentions represent objects that have led to gratification. If both the need and desired objects are present, motivation occurs, leading to (learned, patterned) action. Between the need and intentions, however, there is another layer of cognition: motives. Motivation is typically conscious and can be verbalized; motives are preverbal and not necessarily aware (Kuhl, 2001). Motives are learned before object representation is possible, like base-level categories, through interaction with the environment. Early experiences form a cluster of situation representations around the need. Over time, motives become cognitive processes that connect and integrate both the need and the experiences of satisfaction or frustration with higher-level cognitions that inform action and decision-making. Motives themselves represent meta-strategies, representing types of strategies of how to get access to objects of gratification.

There are three main motives with a basis in evolutionary biology that are independent of culture: affiliation, achievement, and power (Kuhl, 2001, 2010). Thinking in terms of meta-strategies, affiliation clusters all strategies based on exchange and interconnectedness (with people). Achievement represents strategies based on merit, where success is based on quality of action, including situations of independence or competition. Power connects all situations where only a well-integrated group effort can lead to success. In its pure form, the motive values influence and leadership, but it also values order and stability. The wish to belong however is part of the affiliation motive. Each motive can have several different qualities/shapings/characteristics, for instance, if it is fueled by attraction or avoidance. Even though situations activate or discourage motives, a person develops a stable tendency that becomes part of character (Kuhl, 2010). In a new situation, the perception and framing of that situation as well as the strength and direction of goal-oriented behavior is strongly influenced by motives (Kuhl, 2010), which predispose toward classes of actionable goals and types of strategies or inversely prohibit them (Kuhl, 2001).

Additional to preselecting goals and fields of action, motives can actively contradict stated motivations or even logic appropriate in a given situation (Kuhl, 2001). They are like maps of roads toward gratification or away from frustration and danger, and just like maps they can be outdated in novel territory. There is a particular challenge inherent in motives: Unlike mere categorization or the processes of mutuality, a motive necessarily involves judgment. The intertwinement with needs leads to potentially strong emotion, toward others but also within one person. Taken to the extreme, there are trade-offs between motives: Unlimited power contradicts both some parts of affiliation and quality of achievement, as well as the other way around. The map thus contains patterns for decision-making in situations where one motive can only be satisfied at the cost of another.

Considering these aspects there are again several conclusions for team cooperation:

- Preverbal motives have a large influence on the structure of communication. They influence what is said or heard, when and where and by whom. They also heavily influence structures of collaboration and goals of cooperation. Knowing motives, which are not necessarily congruent with motivation, gives a powerful tool to structure team communication successfully.
- Since motives involve judgments, achieving synchrony involves discussions about values and principles as well as motivation, goals, and plans. Incongruences between team members can lead to conflict and lack of motivation, while alignment can be a powerful common denominator supporting more specific processes of synchronizing content, tasks, goals, and general communication.
- Focusing on the three motives provides the advantage that they are shared across cultures, since their neurobiological bases are part of human biology. Also, they are inherently process oriented and create stability across various

specific goals, important in the age of fast-paced innovation which requires organizational flexibility.
- Since motives are so intimately involved in decision-making processes, it is helpful to reflect upon them consciously (and jointly) in order to improve the quality of the metaphorical map for the actual territory.

All aspects discussed have shown the complexity interdisciplinary teams are confronted when working together with the need of cooperative communication. One aspect we believe could help to improve the team communication in an improved representation with the help of patterns which will be discussed in a next step.

3.3 Patterns for Better Shared Representation

3.3.1 Design Patterns and Pattern Languages

Patterns are named descriptions of generic solutions to common problems in a given field. Alexander (1977, 1979) coined the term for design patterns in architecture, in an effort to make the experience of experts discussable. The concept has since been adapted in software development (Gamma et al., 1995) and project management (DeMarco et al., 2007), among others. "Each pattern describes a problem which occurs over and over in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander, 1977, p. 10). Typically, the description of a pattern consists of a name, the situation in which it is applicable, the problem(s), and the solution (Alexander, 1977). Patterns are useful in complex, yet not chaotic contexts, where plans and prescriptions fail but similar problems do reoccur.

In a defined context, design patterns can form pattern languages, since "… no pattern is an isolated entity. Each pattern can exist in the world, only to the extent that it is supported by other patterns: the larger patterns in which it is embedded, the patterns of the same size that surround it, and the smaller patterns which are embedded in it" (Alexander, 1977, p. 13). Meta-patterns work like a grammar, specifying proper combinations of patterns on different levels of complexity. Similar to natural language, which is made up of words, rules of grammar, and actual sentences; pattern languages contain patterns, meta-patterns, and actual buildings and towns, software code, meetings, or communication acts.

3.3.2 Cultural Communication in Patterns

These pattern languages are action counterparts of the taxonomies formed by categorization patterns described above. In other words, a "cultural communication pattern" is the base-level category of social interaction. It is learned via experience, used subconsciously yet correctly, and implies both a problem and its solution—a prototypical image—as well as typical actions associated with it. If a base-level category is "human sized," a cultural communication pattern is "group sized": It does not necessarily or naturally apply to large organizations. Their structures are much more flexible, just like abstract categories.

The grammar of social interaction is made up of settings, which order space and resources into places of, for instance, work. Places have associated activities, which are broken into pieces which also include the base-level patterns down to the actual words, gestures, and actions. For example, the setting "office" has a variety of appropriate activities, from filing to strategic meetings. A base-level interaction could be a "greeting" or "making friends." No two greetings are alike, yet the problem they solve, as well as their general shape, is similar enough to be recognized as a pattern.

A characteristic of patterns as defined by Alexander is that they resolve complex situations, where conflicting forces or various needs are at play. A pattern provides a structure in which all those forces are harmoniously resolved and all needs are simultaneously met (Alexander, 1979). Since patterns are used intuitively, if they do not serve that purpose, they will quickly fall out of use or chance. Also, if the situation and its forces and problems change, new patterns will arise from the daily trial and error of the group tackling them. "Good" patterns are instantly recognized and copied in a living pattern language. This flexibility makes patterns better tools for complexity than more rigid plans and procedures/structures.

The focus on patterns puts culture in the context of problem solving. It implies that cultures are at least in part structures of collective problem solving. There is evidence for that. Traditional cultures may contain in their seemingly random traditions effective systems of resource management, a fact that has come to the attention of ecologists interested in conservation of ecosystems (e.g., Berkes (1999)). Those systems, rather than relying on the precise measurements and complicated calculations possible in science today, rely on simple heuristics—patterns—which are often embedded in cultural myths, traditions, and taboos. Even though the rationalizations are often either nonexistent or empirically false, the patterns work and require a fraction of the resources necessary in science (Berkes, 1999). If it is possible to establish a shared pattern language instead of or complementary to plans, rules, and regulations, the problem solving and innovation capacity of a team, while requiring less resources, could increase greatly.

3.3.3 Motives in Cultural Patterns

The thought that cultures are at least in part problem-solving entities is not new. Actor-network theory (Latour, 2007) and distributed cognition (Hutchins, 1995) or, on a smaller scale, communities of practice (Wenger, 1999) all describe mechanisms of cultures of collaboration. The final hypothesis is that the three preverbal motives, affiliation, achievement, and power, shape styles of cultures of cooperation.

The central points discussed, base-level categories, synchrony and mutuality, preverbal motives, and also patterns all share a central theme: They represent one semiconscious layer of a multilayered, embodied, and situated process that also has a conscious part, and they are, one could say, placed "in the middle." It is possible to consciously reflect upon them, yet their nature is tacit knowing-how, and their interaction with conscious processes is often complex and sometimes conflicting while always exerting a strong influence from the subconscious toward the conscious. They are learned in tacit, situated, embodied ways, but unlike other parts of cognition they remain in close relation with the environment. For example, folk taxonomies of plants at the base-level categories resemble biological/scientific categories closely across cultures, which is not true for more detailed or more abstract parts of those same taxonomies (Lakoff, 1987). Base-level categories, synchrony, and preverbal motives are strongly rooted in evolutionary biology. This makes them more universal and thus more suited when looking for solutions in interdisciplinary exchange. Patterns are nonspecific in this respect, yet it could be argued that they are condensed experience. They also have a close relationship with the environment; it is said that design patterns are not invented but rather found. But also on a neurological level, there is evidence that patterns are not learned randomly. A recognized pattern makes sense as the best interpretation of sensory data (Tschacher & Haken, 2007). Situations are not neutral or random; they have affordances (Gibson, 1977). "Affordances reflect the possible relationships among actors and objects: they are properties of the world" (Norman, 1999, p. 42).

A pattern language can be seen as a map: What context-specific problems have occurred, and which solutions have been approved by cultural cognition. Implicitly, it also maps which forces are at play in the context for the actors using the language. Motives are also mappings, on an individual level, of what types of strategies have proven effective. Since that is at least in part bound to the context, there is an overlap. The argument is that through processes of mutuality, maps are shared. Wenger (1999) pointed out specifically about communities of practice that knowledge is constantly updated socially and resides in the communities' processes more differentiated than in any individual. Hutchins coined the term of distributed cognition (e.g., Hutchins, 1995) to have a word for a cognition that resides not in either people, things, or processes but within the dynamic whole.

Leading a team of firefighters, creating a new app for graphic designers or choreographing a dance act can all be done using strategies from all different motives. The question is whether the results would equally be satisfying. Motives are learned from success and frustration, so inherently some situations are conducive more to one than the other motive or, of course, combination and prioritization of motives. This also means that optimizing toward one motive only results in less desirable results if a task is attempted that is better done using different alignments of motives. Ultimately, to persist in complex and changing contexts, all three capacities are at some point required. The challenge for interdisciplinary teams is to find a shared pattern language that is both stable enough to work and flexible enough to adapt.

3.4 Conclusion

In times of digital disruption, with highly dynamic environments and improvements in technology with increasing speed, social and human practices need to follow. Good cooperation in interdisciplinary teams might become a key aspect in competing with machines and artificial intelligence for delivery of new and innovative ideas, concepts, products, or services fast and efficiently. We see cooperative communication as a core in doing so. As important aspects of communication, we discussed embodiment, process orientation, and the importance of the three basic motives, affiliation, achievement, and power.

Many interdisciplinary teams today are confronted with increasing speed of changing context, with significant fluctuations and changes in the team constellation over time. The participants have less time to learn from each other. Taking into account embodiment for processes of synchrony and mutuality, as well as a focus on process instead of the product of communication, cooperation offers an opportunity of shaping interdisciplinary experience in a minimal, yet effective way. Shared motives can provide a common map to guide the fluidity of processes of mutuality. To provide novel solutions in an ever-changing digital environment, the differences between disciplines are a necessary asset. Heterogeneous teams with different viewpoints and sometimes opposing values which are well integrated and have compatibility are necessary to tackle complex problems. In situations with multiple and conflicting goals of many stakeholders in a changing environment, cultural communication patterns can help integrate the various views to inform better decision-making that can hold up to complex standards. Sustainable risk management and innovation both depend on having a grasp on complexity.

Although some further research needs to be done in this field, we think the idea of pattern language with perception and action patterns might help to:

- Observe behavior, analyze intent, and make sense of what other people are doing.
- Provide a framework to evaluate communicative behavior specifically in interdisciplinary teams. An analysis along the axis of motives can help resolve conflict and plan better ways of dealing with each other.
- Support decision-making with multi-view, multipurpose strategies better suited for complex problems and fast-changing situations, such as in the development of new technology.

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Chapter 4
Technology and Disruption: How the New Customer Relationship Influences the Corporate Strategy

Andreas Krämer, Thomas Tachilzik, and Robert Bongaerts

Abstract It is increasingly the case that major changes in the technological environment and customer digital behavior have a significant impact on the way companies manage their customer relationship. Here, the related perspectives of value management are concerned: (a) the design of products and services including the way of interaction with the customer that generate a high customer benefit and (b) the focus of companies on customers with high profit margin and sales potential.

The flow of information is also in two directions. Firstly, one information flow refers to data that originates from the customer. Through digitized customer relationship processes, companies receive more detailed and real-time data about products and services than was the case earlier—this is a noticeably new situation for industries that formerly had limited contact with the end consumer.

Secondly, there is an information flow triggered by the company as it is now easier for enterprises to actively communicate with customers increasingly in real time and individually. This direct marketing has been revolutionized in a digital and networked world, making a long discussed 1:1 marketing approach feasible.

This is an opportunity and a challenge for the corporate strategy at the same time. The ability to extract information from big data and evolve smart data becomes a competitive factor: on the one hand, tailored products and services can be offered to the customer, while on the other hand, the controlling and steering of customer value management in real time is possible.

A. Krämer (✉) • R. Bongaerts
exeo Strategic Consulting AG, Wittelsbacherring 24, 53115 Bonn, Germany
e-mail: andreas.kraemer@exeo-consulting.com; robert.bongaerts@exeo-consulting.com

T. Tachilzik
Tachilzik Consulting GmbH, Humboldtstr. 4, 53115 Bonn, Germany
e-mail: t.tachilzik@tachilzik-consulting.de

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In the first step, the paper examines the challenges for CRM in a world of disruptive technology. In the second step, it shows how digital transformation changes the flow of information from customer to company and vice versa by looking at different industries. In the third step, the influence on corporate strategy is examined, and a broader definition of CRM is suggested regarding both aspects, the perspective of the company and the perspective (and perception) of the customer.

Keywords CRM • Internet of Things • Big data • Customer value management • Digital transformation • Social CRM • Omnichannel management

4.1 Disruptive Technology and Its Challenges for CRM

Customer relationship management (CRM) is a business strategy that optimizes revenue and profitability while promoting customer satisfaction and loyalty. The occurrence of disruptive technology is changing the framework for customer relationship management. Figure 4.1 describes major challenges for CRM looking at the 3Cs of the strategic triangle (customer, company, and competition, (Krämer, 2015)).

On the one hand, customer requirements are constantly growing and often exceed the capabilities of the companies. Customers expect easy and convenient processes, of course, with real-time solutions no matter where they are and regardless of the communication channel used. Offered solutions have to be customized (in response to the actual service request, at the same time keeping in mind both the discrete

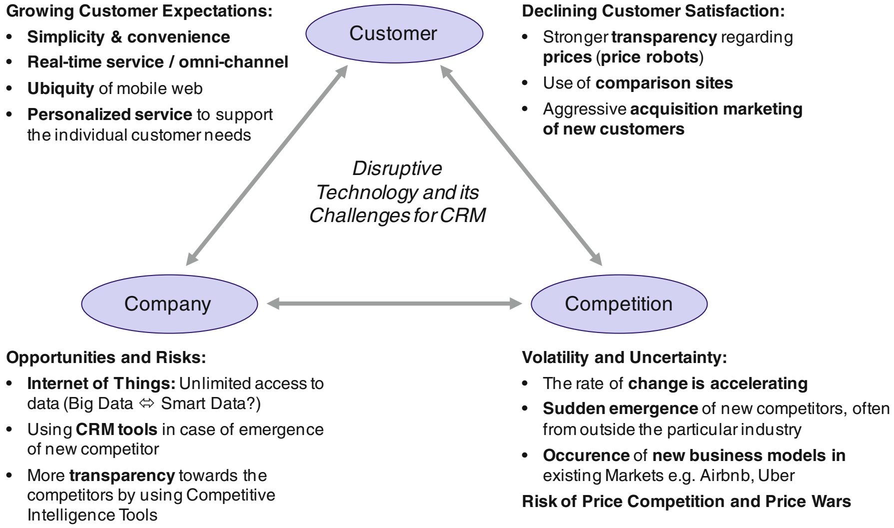

Fig. 4.1 Disruptive technology and its challenges for CRM

product history and the customer personal history in general). On the other hand, indications are that customer satisfaction is declining, due to more transparency by using comparison sites or looking at rating sites (Diehl & Poynor, 2010).

Companies that align their products and processes accordingly have a clear competitive advantage. Accordingly the rapid success of messenger apps is not really surprising: messenger apps fulfill almost all of these customer expectations—they are simple and convenient, real time, ubiquitous, personalized, and free of charge. The numbers of active monthly users are already impressive, and they are still growing: WhatsApp with 900 million users, Facebook Messenger with 700 million users, and followed by many previously provided regional/national services—such as WeChat (China) with about 600 million users (Wolf, 2015).

Although access to these messenger apps for companies can be partly restrictive at present depending on the provider particularly in Asia, providers already demonstrate how money can be earned with messenger-integrated additional services. At WeChat, e.g., taxi services can be searched, booked, and paid for. The expansion to online marketplaces within WeChat is being pushed (e.g., by releasing the source code/open access); overall there are already several million webshops integrated (Eisenbrand & Mühle, 2016). Facebook Messenger and WhatsApp will follow this strategy, as Mark Zuckerberg laid out his plan during the Q2 earnings call in July 2015, but in a slightly different way. First, as seen at the history of Facebook, companies are invited to integrate whatever they want to (e.g., profiles, product/service offerings, contact possibilities), so customers/prospects and companies can get in touch with each other (Zuckerberg: "enabling people to have good organic interactions with business"). As this is achieved, the monetary transaction starts, e.g., the companies have to pay to reach (more) customers (Constine, 2015).

What does this mean for marketing, particularly for CRM? The expected triumphal course of messenger apps at the expense of social media and Internet usage (Wolf, 2015) requires a change in marketing: if companies want to be exactly where the customers are, then "messenger marketing" is required. And CRM plays an increasingly important role: as classic Internet marketing attempts to generate clicks by search engine optimization (SEO), messenger apps and social media deliver more traffic to build a sustainable one-to-one relationship. The additional quantity of higher quality data (assigned to an individual) enables the use of analytical CRM on a database that was never available before (in compliance with the data protection legal framework). SEO can thus be understood more as an instrument of generating new customers, while in the world of social media and messenger applications, the existing customer is the focus of interest. CRM delivers the appropriate instruments to develop a sustainable customer loyalty while optimizing the customer value throughout the entire customer life cycle. In this context, the relevance of SEO will continue to decline, as (1) surfing the Internet on mobile devices/smartphones is inconvenient and therefore continues to drop, (2) search engines grant less space to unpaid content, and (3) SEO marketing is becoming increasingly expensive (Eisenbrand, 2016).

Besides these customer-driven developments, the companies themselves change the CRM framework. Especially the Internet of Things (IoT) is a "game changer":

products and services are generating data when used with the permission of customers, but with no customer-initiated company interaction. While certain companies had strong brands but only limited contact with the end customer (industries with several levels of added value, such as beverages and automotive industries), now in the era of Internet, social media, and messenger apps, this situation has completely changed and continues to evolve further.

To explain the consequences and changes, we would like to combine the concept of value chains (company perspective) and the concept of customer life cycle management (customer perspective). As a result we get a value chain–customer life cycle–matrix (Fig. 4.2).

On the left side of Fig. 4.2, a situation of data transfer between customer and company is shown: contact (in combination with "direct" personal/individual data transfer) between company and customer more or less took place during just two phases of the customer life cycle—when customers requested information and/or actually purchased a product/service. Typically, the data generated was transaction orientated. With IoT, data is provided at every stage of the product life cycle. Customers actively identify themselves with strong brands and communicate their experiences throughout their total customer life cycle—from the first awareness right through to the end of using it. Although data security might be a concern, consumers willingly provide preference data as well as full profile descriptions and agree to the storage of this data in order to get access to tailored offers and services. Customers are paying with personal data for free product or service usage, unconsciously knowing that there is "no free lunch" (Bernasek & Mongan, 2015). If the technical and legal (data protection) requirements are met, a customer-centric map-

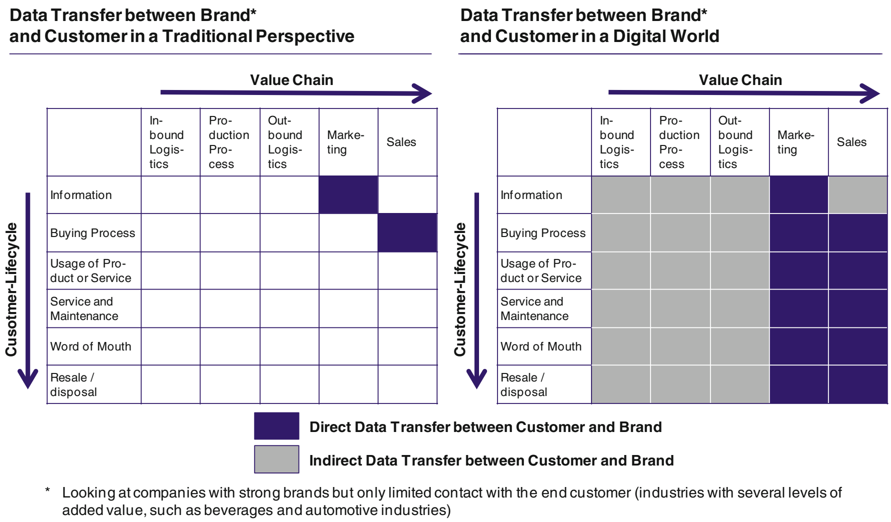

Fig. 4.2 Individual data transfer between customer and brand (traditionally vs. digital world)

ping of data is possible. Looking at the value chain of a business, the data can directly help to improve marketing and sales, but also allows the improvement concerning all the other stages of the value chain ("indirect" personal/individual data transfer).

The IoT is related to big data: now, a huge amount of data is available as a result of the combination of product-generated and customer-driven data. Consequently, it is possible to go beyond the transaction to every little detail of the customer's actual (and upcoming) experience; a company can get access to visibility into (nearly) everything (Merrifield, 2015). For CRM this is challenge and opportunity at the same time. On the one hand, companies face the challenge of extracting the right information (to provide smart data based on big data). On the other hand, there are opportunities to make a long discussed 1:1 marketing approach feasible (Bernasek & Mongan, 2015; Krämer & Kalka, 2016).

Additionally, the competitive landscape changes through the development of disruptive technologies. Unexpected by incumbents, new competitors from outside the industry enter the market. Google Car (self-driving) and Tesla (electric mobility) are typical automotive examples. From the perspective of the incumbents, CRM cannot prevent the entry of new competitors. But some incumbents are fighting back successfully, while mobilizing their own strengths including scale, superior resources, and access to customers (D'Emidio, Dorton, & Duncan, 2015). For example, customer retention campaigns are feasible tools to increase customer loyalty using the given access to customers. Loss of market share toward incumbents may weaken significantly making the new competitors return on investment more distant.

However, there is another development with importance for the future CRM: the unprecedented transparency of marketing within an industry or relating to specific competitors. In the online/mobile environment, an entire new industry has formed, which offers competitive intelligence tools (Ziegler, 2016), e.g., "SimilarWeb" and "Sitrix" are tools to analyze search engine marketing (What are the relevant key words? Which key words are competitors using?). "BuzzSumo," on the other hand, is specialized in the analysis of content and identifies the best content in social media. "App Annie" checks all relevant apps in the industry or at a competitor, while "Ghostery" analyzes the tools used on the competitor sites. These examples of disruptive technologies show that it is increasingly difficult and dangerous to further rely on the achieved strategic advantages regarding the competition. For the new CRM, this also means that one's company has to use the relevant tools to identify trends in or among competitors in real time.

The requirements for CRM capabilities have risen sharply. In the following chapters, two perspectives are examined in this context. First, the customer-to-company perspective: "What kind of data is generally available on disruptive technologies in CRM and how can relevant data be specifically incentivized?" The second perspective—from company-to-customer—covers key questions such as "What are the opportunities from the disruptive technologies in CRM?" and "How can they be used specifically?" To understand the changes in relation to these perspectives better, examples are taken from three sectors—automotive, media, and professional services.

4.2 Data in a Digital World

The CRM approach is based on data referring to the (potential) customers' history/future with a company. A holistic view of the (potential) customers' data helps to improve business relationships with existing and potential customers, in order to drive sales growth and to generate customer value. In general the more data the better.

Limited access to consumer data is changing. Companies can now receive more detailed and real-time data about products and services than previously through digital customer relationship processes and by linking different data sources (Fig. 4.3). This is true for data internally available for firms as well as externally accessible. This results in different challenges for data management, summarized as "4 V" model (Krämer & Tachilzik, 2016):

1. Volume: Data volume is growing rapidly.
2. Variety: Constantly new data sources occur and need to be linked.
3. Velocity: The ever-increasing speed of new data that need to be connected and analyzed.
4. Veracity: The validity of the used data is becoming more critical.

In the development of data management during the last decade, these challenges can already be observed and have led to changes concerning data structuring, data aggregation and in the supporting of the sales process (Fig. 4.4). Starting with manual observations of customer interactions and data analysis largely by hand, the processes have evolved to a complete automation today. In the field of CRM, Payback, a multi-partner-loyalty program in Germany is a good example of this automation process. With more than 25 million members, Payback gives out more up to 64 million account statements per year in 13 million personalized versions per account statement (Payback, 2016).

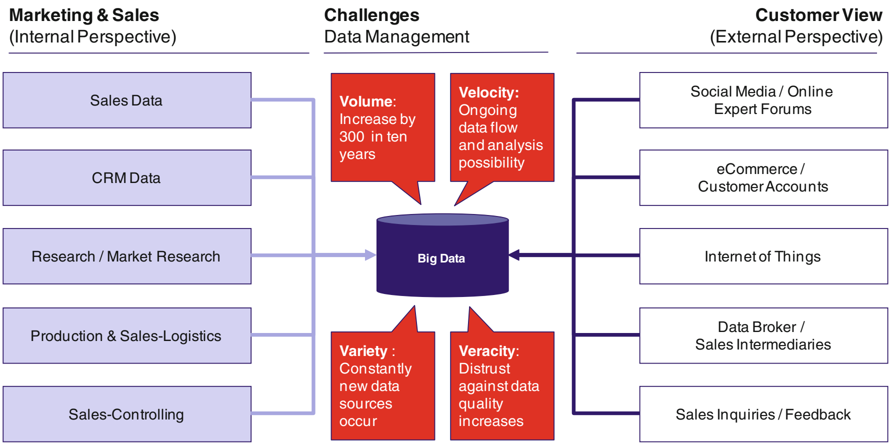

Fig. 4.3 Changed market and customer environment to create big data

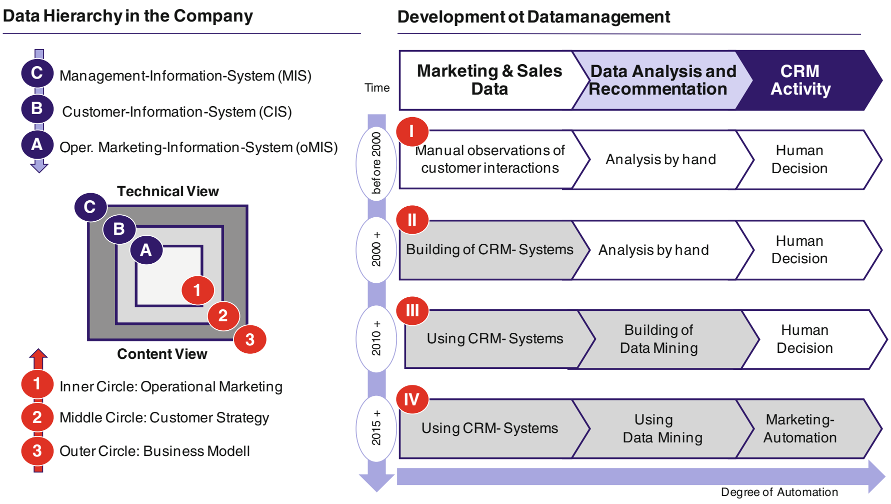

Fig. 4.4 Data hierarchy and the development of data management

The goal of the first CRM systems was to aggregate all the information of the customer and prospects, which was available in one company. The data sources were all the sales representatives, who were forced to enter their customer relationship into a centralized system that provides access to the whole sales department. The quality of customer data relied on the ability of the sales representatives to summarize and articulate the needs of customers in a structured form appropriate to the data structure of the CRM system. At this stage the customer data was a combination of both product information based on sales history and filtered usage information by sales representatives. The customer relationship management was able to analyze and recommend additional sales potential out of structured and aggregated data. Aggregating customer data was one of the key results, but at the same time relatively cost intensive through the amount of time required for every sales representative generating this data.

The corporate strategy changed with this new sales potential toward CRM. This was especially true when companies had direct customer contact, provided high value goods or life cycle products, and a large number of sales representatives were working in the organization. Finally, this strategy resulted in delivering data to other departments like marketing which used them, e.g., to design dialogue campaigns. On the one hand, an advantage for the customers was created due to a new opportunity to buy products based on customer needs. On the other hand, companies created omnichannels where no longer just sales representatives generated sales at these companies. Thus, the CRM changed from one-to-one sales relationship toward one-to-many-relationship (Tachilzik, 2012). The success factor of the strategy at these companies relied on generating and using customer data on a company level regardless of the ownership of this data within a company. Companies which were not able to leverage the ownership of customer data within their company could not encourage sales representatives to generate high-quality customer data as input for the CRM systems. Consequently, the implementation of the CRM strategy failed as well as the automation in marketing and sales.

During the last decade, the customer data generation process at companies was more and more transferred from sales representatives toward automated generation which allowed other branches to set up CRM in their corporate strategy. Automation leads to cost reduction where campaigns allow additional sales (one-to-many communication) and new information out of the campaign results (opening rate at email campaigns, etc.). With more and more customer data, the classical CRM-based companies face the variety of data which enhances the customer database. Companies without access to customer data and without a CRM system either established in the market or as new market pioneers are challenged by receiving more and more customer data. Social media, smartphone usage, and Internet of Things are changing from one-to-many toward a many-to-many communication. Customers are talking in social media about brands to the community as well as to the companies directly.

Companies with strong brands are having direct customer contact regardless of the established sales chains in their branches. The automotive sector as an example shows how customer data is changing a corporate strategy in these days. The new technology allows new business models, e.g., the German automotive companies BMW, Daimler, and Audi are investing in enhancing their vehicles with mobile communication and combining the moving data of two million vehicles with Internet access in one database and managed by the new company "HERE." Linking the local mobility information with maps allows new traffic services available in the vehicles' navigation systems. The vehicles are sending error codes to the next car service station enabling the contacting of the driver in case of serious errors. When self-driving cars are used in the future, privately owned cars will be offered for car sharing and thus allow the automotive industry to target new business models and customer segments. Analyzing movement data from mobile customers allows not just to offer this service on demand but also with predictive modeling to places with high flow of traffic and potential customer contact. Supply will not only be offered to private devices but also on advertising screens near the traffic flows of potential customers.

Digitizing products allows companies with limited CRM establishing customer relationship management through actual product updates and not like just one anonymous customer selling event in former times. The usage of digital products generates customer data across three dimensions—quantity, time, and quality. Media companies, e.g., are offering actual paragraphs in law-related online books with new payment models and are able to establish more frequent customer interaction not limited to the bookstores in their value chain any more.

During that development of data management, the data flow between customers and companies is changing toward devices to company. Subsequently, there is a challenge in this data flow to link multiple data sources to one customer account, deciding which information is relevant (variety and volume of data) for which purpose. Companies with a high volume of customer data and low in-house usage of this data are frequently using data as an asset to generate cash flow when acting as a reseller. Companies which offer their customers a free service such as Google, WhatsApp, or WeChat are looking for other business models, e.g., generating revenue by indirect use of the data (by creating B2B markets).

Offering the potential customer a service for free or at a reduced price after signing into a customer account is another way to generate authorized customer data inside the company. Customers are leaving digital footprints outside the company on shopping websites (accepting cookies), using locality programs in stores and inside the company by interacting directly with the company. Even if companies are not able to digitize their products or value chains, nevertheless they are able to purchase external data about their existing or potential customers on the market.

Every interaction with a technical device generates customer data which allows generating a customer view related to the needs for specific expectations concerning products and services. Customer data is no longer generated by just asking the customer about their needs. Instead, it is generated by listening to the customer and observing customer behavior. This has far-reaching consequences for service industries as, for example, the market research which was for decades strongly focused on surveys as a core element of the business model. New possibilities for data generation and delivery challenge the established business models, because customer expectations change rapidly. Obviously, the need is shifting from social sciences to data sciences.

Identifying customer behavior is no longer limited to actively sign-in or registered customers. The majority of generated customer data is based on cookies on PC and smartphones. The transparency of the listing process toward the customer is one key element of corporate strategy in the next decade (Tachilzik, 2013). It is easier for companies with strong brands to get an active permission from their customer to allow permanent listing (e.g., Apple) than new and not established brands. Permission to customer data usage is linked to the emotional loyalty and trust level of a brand.

Today technology and cultural change in using digital communication channels enable companies not only to manage customer journeys to increase sales for existing products but also to develop new product innovations or even new business models. Customers with a specific product need are organizing themselves in social media platforms. If necessary, crowd funding allows a company to develop the needed product or even new companies are founded (e.g., www.kickstarter.com, www.FundRazr.com, and www.RocketHub.com). Customers are giving proactive information on social media platforms to optimize products which can be linked to CRM systems and used by product development departments. Intensive customer research activities are replaced by analyzing real-time usage data and automated do-it-yourself research campaigns (e.g., SurveyMonkey). More and more digital equipment and processes are used in generating more data in real time. This results in a boost of relevant customer data accessible for companies. Each company has to define which kind of data will be relevant for their customer relationship management. In this context it is becoming obvious that transaction data will dominate the customer data in the next decade in each branch and in each country, but not at the same time, and not at the same disruptive level depending on the cultural environment.

Disruptive technologies lead primarily to the fact that at different levels of the customer relationship, pieces of data are generated by the customer (either consciously or unconsciously), which made available to the companies involved. The "four Vs" (volume, variety, velocity, and veracity) are an opportunity and a risk at the same time, since data no longer constitutes a limiting factor for the company. The limitation exists in the ability to draw the right conclusions from the data and support decision-making in marketing and sales, for example, by preparing targeted marketing campaigns. This analysis can cover the following areas: predictive (forecasting), descriptive (business intelligence and data mining), and prescriptive analytics (optimization and simulation).

4.3 Information Flow Triggered by the Company

Section 4.2 described the first component of the information flow generating customer data. The second component is outlined in this section; this is the information flow triggered by the company due to the greater ability of enterprises to actively communicate with customers.

4.3.1 Using Data to Improve the Customer Experience

Information and additional offers to customers are provided more and more real time and individually, but with nonclassical customer data. Once transaction data is linked with a customer account or at least contact data, there are numerous ways to create additional value to the customer, for example, by

- sending information on the status of delivery or offer the possibility to change predicted time or day of delivery (e-commerce)
- providing information on flight delays or gate changes at airports or customized offers
- informing travelers about upselling options (e.g., to book a more comfortable seat in the aircraft after the ticket booking process is terminated).

The "relevant moment" in marketing communication opens new opportunities. Amazon is one example here, sending products to customers while there is no existing order. Products are finding customers and the other way round, with non-customer relation in advance (e.g., Amazon patents "anticipatory" shipping goods before the customer bought it). But also the direct marketing has been revolutionized in a digital and networked world, making a long discussed 1:1 marketing approach feasible. By combining different data sources, a more accurate way to improve performance in marketing and product development becomes possible. On the one hand, tailored products and services can be offered to the customer; on the other hand, the controlling and steering of customer value management in real time is possible. By using transaction-oriented customer satisfaction measurements, managers can quickly identify and eliminate performance defects, when the degree of customer satisfaction or the intention to recommend (Net Promotor Score = NPS) of a single transaction is linked to sales, production, and logistics as well as social media data.

Real-time decision marketing allows the generation of the next best action depending on the customer needs and established rules. The company is steering the information flow more and more to the customer than initializing it by product-driven campaigns. Offer delivery changes from customer personal data delivery to user event-related delivery. Companies are budgeting in-sales automated tools where they can select target groups in direct competition to other companies targeting the same customer groups. For these companies, it is not necessary to keep customer data, e.g., the email address in their system, to establish a customer relation to these target groups. Depending on the value of the customer groups, the company is able to place their offer and navigate the customer to the company website, start a chat, and receive a call or video chat. Banks are using the most innovative CRM processes like video chat for user account validation or messenger app paying functions.

4.3.2 Customer Feedback as a Learning System

Due to the digitization of business processes, the possibilities of companies have improved in obtaining customer feedback and thus achieving an immediate change in operational marketing. First, a new trend in customer satisfaction research can be seen. While, earlier, companies had sought to measure customer satisfaction in detail as a core element of the relationship management (the individual level, not the individual transaction, is a key element), in recent years, the trend of satisfaction measurement has gone toward transaction orientation. As Markey, Reichheld, and Dullweber (2009, p. 3) point out, most companies devote a lot of energy to listening to the "voice of the customer, but few of them are very happy with the outcome of the effort. Managers have experimented with a wide array of techniques, all useful for some purposes - but all with drawbacks." Instead, the concrete (last) customer point of contact, be it a product delivery or a service request, is the main focus. This is particularly due to the fact that the marketing decision-makers are looking for immediately implementable actions. This was the perfect touchdown for Reichheld (2003), when introducing *The One Number You Need to Grow*. Nowadays, companies in almost all industries have embraced the NPS as a way to monitor their customer service operations. The main advantage of the tool is its simplicity (Bendle & Bagga, 2016), since consumers answer only one simple question (How likely is it that you would recommend X to a friend or colleague?) on a scale from 0 to 10, with 10 being the most positive. Customers who answer 9 or 10 are considered promoters; those who answer 6 or less are rated as detractors. The score is the percentage of promoters minus the percentage of detractors.

Secondly, through the spread of the Internet, a stronger customer focus in marketing (creation of CRM databases with appropriate contact information such as email, etc.), and the accessibility to free market research tools, the conditions for an inexpensive measurement of customer satisfaction have been significantly improved. The execution and analysis of customer satisfaction measurements has traditionally been a core competence (with exclusive claim) for external consultants. Today, companies are able to conduct market research projects themselves quickly and cost-efficiently. An essential element of this is the offering of online survey tools for free or at relatively low cost; the US American company SurveyMonkey is a particularly good example of the new business model. In the ranking of "most disruptive companies" is the company's 14th place (CNBC). SurveyMonkey, the amusingly named online survey company, has enabled literally everyone from Fortune 500 companies to small companies to know what's on their constituents' minds. The Palo Alto, California-based company was started in 1999, and its core survey business allows companies and organizations to quickly set up online surveys, most of which are free. The company earns money (estimated to be more than $100 million in annual revenue) by charging for premium services such as downloading the survey results or the ability to address larger samples. In addition to conducting the survey and the data management for the nonprofessional users, the particularly challenging part is still the creation of a suitable questionnaire. Here, the provider supports by offering standardized questionnaire designs, which can easily be adapted. In early April 2015, the company launched a new tool, called Benchmarks, which let users compare metrics, such as website feedback or employee engagement, with their competitors. Consistent to its business model, basic information from Benchmark will be free; the paid service starts at less than $1000.

If customer satisfaction information is generated in the aftermath of the service, this can in principle be linked to other data sources. A good example is the airline Germanwings (since the beginning of 2016 rebranded to Eurowings), which since the beginning laid great emphasis upon both a centralized customer account and the ticket sales via Internet. A few days after the flight, customers will receive an email with an invitation to a short feedback. This offers several advantages for the company: first, a continuous flow of data is possible. Second, immediate adjustments in marketing can be made because the data can be provided within hours after sending the mails. Third, the satisfaction scores can be cross-linked, for example, with production data or CRM data. The relevance of management actions may be different, i.e., if a low user with a small lifetime value or a regular customer with a very high lifetime value complains about a service deficit, the way the company reacts may differ dramatically.

Figure 4.5 shows the dependencies between a targeted segment-oriented marketing and the factors big data and central customer account. Ideally, from the big data, information is provided that can be assigned to individual customers. In this case, the customer profile can be enriched so that the central dimensions as driver of customer's needs and customer contribution margin are mapped (Bongaerts & Krämer, 2014). This is itself necessary for the targeted implementation of specific marketing measures. These may affect the activities like customer feedback, loyalty management, or direct marketing campaign.

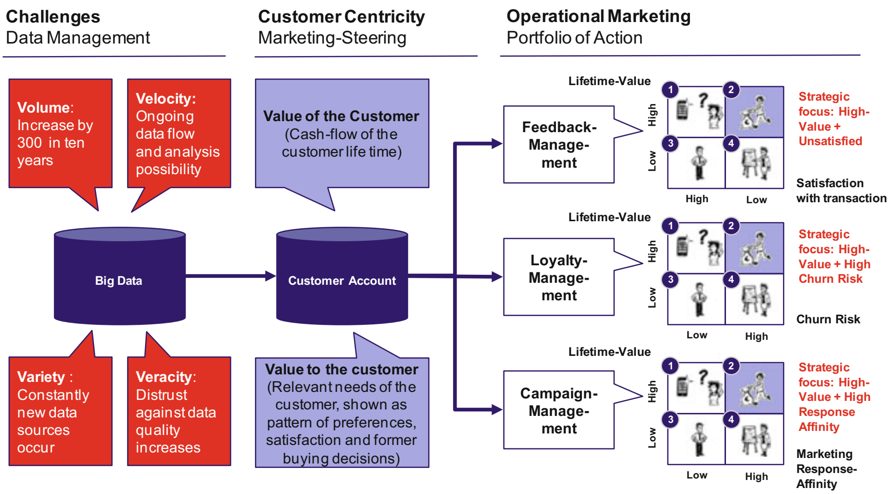

Fig. 4.5 Big data-driven customer-centric marketing

4.3.3 New and Modified Products to Meet Customer Requirements

The media industry is a good example of how managers have initially misunderstood the digitization of the industry and have tried in the second step, to correct the mistakes of the past. Basically, the newspaper business is characterized by a high proportion of fixed costs. Once the editorial work completed, the marginal costs are almost zero. Consequently, the majority of newspapers have offered significant high value content to online editions or Internet portals for free. This may represent, at first glance, a way to increase the accessible readership. At second glance, however, there is the risk that consumers draw the conclusion that editorial content has to be regarded as a readily available product provided free of charge. Only when the industry had realized this severe threat did managers try to develop new business models for online marketing. In the meantime, a number of intermediaries have been trying to meet customer needs better by individually created news services. They are not publishers, but provide editorial content tailor-made for the reader. Flipboard is the innovator and leader in this small but rapidly evolving market (Macmanus, 2011). Social magazine is a term that Flipboard came up with. The business model focuses on a news reader-type application for the iPad that has the visual appeal of a magazine, along with the social media features common to this era of the Web (integration with Facebook, Twitter, and other social apps). Flipboard can, of course, choose to generate a cash flow by being a paid app in iPad and other app stores. Instead, Flipboard has chosen to remain free, a sensible move given that it wants to maintain its first mover advantage and ramp up its user numbers.

Journals have gone another way. From the beginning they pursued rather a value pricing approach and thereby only address a limited demand segment. While newspapers like *The New York Times* have erected pay walls that are aimed at charging readers pennies per copy for their digital content, reading a single article in an academic journal published by a company such as Reed Elsevier or Wiley can cost up to $40 or more per article. Besides single readers there is a valuable market segment such as libraries: they subscribe to these journals and magazines and have to pay in some cases as much as $20,000 for a single journal. The past few years have seen a change, however. The number of open-access journals is rising steadily, in part because of funders' views that papers based on publicly funded research should be free for anyone to read (van Noorden, 2013). For the authors this has several advantages. First, the publication is cost-effective and secondly, the process of publishing is significantly shorter (between submitting the papers and the publication potentially less than 3 weeks). Thirdly, opportunities to reach a wider audience and to address them with the latest research results are also achieved. Another step in this logic is the development of textbooks to a learning system. While new information and additional facts were previously recorded with the new edition (offline), online publishing leads to completely new opportunities. For example, the German C.H. Beck publishing group, specializing in legal and economic literature, actually offers standard textbooks as online versions in addition to books traditionally sold through bookstores. These ensure that current online jurisprudence experience is taken into account. By contrast, printed books are often already outdated when they appear in bookstores.

As is true for market research also management consulting's fundamental business model has not changed in more than 100 years. It has always involved sending smart outsiders into organizations for a limited period of time and asking them to recommend solutions for the most difficult problems confronting their clients. Typically, companies entrust either large consulting firms or smaller specialists to manage specific issues and to prepare solutions and/or to implement them. This usually happened through solid teams of consultants (larger consulting firms are organized in functional competence centers). Since there is a significant turnover in prestigious consulting at all levels, it is estimated that the number of alumni of the Big Three combined are approaching 50,000 (Christensen, Wang, & van Bever, 2013). Part of this pool is available on the market as individual consultants. Alternative professionals such as Eden McCallum and Business Talent Group (BTG) assemble leaner project teams of freelance consultants (mostly mid-level and senior alumni of top consultancies) for clients. Consequently they are able to offer projects at much lower cost than large consulting teams without clear quality differences (Krämer, 2010). Similar to the successful business model of Airbnb or Uber, the new providers use existing capacities in the market and are not burdened by high fixed costs. Further possibilities arise for the customer-company: the consultancy team can be optimally designed, depending on desired skills.

4.3.4 Differentiated Customer Management to Increase the Customer Retention Rate

The customer lifetime is mostly driven by the length of business relationships with the customer. The longer this relationship is, the longer the customer lifetime. In addition, the longer this relationship, the lower the costs and the bigger the volume of purchase. Typically, the price sensitivity decreases over time due to an increased customer loyalty. Some empirical researches have proved the cited advantages of investments in customer retention. Thus, for instance, Gupta, Lehmann, and Stuart (2004) have shown that it is far more worthwhile to increase the consumer retention rate by 1 % than to increase the rate of attracting new customers or reduce the margin and increase the discount rate (Gupta et al., 2004).

Churn is predictable to some extent, but partly not. If it is possible to predict the customer's likelihood to churn and simultaneously to determine the lifetime value of a individual customer, there are clear options to rank and prioritize management actions. For example, there is a need for immediate action (i.e., the biggest economic risk) if a customer has a high likelihood to churn and at the same time a high lifetime value (expected future gross margins). Forecasting possibilities are improved when both the quality and quantity of data increases. Then, companies can discern the drivers of customer behavior (analysis of variance, correlations, etc.). Instead of descriptive analytics, managers are looking for predictive and further prescriptive analytics. In addition, automated routines are required for larger customer bases, enabling a decision support in individual cases and in real time.

Digitization includes an information flow from consumers to companies but also from companies to consumers. Hence, it is possible (1) to use data to improve the customer experience, (2) to establish systems to collect customer feedback and use it as a learning system, (3) to develop new and modified products to meet customer requirements, and (4) to differentiate the customer management to increase the customer retention rate.

4.4 Customer Centricity as Key Element of the Digital Business Model

As digitalization and big data increase, the role of CRM in organizations is changing. The new way of managing the customer relationship shows a development from the classical target "gathering customer data" and adding customers to defined product campaigns toward a customer-centric CRM approach (Krämer and Burgartz, 2015). Customers only want to be contacted by companies when relevant and only by the communication means preferred. Personal interaction is no longer a must. Using messenger apps, social media forums, and self-service portals, CRM enhances the classical channels phone, mail, and email. In the self-service portal, needed information is directly applicable, and just relevant product offerings are building a customer-centric approach. Offering the right product at the right time can now be implemented on strong usage of smartphone and messenger apps. One-stop shopping with one click will be a challenge for all companies through all branches. Real-time analyzing the “next best offer” is not limited to branches with less customized products anymore (Tachilzik, 2013). Customers will ask for customized offers in a high value and complex product environment, without any time-consuming choosing process. Holiday bookings or even a new car could be offered and bought final customized. The cultural change in knowing or even allowing companies to listen to customer journeys will be reflected in the need for relevant product offerings only, or even direct product deliveries. Companies with a high match of relevant offers will dominate.

Easy and convenient CRM processes will substitute complicated and untransparent processes in sales. Companies with the ability to analyze automated customer data can concentrate their valuable personal CRM processes on the right customers to generate value.

The new CRM has a strong self-service focus which allows validating data by the customers themselves, offers automated relevant customer activities (next best action), and generates a company—wide data source for customer data.

In the final consequence, the changed strategic role of CRM means that the business model has to be aligned accordingly. Based on the model suggested by Osterwalder, Pigneur, and Wegberg (2010), these crucial adjustments are presented (Fig. 4.6). The central element of the business model is the focus on the customer. The consequently modified core elements are (1) the customer data management, (2) the generation of a customer value, and (3) the value extraction, that is, the con-

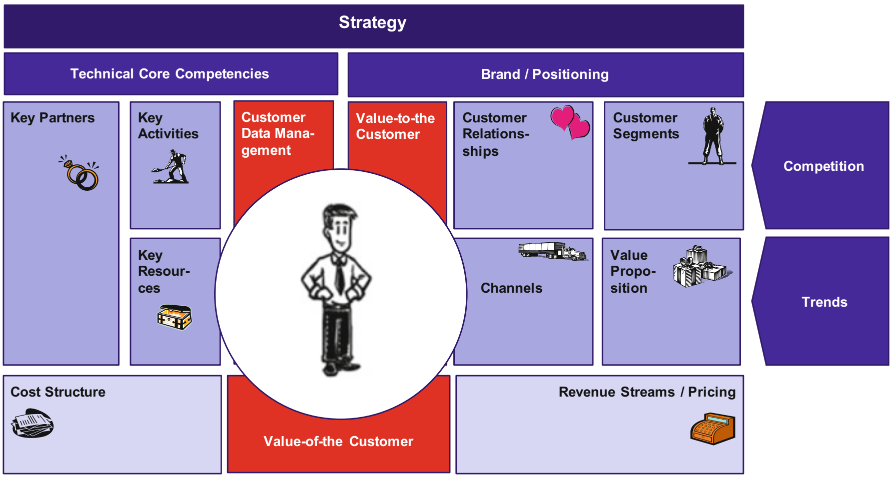

Fig. 4.6 The new customer-centric business model (adopted from Osterwalder et al. (2010))

version of customer benefits into cash flow for the company. All the parts of the traditional business model are thus affected.

Disruptive technologies are both an opportunity and a challenge for the corporate strategy at the same time. The ways to extract valid information from big data and evolve smart data become a competitive factor: on the one hand, tailored products and services can be offered to the customer; on the other hand, the controlling and steering of customer value management in real time is possible.

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Chapter 5
Platform Business Models and Internet of Things as Complementary Concepts for Digital Disruption

Oliver Mack and Peter Veil

Abstract Currently, almost all industries are undergoing a fundamental transformation, based on the approach that everything that can be calculated will be calculated. This more and more leads to a digitalization of the world where software becomes more and more the key success factor also in many brick-and-mortar businesses and change appears more as disruption as evolution. A core concept and business model for the new age is the platform concept. In practice, companies like Airbnb, Facebook, LinkedIn, and Uber are examples of this platform business model. In management theory, the platform model is still in a very early stage of discussion.

The chapter will have a deeper look into the concept of platform business models, describing their characteristics and major functional mechanisms. We will also discuss the major differences in comparison to traditional business models and analyze why it is so difficult to implement this concept in existing companies. Understanding this gives a good explanation why new players in a market using the platform model have such disruptive effects on the whole industry. Also the paper will explore into the concepts of Internet of Things (IoT) and Industry 4.0 (I4.0). With this understanding, it is possible to have a first glimpse why many traditional industries will be "platformized" in the future and what a suitable lens for a company might be to analyze its position, opportunities, and treats in this new game.

Keywords Platform concept • Business models • Industry 4.0 (I4.0) • Internet of Things (IoT) • Mechanical engineering

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O. Mack (✉)
xm:institute, Hyegasse 3/51, 1030, Wien, Austria
e-mail: oliver.mack@mack-consulting.at

P. Veil
Rolandstrasse 85, 50677, Cologne, Germany
e-mail: peter.veil@gmx.net

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5.1 Times of Digital Disruption

Over the last three decades, a lot changed in the world we are living and working. Today we operate in a real global marketplace. Also technological inventions like computers and the Internet sustainably changed the work- and marketplace significantly. Today's environment for organizations but also for workers and consumers can be described as VUCA environment (Mack & Khare, 2015). With high volatility, uncertainty, complexity, and ambiguity, we are now standing at the corner of something new, what Peter Drucker already described in 2001 as the "Next Society" (Drucker, 2001a, b). Brynjolffson and McAfee (2014, p. 45) call this corner together with Ray Kurzweil (2000) "the second half of the chessboard," seeing the phenomenon that due to exponential development of processor power, memory price, and broadband width, in comparison to the past, we will see significant changes based on the digitalization in the near future we cannot imagine today. Many new Internet companies like Google, Facebook, etc. grow with a significant speed. This form was recently named as "exponential organization" (Ismail, 2014).

This article will pick up an important concept of exponential organizations: the platform concept. This concept is a dominant business model in the information and communication technology (ICT) sector and the basis for rapid and sustainable growth of many new Internet companies, like Facebook, eBay, Amazon, Uber, and others (Ismail, 2014). We will describe the current state of discussion on platform concepts and develop a first framework for risk and opportunity evaluation of platform concepts in different contexts.

5.2 Platform Concepts

5.2.1 Markets, Integrated Firms, Intermediaries, and Platforms

The goal of this section is on giving a clearer picture on the central concept that is linked to digital disruption: platforms. Typical examples are companies like Facebook, Amazon, Airbnb, Uber, or WhatsApp. Airbnb is a marketplace, where people can offer a room or apartment for others to rent. It competes against traditional hotels without any own rooms and assets. Although traditional hotels still have their USPs where Airbnb cannot follow, the platform company became a significant competitor of traditional accommodation business in many cities (Cusumano, 2015). Based on this example, platforms have the character of markets, where two or more parties interact directly for their mutual benefit. A marketplace is the defining framework for the interaction may it be prices, opening hours, rules in case of conflict, etc.

Marketplaces are no new phenomenon—they have been around for ages, you might even say that have been around since almost the beginning of mankind.[1] With marketplaces having been with us for such a long time, why should they turn into such a central mechanism right now in the context of digitalization?

In general, the intermediation between two parties can be done in various ways: One integrated firm can sell the goods directly to a consumer. Or a reseller can act as an intermediary, buying the goods from one party and selling it to another party. The market option is another one, where both parties are affiliated and directly interact on a regulated platform (Hagiu & Wright, 2015).

When will which form be better? A main difference between those types lies in the concept of transaction costs (e.g., Jacobides & Winter, 2005). Transaction costs are the costs that come with the coordination of transactions. They include the search costs, the costs of the transaction itself (e.g., payment, logistics), and the costs of setting up and maintaining the market (Coase, 1937). The big advantage of a market in classical terms was that once on the market the transaction costs were much lower compared to a non-marketplace approach. The big problem was to set up the market, organize the market, ensure enough choice and customers, and to get the goods and yourself to and from the market. That is why there were markets, but most of the transactions did not happen in a marketplace setting but rather in a reselling mode or a vertically integrated firm (e.g., Hagiu & Wright, 2015).

With digitalization, the attractiveness of the market model increased strongly as transactions cost goes down significantly by different reasons:

- The character of traded good itself becomes digital (i.e., the e-book market share is expected by ReportsnReports (2014) to increase to more than 27 % in 2019). This directly influences the logistics costs and makes them easy to be traded on digital markets.
- Also bringing demand and supply on to the market is tremendously easier in the age of digitalization, as the search costs are normally much lower (of course it is not enough that offer and demand are digitalized)—the search mechanism becomes crucial.
- And last but not least, the costs of setting up and maintaining the marketplace itself also go down considerably, as technology can be used to observe and control the market.

The disruptive potential of platforms does not come from the fact that there are *more and more* marketplaces going into competition to the traditional firms operating in a vertically integrated or reseller mode but from the fact that the role of the intermediary becomes *obsolete*. In other words, it does not help to adapt and transform your existing business model as the whole business model is disappearing (Christensen, 1997).

[1] It is important to note that we are not talking about markets as a general means of coordination, but about marketplaces which we define as a framework which sets some rules and structure of the market interaction itself. Also interesting to note that from a historic perspective, marketplaces have often been a nonprivate framework, whereas the marketplaces we currently see are mostly privately organized and owned.

In current business reality, digitalization is in all mouth, but it seems that only very few companies so far have really understood the platform game and based on this can clearly define and implement a successful strategy.

5.2.2 An Overall Perspective on Platforms

Interestingly the research around platforms is quite young. A well-perceived piece of work was done by the MIT economist Michael Cusumano and his doctoral student Annabelle Gawer in 2008 named "How companies become platform leaders" (Gawer & Cusumano, 2008). In recent past, more and more research is done on the topic, discussing various aspects of platforms, platform concepts, and platform strategies. But a clear and agreed definition of platforms is still missing. Table 5.1 shows a brief overview of some different definitions and aspects.

Table 5.1 Evolution of different definition criteria of platforms

Year	Author	Category	Core definition criteria	Source
1997	Meyer, Lehnerd	Product platforms	Components that can be reused	Cusumano (2010)
2002	Cusumano, Gawer	Industry platforms	A system whose components are likely to come from different (complementary) companies and the industry platform has relatively little value to users without the complementary products and services from the complementors	Cusumano (2010)
2003	Caillaud, Julien	Multisided platform (MSP)	Cross-group or indirect network effects	Hagiu and Wright (2015)
2006	Rechet, Tirole	Multisided platform (MSP)	Structure of prices is non-neutral	Hagiu and Wright (2015)
2009	Boudreau, Lakhani	Integrator platforms	Intermediator between external innovator and customer	Boudreau and Lakhani (2009)
2009	Boudreau, Lakhani	Two-sided platforms	External innovator and customer are free to transact directly with one another as long as they also affiliate with the platform owner	Boudreau and Lakhani (2009)
2014	Haigu	Multisided platform (MSP)	"Multisided platforms (MSPs) are technologies, products, or services that create value primarily by enabling direct interactions between two or more customer or participant groups"	Hagiu (2014)
2015	Haigu, Wright	Multisided platform (MSP)	Enabling of direct interactions and affiliation of each side to the platform	Hagiu and Wright (2015)

The different definitions have different entry points and theoretical backgrounds, like economics, research on industry structure, product strategy, or competitive strategy. They also differ between two-sided platforms, where only two parties interact, like Uber (professional drivers and passengers) or Airbnb (apartment owners and renters), and multisided platforms going beyond this limitation, like Google's Android operating system (users, hardware manufacturers, software app developers) (Hagiu, 2014). Whereas in older definitions the existence of network effects is used as a defining criterion, newer definitions acknowledge that network effects are coming with platforms but are not a defining condition (Hagiu & Wright, 2015). Another phenomenon that is attributed with platforms is that there is a certain openness (or limited control) of the platforms. Also standards by themselves are not platforms, but it is quite clear that without standards a platform will not get very far (Cusumano, 2010).

Here we propose the following definition: Multisided platforms (MSPs) are common grounds where two or more types of parties can affiliate and directly interact with mutual benefit while being partly controlled by the platform.

MSPs have some specific characteristics which are important to understand (Hagiu, 2014):

- The direct interaction of the parties in MSPs differentiates them from resellers and integrated firms. This means that the parties keep direct control over the key terms of the interaction. The intermediary doesn't take over full direct control of these interactions (Hagiu & Wright, 2015).
- The affiliation to the platform means that parties need to make platform-specific investments that are the prerequisite for the parties to interact with each other on the platform. This leads to lock-in effects of the parties to a specific platform and hinders them to switch easily (Hagiu & Wright, 2015).
- Another factor is that the value to the customer on the one side increases not just with the number of customers (direct network effects) but also with the participants on the other side(s). These effects are called indirect or cross-sided network effects, as they are effective across platform parties and not just within them (Hagiu, 2014). They are basically positive feedback loops that grow at geometrically increasing rates (Cusumano, 2010). The key piece of research on network effects was written by Shapiro and Varian in 1998: *Information Rules—A Strategic Guide to Network Economy* (Shapiro & Varian, 1998). A major consequence of the network effect is the "chicken-and-egg" problem: The likelihood of new participants to join depends on the number of participants on the other side and vice versa. To solve the chicken-and-egg problem is one of the crucial hurdles when building a successful MSP. Also many MSPs show *economies of scale* (especially software MSPs) which also leads to reinforcing feedback loops. The debate if this also leads to monopolistic tendencies is still open. Cusumano (2010) argues that as long as there is enough room for platforms to differentiate and as long as the switching costs for the customers are not too high, monopolization is rather unlikely (also Hagiu, 2007). Of course this conclusion depends heavily on the two "ifs" in the sentence.

- Due to the open character of the platform, there is also a fine line between openness versus control and competition versus cooperation. As the platform play is an ecosystems play, cooperation is vital. On the other hand, as players want to expand their roles in the quest of growth, they can easily come into competition to each other. Gawer (2011) argues that a particular danger is that your complementor of yesterday could become or even dislodge you as a competing platform tomorrow with a Trojan horse strategy.

Now knowing the definition and some main characteristics, we can focus on the main design parameters of MSPs. A quite good summary has been provided by Hagiu (2014), seeing the following main levers:

- Number of Participants: More sides lead to potentially larger cross-side network effects (as with Microsoft Windows), larger scale, and potentially diversified sources of revenues (as with LinkedIn). Two main advantages come with fewer sides. First, it may not be economically attractive for all sides to exist independently. Second, even if attracting many sides is possible, doing so carries the risk of creating too much complexity and even conflicts of interest between the multiple sides and the MSP.
- Pricing Mechanism: As MSPs serve different types of customers, they have different revenues and profit sources. In reality, however, most MSPs function the way that they provide their services for free or at subsidized prices to at least one side of the platform and derive their profits on the other side.
- Governance Rules and Balance Between Openness and Closeness: Governance rules should be place where market mechanisms do not function properly. The main categories are access and interactions.

Due to the all described characteristics of an MSP, it is essential to analyze and act from a fundamental standpoint of systems thinking (e.g., Senge, 1990) and to always have a dynamic and not a static perspective (Hagiu, 2007) as everything seems connected to each other and functions in a highly dynamic mode.

5.2.3 An Individual Perspective on Platforms

As a next step we ask the question, how an individual company can take a strategic role in a potential platform play. The bad news is that successful platforms are hard to build, and definitely only few companies have a viable shot of being the centerpiece (Hagiu, 2014; Gawer & Cusumano, 2008). And even with companies like Google and Apple seeming more dominant than ever before, concerning Facebook market analysts are not that sure: With newer social media platforms on the way, the rise and fall of success is very close (Runge, 2015). Formerly well-established social platforms like MySpace made this painful experience. Especially when opinion leaders leave the platform, others might follow.

To better get hands around our question in this section, it is necessary to shed a clearer light on the business models of platform concepts. A good framework for this has been developed by Kübel and Zarnekow (2014) by building on older literature like Cusumano and Gawer (2002) or Eisenmann, Parker, and Van Alstyne (2009) which is developed a little further in Fig. 5.1.

A platform business model can be described in these five different dimensions (Kübel & Zarnekow, 2014):

- Value Proposition: This dimension describes the value created by the offered products or service to customers and complementors.
- Value Architecture: This dimension describes how the resources and competencies for providing the service are set up and distributed, either technological or customer oriented.
- Value Financials: This describes the revenue side with price models for customers and complementors as well as the cost side for cost of using and switching the platform.

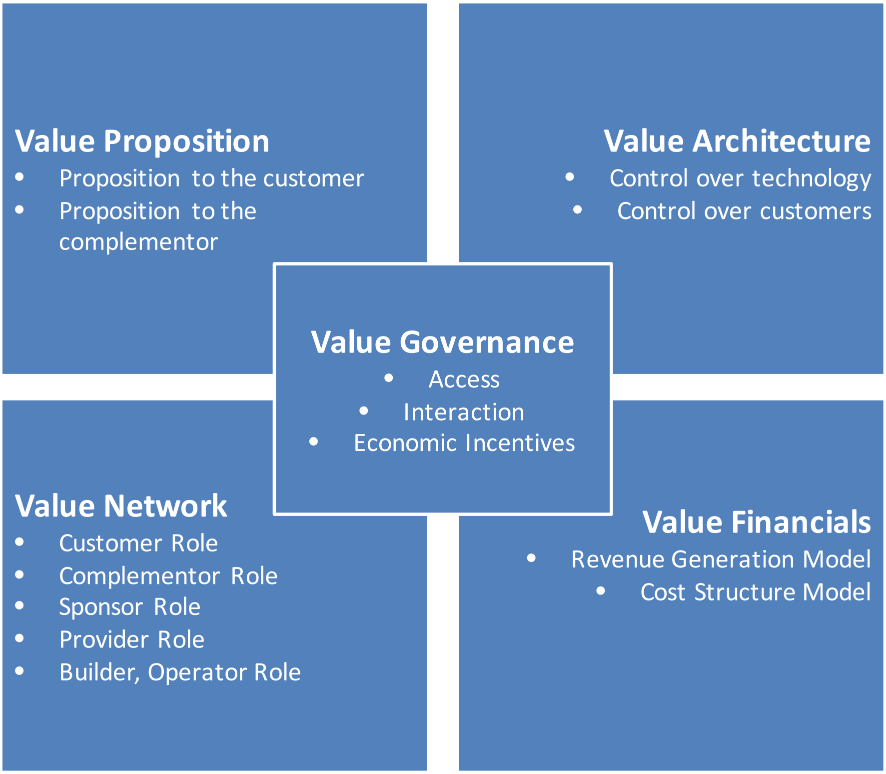

Fig. 5.1 The different design elements in a platform play (based on Kübel & Zarnekow, 2014)

- Value Network: This describes the different roles of the platform concept. Customers are the directly interacting parties on the platform. Depending on platform type, this can be two (two-sided) or many (multisided). Complementors add additional value to the platform in a more indirect way. The other three roles describe the parties for setting up and providing the framing platform. These roles can be taken by one or more companies and the split is for better understanding these aspects. Sponsor is the holder of IP rights and overall business model architect of the platform. The provider can be understood as the primary point of contact of the platform to customers and complementors (Kübel & Zarnekow, 2014; van Alstyne, Parker, & Choudary, 2016). Finally, we added an additional role called builder/operator role, which describes either the service function of building and maintaining the technological infrastructure or even the ownership of the technological infrastructure of the platform. This was based on our practical experiences as a lot of ICT activities are needed in a supplier function to make platforms actually work. Also we see in practice here a significant issue especially in the ICT industry, where many players try to compete for a value governance role (see below), but often are not successful in other roles like sponsor or provider.
- Value Governance: This overlapping dimension focuses on the mechanics of access, interaction, and economic incentives, which is closely linked to other dimensions like value financials or value network. In addition to Kübel and Zarnekow's (2014) four dimensions of platform business models, we added this fifth dimension explicitly as we see these aspects of high importance in the success and functioning of a platform concept.

This builder/operator role is split up more in detail in Fig. 5.2. It describes the technical aspects which are necessary to make a platform work more in detail. As discussed already before, it should be clear that an MSP is not the IT system as such, but to function, MSPs are dependent on a well-designed IT platform.

Unfortunately today there are only a few vague indicators so far, how exactly an individual company can successfully establish a platform concept, as this strongly depends on context factors like corporate (core) competencies, market situation, and competitive dynamics. Some quite generic advice to establish a product or service as a platform can be found at Gawer (2011), who refers to a specific essential technological function, that solves a business problem for many companies in an industry. If this is given, a company has to build an ecosystem around the product or service to keep it attractive over time. Gawer and Cusumano (2008) describe the strategies of "coring" and "tipping" for creating new platforms or winning platform wars in existing platform markets. According to van Alstyne et al. (2016), the competitive forces which we know from traditional industries are still there, but they behave in a very different way and also new factors will enter the scene.

As a next step, we would like to introduce the concept of the Internet of Things (IoT), and "Industry 4.0" links some ideas with the platform concept.

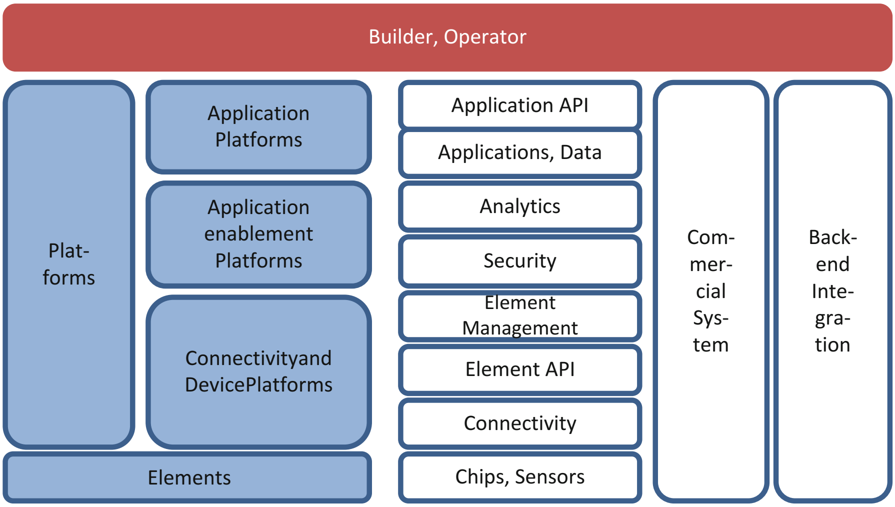

Fig. 5.2 Detailed technological aspects of the builder/operator role

5.3 The Internet, the Internet of Things, and "Industry 4.0"

5.3.1 Similarities and Differences of Internet of Things and "Industry 4.0"

The Internet as of today is a global network of computer networks connecting billions of devices based on the TCP/IP standard worldwide and that offers ubiquitous and inexpensive connectivity to IT devices.

While it was a network of computers in a first step, more and more mobile and other devices are now connected to this global network. The term "Internet of Things" (IoT) is used as an umbrella term to reflect this. Smart connected products or things are objects that contain electronic components, software, and network connectivity that enables these objects to collect, process, and exchange data (Anon, 2016). This communication allows the product to exchange information with its operating environment, users, producers, or other products or systems as well as it allows additional functionality in the virtual nonphysical space (Porter & Heppelmann, 2014).

A similar approach is the so-called Industry 4.0 (I4.0). This concept is broader than the IoT and became famous in 2011 mainly in German-speaking countries when the German government announced "Industry 4.0" as a key initiative of its high-tech strategy (Herrmann, Pentek, & Otto, 2015). Although broadly adapted in German-speaking research and industry, there is currently no generally accepted definition of "Industry 4.0" (Bauer, Schlund, Marrenbach, & Ganschar, 2015). The naming is not well known outside the German-speaking community, but the idea fits well to global concepts like Industrial Internet, Advanced Manufacturing, Integrated Industry, Smart Industry, or Smart Manufacturing (Herrmann et al., 2015).

Herrmann et al. (2015) define the term "Industry 4.0" based on a literature research as "a collective term for technologies and concepts of value chain organization," focusing on the field of industrial manufacturing. It integrates four components (Herrmann et al., 2015):

- Cyber-Physical Systems (CPS): Cyber-physical systems (CPS) are defined as the next generation of embedded ICT systems where computation and networking are integrated with physical processes and they control and manage their dynamics and make them more efficient, reliable, adaptable, and secure (Herrmann et al., 2015). This concept is quite similar to smart products discussed before under the umbrella of the IoT.
- The Internet of Things (IoT): The Internet of Things can be understood as "a network in which CPS cooperate with each other through unique addressing schemas" (Herrmann et al., 2015, p. 9).
- The Internet of Service (IoS): This element is rooted in the concept of interorganizational networks (Mack, 2003). The IoS provides individual service providers the ability to offer their services over the Internet, where services can be flexibly combined into customer-specific value-added services that can be offered in various configurations, integrating them into the value chain activities of interorganizational networks (Herrmann et al., 2015).
- Smart Factory: "Smart Factory can be defined as a factory where CPS communicate over the IoT and assist people and machines in the execution of their tasks" (Herrmann et al., 2015, p. 10).

Although in the definition above IoT is seen as one component of I4.0, overall the I4.0 concept has many similarities and broader overlaps with the IoT approach. Therefore in this article, we will deal with both concepts together, only differentiating by the field of application: The IoT is defined broader and more general, being adopted in the area of manufacturing as well as in the consumer and service industries (Lee & Lee, 2015). The I4.0 focuses more on the B2B business and the operations and productions field (Borgia, 2014).

From our experience "Industry 4.0" currently has two shortcomings: First, it still focuses very much on the technological aspects and does not adequately take into account potentially disruptive changes in business models. Based on the distinction from Porter and Heppelmann (2014), we currently see it more as a framework to increase operational effectiveness than one for strategic positioning. Second, we see it the initiative not at the adequate speed. Compared to the US "Industrial Internet Consortium" (IIC), the German Verbändeplattform "Industry 4.0" seems to be too slow. Rinke (2015) believes that with this concept Germany is still acting like in the dying industrial age.

5.3.2 *Application of Internet of Things and Industry 4.0*

IoT and I4.0 concepts can close the gap between industries that are traditionally physically driven and primary virtually driven Internet and software companies. With IoT and I4.0 technology, we will be able to be connected "anytime" "anywhere" with "anyone" and "anything" by the use of "any path/network" and "any service" (Borgia, 2014). We will briefly look at three levels of application: the technological level, the enterprise level, and the industry level.

Various key technologies are linked to the IoT and I4.0 idea, integrating components and creating platform structures on different levels, where three major technology-oriented levels can be identified (Borgia, 2014): The data collection level, where different sensor technologies are tracking data; the transmission level, where data is transported across higher differences and the process management; and utilization level, where data is finally processed and used via service platform and enabler technology. Thinking about these layers, it becomes obvious already from a technological perspective that IoT and I4.0 are closely linked to platform concepts, especially to the builder/operator role.

On enterprise level, Lee and Lee (2015) identify three different applications of IoT:

- Monitoring and Control: In this case, machines or products collect sensor data on performance, energy consumption, or environmental conditions and allow humans or automated controllers to track and steer the condition of the machines or products anytime and anyplace. By adding more advanced technologies, patterns and areas for improvement can be identified and even (Dijkman, Sprenkels, Peeters, & Janssen, 2015) (e.g., smart homes, smart cars).
- Big Data and Business Analytics: Sensors in IoT products can collect a big amount of data which can be transferred and processed further with data analytics and business intelligence tools. This allows to support decision making based on the information of one single IoT product or by integrating, processing, and analyzing data from many IoT devices (e.g., predictive maintenance, smart grids).
- Information Sharing and Collaboration: IoT devices can also support information sharing and collaboration between people, between people and things, or between things. Sensors can recognize changes or predefined events and initiate a specific communication or action (e.g., beacon technologies in retail stores).

All three applications can be seen as opportunities for cross company platform concepts, where data generated can be used for various value-added data-driven services that go significantly beyond the traditional use of machinery, products, or services.

On industry level, the application of IoT affects almost all areas and sectors, like human/healthcare/personal and social life, home, retail environments, offices, factories/worksites, vehicles/transportation and logistics, cities, and outside (McKinsey & Co, 2015; Azori, Iera, & Morabito, 2010).

For implementation, there are still major challenges of IoT in the areas data management, data mining, privacy, security, and coordination (Lee & Lee, 2015), which can be also seen as opportunities for platform concepts solving the problems in these areas in a more efficient way than individual companies.

5.4 Opportunities of Platform Concepts in the Area of Internet of Things and Industry 4.0

As already indicated, we see big opportunities in linking the idea of platform concepts with the IoT and I4.0 concepts. Let us take traditional industries, like the segment of small- and medium-sized mechanical engineering companies as an example. Many of them are thinking about application of IoT/I4.0 concepts. Seeing this as an enabler for new platform models in their industry, they can provide their current and potential customers services beyond the traditional machine and maintenance models. Thinking beyond traditional one-on-one customer relationships, platform concepts can be the foundation of new business models. The following examples can be understood as ideas for thinking further into this direction:

- Companies can set up platforms collecting anonymous data from all their customers and also open this up for other companies, providing value-added services from this data, like better predictive maintenance or recommendations for replacement investments. They can jump into the sponsor, the provider, but also the builder/operator role to run new multisided business models.
- Companies can even think about moving totally away from developing and selling machines, moving more into the direction of independent maintenance and service providers with business models based on platforms of collecting and analyzing data as a trusted third party player with traditional mechanical engineering companies as complementors on the platform.
- Or even more radical acting as a pure multisided platform provider, bringing together independent local maintenance experts on the one hand side and companies using machinery from different producers on the other hand side. Here the competitive advantage could be the collection and processing of machinery data about the status, production hours, technical parameters, etc. across different machines and producers as well as service engineers in a way individual mechanical engineering companies would never be able to do.
- These examples might show directions, in which traditional mechanical engineering companies could move. Either in a direction where platform models are

a valuable additional service they can offer to the customer or even in a direction where data collection, transportation, and processing/analytics in form of a platform concept become the core business of the company, replacing completely the machinery production. But not just for mechanical engineering companies, but also for ICT companies, the integration of those models offers new opportunities. ICTs are traditionally in the builder/operator role, but with the virtualization and digitalization of the mechanical engineering industry, software companies or telecommunication companies can take over a stronger role as platform sponsors or providers in this industry, as the needed core competencies are more in the area of software development and customer service than in physical mechanical engineering.

5.5 Closing Remarks and Outlook

The idea of the chapter was to give an idea about the concepts of platform business models and strategies as well as on the concepts of IoT and I4.0. We gave also a first idea on how these two concepts might fit together and which benefits arise when combining both, based on the example of the mechanical engineering industry. As we see a strong platformization trend in many industries, we see this as a core concept to be understood when talking about the digital disruption. Further research is needed in this area, like concrete frameworks to analyze and judge which industries are how likely to get platformized or frameworks to analyze and judge which role to take in a specific platform ecosystem and what a specific player should do in a platformized business situation.

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Chapter 6
How Digital Disruption Changes Pricing Strategies and Price Models

Andreas Krämer and Regine Kalka

Abstract The digitization of the economy leads to significant changes in the way companies determine their prices. Technological changes (availability of the Internet, digitization of production, product innovations) basically influence the corporate environment, since the basis for pricing can be improved. Companies can collect and analyze more relevant information and hence optimize their prices. However, these causes accelerate competitive reactions. On the one hand, consumer behavior changes (more information is available online, search engines and price robots help to find best offers); on the other hand, market structures become fragile (market entry barriers for new competitors are lowered, traditional products are cannibalized by digital products). Due to these factors, the pricing strategy must undergo a complete rethink. In addition, this has consequences for the types of pricing models applied in the digital age. In this context, this paper focuses on four pricing models. Firstly, the digitization makes it possible to offer products and services for free to the consumer (Facebook and Google are particularly profitable examples), while at the same time other sources of revenue streams (here: advertising revenue) are generated. Secondly, freemium models are especially popular with start-ups, which are also free of charge for a basic service, but for upgraded services (full range of features, no ads), users pay a fee. LinkedIn, Dropbox, and Spotify are prominent examples of this pricing model. Thirdly, subscription models have a strong boost. Since production costs drop when new business models are based on digitization, subscription models (like Netflix)—which have a long tradition—become more attractive, nowadays. Fourthly, pricing models with flexible prices, which are dependent on demand and customer profile, will be discussed. Dynamic pricing has a growing importance in online trading, but is also being applied more frequently in retail stores.

A. Krämer (✉)
exeo Strategic Consulting AG,Wittelsbacherring 24, 53115 Bonn, Germany
e-mail: andreas.kraemer@exeo-consulting.com

R. Kalka
HSD University of Applied Science Düsseldorf, Von-Groote-Str. 43, 50968 Köln, Germany
e-mail: regine.kalka@hs-duesseldorf.de

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This paper examines the implications of digitization on strategic and operational pricing decisions and shows examples from various industries (retail, media, music) and enterprises. The limits of technological changes are also discussed, mindful of both aspects the company perspective and the perspective (and perception) of the customer.

Keywords Big data • Freemium • Dynamic pricing • One-to-one pricing

6.1 Good Reasons to Rethink the Current Pricing Strategy

A frequently stated key objective of pricing strategies is maximizing sellers' profits by capturing consumers' heterogeneous product valuations and accounting for competition and cannibalization (Kim, Natter, & Spann, 2009; Simon, 2013). Furthermore, consumers' willingness to pay and reactions to different pricing strategies may not be purely rational but rather driven by behavioral aspects, such as perceptions and preferences. Therefore, consumers' perceptions of different pricing models may be an additional opportunity for companies to differentiate themselves from competition (by applying a preferred or innovative pricing mechanism that is not typical for the industry).

Today, for most businesses and markets, customer loyalty and customer relationship management have become key competitive factors. During the process of optimizing prices, it is often assumed that the market is composed of single transactions, missing the perspective of a dynamic customer relationship with the company. Therefore Krämer (2015) proposes a widened definition of optimal pricing. This should include the customer's willingness to pay as well as taking into account the effects on customer loyalty, and future gross margins generated by individual customers in terms of customer lifetime value.

There are several major factors motivating a company to rethink its positioning and its pricing strategy: (1) excess capacities raise the question whether there are ways to significantly increase sales. In a digital company there are almost no capacity constraints (at least in the short run). (2) Managers increasingly face the risk of commoditization. As a recent study of Roland Berger Strategy Consultants (2014) shows, ~60 % of managers believe they are caught in a "commodity trap" (a situation where even complex products and services are downgraded to "commodities," with limited differentiation and a competition that is primarily price based). Therefore, decision makers are looking for a new (unconventional) way to set prices. (3) In many new markets, lowering prices makes the market grow more quickly. The lower the price is, the stronger the additional demand effect. For firms that do not fear the risk of revenue cannibalization, radical price reductions could be an option to attract new demand (Krämer & Burgartz, 2016). As a consequence, it is stated that managers in marketing and sales increasingly see themselves exposed to stronger price competition and even price wars (Bertini, 2014).

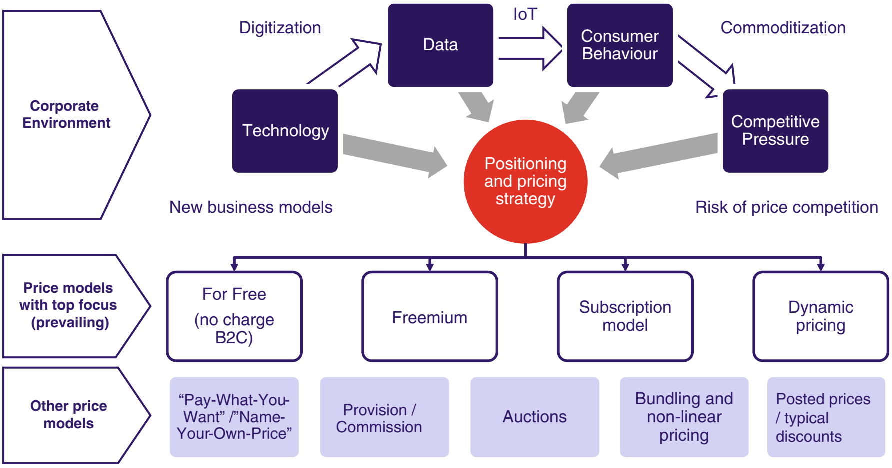


Fig. 6.1 Impact of a changed corporate environment on pricing models

Essentially, there are four pricing models that characterize the digital world and have themselves led to a certain disruption in pricing: (1) the free (no charge) offering, (2) the freemium model (created from "free" and "premium"), (3) the subscription model, and (4) the dynamic pricing. The discussion below will focus on these models. Nevertheless, other pricing methods have evolved in the Internet age, which are, however, less widespread (Fig. 6.1).

One trend is toward participative pricing, which gives customers more options to acquire a greater influence on the setting of prices (Krämer & Burgartz, 2016; Bertini and Koenigsberg, 2014). The most prominent examples of participative pricing mechanisms with horizontal interaction are auction (classic auctions, reverse auctions, and exchanges) negotiations, in which the buyer and seller haggle over the price for the product; eBay is certainly the most prominent example. "Pay what you want" (e.g., openbooks.com) and "name your own price" (e.g., priceline.com, bandcamp.com) are both characterized by the buyer setting the final price (Kim et al., 2009). The subjective evaluation of whether the price is adequate for the performance and represents fair value is the main factor influencing the final price.

6.2 Prevailing Price Models for the Digital Economy

Subsequently, first, a pricing model is presented, which is particularly extreme in its design: a model where the price of the product or services is zero. Based on this model, an extension is considered, the so-called freemium model. In contrast, models such as subscription fee and dynamic pricing are more driven by the objective of exploiting the consumers' willingness to pay. This is particularly true for an extreme form of dynamic pricing, which uses customer data and profiles in order to develop an approach for one-to-one pricing.

6.2.1 For Free

A key objective of innovative pricing models is to activate latent demand. To offer utilization of a product or service without being charged seems particularly effective for attracting new customers. One issue, often pointed out from behavioral economics, is that benefit increases disproportionately during the transition to a zero-price offer ("for free"). Ariely (2010, p. 107) describes this phenomenon as follows: "Zero is almost another world. The difference between two cents and one cent is small, between one cent and zero cents, however, enormous."

One strategy—perfectly executed by Google—is to charge third parties. The first step was to offer an outstanding search engine for free and to generate value to the customer, which led to an enormous flow of traffic. In 2015, mainly due to advertising, Alphabet (Google) earned profits of almost $16 billion after taxes, based on $75 billion revenues. When Gmail introduced its free service in 2004, it provided ten times more storage than Yahoo, the leading provider of free e-mail at the time. Yahoo, the leading provider of free e-mail, responded to Google's entry by matching, and then exceeding, Gmail's free storage offer. Another example is Finnish telecommunications company Blyk, which offers 200 free cell phone minutes a month to 16- to 24-year-olds who fill out a survey and agree to receive ads. Blyk then sells access to its customers, and information about them (Bryce, Dyer, & Hatch, 2011).

Another strategy may be to offer a product free of charge in the market in order to create a new market (e.g., as a launch action) or to stimulate additional demand in off-peak periods. Megabus, a leading supplier of intercity bus trips, used this trick when entering the German market (Krämer, Jung, & Burgartz, 2016): it proposed to supply 20,000 free tickets to get into the market in January 2016 (only the payment of a transaction fee was required). BlaBlaCar, a French start-up company, which offers car ride sharing has a free of charge service in Germany, while in France a provisional model was established once the market had developed. Basically, the offer of a free service seems particularly attractive for the start of the life cycle of a product (launching of the product free and later charging a normal price), an extreme form of penetration strategy. However, there are counterexamples as well. Thus WhatsApp, the leading supplier of messenger services, announced early in 2016 that it was abandoning its 99-cent subscription fee. Obviously, the subscription system introduced in 2013 had become rather a barrier, preventing the company from growing fast enough during its global expansion (the volume of users exceeded the threshold of one billion in 2016). However, the company pledged not to introduce ads and instead hopes to find a way to make firms pay to connect with customers using the app.

Other companies use free services as an integral part of their product range. German Rail (DB) provides free train travel for children up to the age of 14, if accompanied by their parents. On the one hand, such an offer always includes the risk of revenue cannibalization; on the other hand, risks are limited here. Furthermore, the free travel of children leads to a nonlinear pricing of the family journey and thereby improves the competitive position of DB.

Obviously the main advantages of offering products and services for free are the attention gained and the rapid generation of customers by reducing or even eliminating their financial risks. By using “pricing for free,” companies have a powerful marketing and an easy sales promise and can achieve a good market position in the short term. But, of course, there are risks, which need to be taken into consideration. Consumers could have the attitude “what costs nothing is worth nothing.” This attitude depends on the subjective value of the product and/or services and has to be evaluated by the company with regard to their brand identity and portfolio. Moreover a study of Shanpan’er and Ariely showed that in the zero-price conditions, test persons were more likely to choose a less attractive product than to pay a reduced price for a higher quality and more attractive product. By testing several possible psychological antecedents of this effect, they found out that the affect is the most likely source and conclude “In general, this research joins a larger collection of evidence, showing that zero is a unique number” (Shanpan’er & Ariely, 2006).

The most important driver of the success of this pricing model is to find a way to cross-finance the zero-price product. As shown, the most successful strategies are either to charge third parties, to create a new market, or to use it as integral part of the product range.

6.2.2 Freemium

The digitized era has not only spawned new business models and products but also new pricing models. During the last decade, “freemium”—a combination of “free” and “premium”—has become the dominant business model among Internet start-ups and smartphone app developers. Users, who are just interested in a basic product or service, receive it for free. If a service with higher quality is preferred, the user can opt for a subscription fee. Nowadays online music providers offer the possibility of listening to an almost unlimited range of songs simply by free registration for an online music account. The challenge for the provider, which covers the cost, is to find a way to cross-finance such offers. One option is to embed advertisement; another is a freemium approach, a popular pricing method due to its user-friendliness. Today, we find various Internet services based on the freemium concept—such as LinkedIn, Dropbox, or Skype (Kumar, 2014)—and the majority of the smartphone apps are based on this concept.

There are obvious advantages of a freemium strategy. First, free features are a potent marketing tool, when basic features offered for free meet fundamental consumer needs, such as free music (Spotify), free cloud-based storage (Dropbox), or free calls (Skype), and free services are conveyed in the social networks as an instrument to distribute new services quickly. Second, it allows new ventures to scale up and attract a user base without expending resources on costly ad campaigns or a traditional sales force. For venture capitalists, it is an attractive proposal to see a business grow at high speed and at the same time generate revenues. Here the subscription fees, typically charged monthly, come into play, since they become a sustainable source of revenue. Dropbox attracted 200 million users with a simple service. Provided a customer has a username and password and thus a unique login, two gigabytes of cloud-based storage is provided for free. If users perceive the storage volume as too limited, they can pay $9.99 a month (or, alternatively, $99 a year) for 100 GB of storage. Hence the business model targets at least two different customer segments. The first segment is satisfied by the adequacy of the free version for basic documents; the second segment needs more space since customers use Dropbox professionally or back up large files (music, photos). By accepting the subscription fee, people belonging to the second segment create a cash flow that is necessary to cross-finance the first segment. Although there is a certain willingness to pay even in the first segment, Dropbox leaves the full consumer surplus on the user side.

One important success factor for the freemium concept is, therefore, to increase the conversion rate (or reduce the correlation between users who pay nothing and users who pay the subscription fee). However, a high conversion rate could also be counterproductive (Kumar, 2014). Accepting that one of the benefits of a freemium model is the ability to generate traffic means that a significant basic customer value delivered for free is required. Additionally, the supplier must find a way to make its service distinctive and create additional value.

Another important point is easily overlooked: a large number of users who do not pay for performance not only generate costs but are also an asset, for they increase the company's goodwill (an important factor when measuring company value is the customer base). While Skype attracts 400 million users (many of whom become paying customers), Flickr, the free photo-sharing site, has a much smaller user base and a low conversion rate. This partially explains why eBay paid $2.6 billion for Skype (in 2011 Microsoft even paid $8.5 billion in cash to aquire Skype; the number of users amounted to 660 million at that time), and Yahoo paid less than $30 million for Flickr.

Furthermore, the seller also has unlimited possibilities to gain insight into their consumers by observing the usage behavior or to understand customer behavior better (e.g., Spotify can identify what kind of music a specific segment prefers or shares and categorizes customers based on those information and can use the same data to define upsell campaigns and LinkedIn offers a free premium account or the option to use Lynda.com, a service that provides educational videos, for a limited period of time).

6.2.3 Subscription

The subscriptions model including a yearly or monthly payment does not constitute a truly new form of pricing. Even before the digital age, companies used subscriptions either to generate customer loyalty by offering subscriptions or to achieve a basic utilization of production and marketing capacities. The underlying price logic of flat price, however, has a significant disadvantage in a non-digital world. Consumption must be limited at all costs. In newspapers and magazines, a given circulation defines this limitation. Corresponding limitations for service branches such as fitness studios or telecommunications would hardly be feasible. An example for a kind of "natural" limitation is embodied by hellofresh.de. The online food service sends their members weekly cooking boxes filled with the ingredients to prepare a specific recipe for a price flat per month. Dollarshaveclub.com follows the same concept sending their members specifically chosen blades, shaves, and creams each month for a monthly flat rate. The frequency of the delivery can be adjusted, and the membership can easily be canceled per month for both these online shops.

The high market share of the public transport in Switzerland is not only due to easy access by train and bus as well as outstanding network and quality but also due to the proliferation of the "General Abonnement" (GA), which guarantees unlimited use of buses and trains in Switzerland. Currently about 6 % of the Swiss population own this network card. A significant proportion of the total public traffic is allocated to this ticket. Consequently, the GA allows the public transport system to predict quite accurately with respect to demand, but there could also be capacity constraints if the GA is utilized intensively. The example also shows that no effective levy of willingness to pay is possible with flat pricing. For those with low train use, there is a slight discount compared to the regular price, while a very strong use results in an extremely high discount (Kalt, Bongaerts, & Krämer, 2013). In Germany, the BahnCard is a well-known marketing element (five million users) to increase train trips. Customers of Deutsche Bahn pay a yearly card price (subscription differs across target groups) and get access to a 50 % discount on the usual full flex fare (BahnCard 50) and 25 % discount on full flex and saver fares (BahnCard 25), respectively.

The subscription model is not only used by industry giants like Netflix but also by promising start-ups like The Honest Company. Launched by actress Jessica Alba, the e-commerce company The Honest Company could collect 100 million dollars in Series D funding in August 2015—with an average rating of 1.7 billion US dollars. The basic idea is a monthly fee for a constant supply of ecological products for babies and small children.

The safety of capacity consumption and/or product use is one advantage of the subscription model while also being an efficient instrument for customer loyalty. It can be especially targeted at heavy users and users who prefer to have certain price security. At the same time, the model includes an entrance hurdle. Therefore, communicating the key value is one of the main success factors, and the customer loyalty is mainly based on a contractual level. In addition, important elements of emotional and nonrational customer loyalty must be kept in focus and have to be expanded. Finally, there is an ultimate risk for the provider if the consumption growth is stronger than expected, accompanied by an increase in the variable costs.

6.2.4 Dynamic Pricing

As the economist Paul Krugman has pointed out, dynamic pricing is merely a new version of the age-old practice of price discrimination (Krugman, 2000). Parties involved in commerce have experimented with variable pricing since the beginning of commerce itself. Yet, what is new about today's form of price discrimination is that current technology has made dynamic pricing not only widely possible but also commercially feasible and faster. Over the past 15 years, technological development has progressed further. Digital companies offer customer accounts in which all the essential data is recorded, they know about the search behavior of customers and their preferences, even being able to discern the probability of them terminating their relationship with a firm.

In comparison to the previous three models the dynamic pricing is not to be regarded as an acquisition instrument to attract new customers. It is more a general rule and the fact that prices can vary due to specific factors is not openly communicated to consumers.

Since for pricing managers the limitations of an undifferentiated posted price are clear, they are working with a wide toolbox to adjust prices. A common form of dynamic pricing is variation of prices over time. On days or time slots in which the companies expect a clientele with more purchasing power, the prices will be increased and correspondingly reduced in times of weak demand. These are norms that consumers have experienced over many years for services such as airlines, hotels, or car rentals. These companies strongly rely on yield management systems, which try to improve capacity utilization and overall revenues by adjusting available prices to demand (see Cross, Higbie, & Cross, 2011; Hinterhuber & Liozu, 2013). More recently, other sectors like the retail sector are also discussing the increasing use of dynamic pricing.

A further more extreme form of dynamic pricing is to set personalized prices, in which data analysts help companies identify the characteristics of the purchasing environment or the customer's profile and behaviors impacting their willingness to pay. In the USA, for example, *The Wall Street Journal* found that office superstore Staples adjusted prices as did Home Depot and Orbitz, the popular online travel company. In Germany, a study verified that a company supplying lenses online offered customers a lower price when acquired via Google Shopping Ads to the web shop compared to the price via a direct visit to the web shop. Consequently, the direct, and obviously, loyal visitor pays a higher price than a customer probably coming for the first time to the web shop (Kolbrück, 2015).

The Internet, big data, and digitization enable firms to technically incorporate information into their price setting with the help of algorithms such as:

- Time-based pricing: prices rise systematically when increase in demand is foreseeable and alternatively fall when a decrease in demand is forecast. Attractiveness, weather, and school vacations, e.g., can be influence factors.
- Competitive-based pricing: the competitor's price changes can influence the own pricing policy.

- Distance-based pricing: the distance a customer is located from the next bricks-and-mortar store.
- Browsing-based pricing: the customer's browsing history provides knowledge of its willingness to pay.
- Past-behavior pricing: the customer's transactions and hence his loyalty in the past (product, price, etc.) determine the current price.
- Device-based pricing: the use of the technical device (type of smartphone, PC, laptop, tablet), which generated the query, influences the price.
- Demographically based pricing: the customer's age and gender allow an estimation of his willingness to pay.
- Dynamic merchandising: prices adjustment as a tool for stock and inventory management.

Online businesses have experimented with tailored offers since the dawn of the Internet era. Amazon was one of the first to move in price discrimination. In 2000, Amazon.com Inc. infuriated many customers when it sold DVDs to different people for different prices. Amazon called it merely a test and ultimately refunded the price difference to people who paid more (Valentino-Devries, Singer-Vine, & Soltani, 2012). Jeff Bezos said in a news release: “We have never tested and we never will test prices based on customer demographics”; founder and Amazon.com spokesman Bill Curry said the tests were useful in determining a price point—the right balance between how much Amazon.com could charge and still maintain a good sales volume. Nevertheless, because of the consumer outcry, Amazon.com ended up refunding 6896 customers an average of $3.10 each, or a total of $21,377.60.

Despite the public criticism, there were economists who justified Amazon's activities as fair. For example, Weiss and Mehrotra (2001, Nr. 21) argued: “Proponents of personalized pricing contend that prices based on value, and not cost, benefit not only companies, but also those consumers who are offered relatively lower priced goods and services, since these customers pay only as much as they value the goods or services.” There are doubts, however, that the majority of consumers regard such behavior as fair and acceptable (Krämer & Kalka, 2016).

At the end it is the decision of the company, whether the strategic focus of the company is to build up customer relationship and loyalty (this is achieved through a high customer benefit, the so-called value to the customer) or whether the focus is rather on a short-term maximization of cash flows (“value of the customer”). In this case, a company is aiming to extract as much of the consumer surplus as possible (Bongaerts & Krämer, 2014).

Here, the four pricing models presented above have a very different focus. In the trade-off between the “value to the customer” and the “value of the customer” decision, the pricing model for free is in favor of the consumer (Fig. 6.2). In this case, the provider requires a different source of liquidity (Krämer & Burgartz, 2015). As is widely known, Google's decision was (in 2000) to define revenue from advertising and analytics, as, e.g., from the B2B business based on AdWords, as the economic core of its business model (Bernasek & Mongan, 2015).

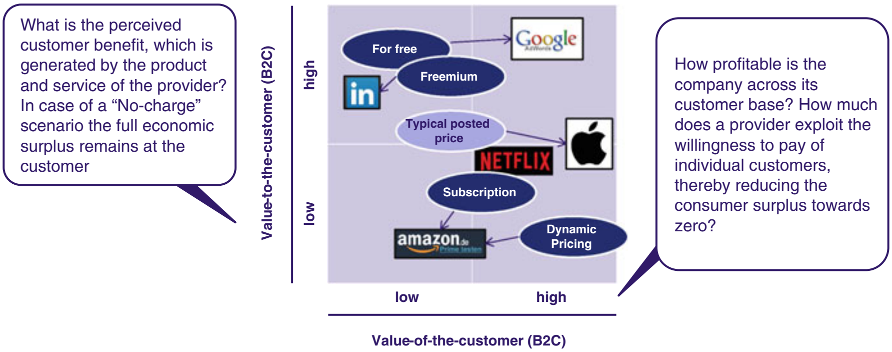


Fig. 6.2 Pricing models of the digital age and customer value

6.3 Case Study: Dynamic Pricing at Amazon

The e-commerce giant Amazon is used as a case study for the review pricing strategies in the Digital Age. The first step explains the special characteristics, which make the Amazon’s business model unique. In the second step, a core element of the business model will be investigated in detail: the customer-centric orientation of the company. Based on an empirical analysis in Germany (online survey, Sep. 2015), the competitive edge of the Internet retailer is investigated from a customer perspective. The prices of a random sample of products at Amazon are analyzed based on typical forms of price discrimination that are used in online retail. Finally, the customer’s perspective (review different forms of price variation on Amazon) is introduced.

6.3.1 Key Elements of Amazon’s Business Model

Founded in 1994, Amazon.com is a leading e-commerce firm, engaging in the retail sale of consumer products, selling merchandise and content purchased for resale from vendors, as well as those offered by third-party sellers through retail websites, such as Amazon.com. Amazon did not invent the online store, but the company recognized the potential to transform the way consumers shop by building the next generation platform and infrastructure that gives customers unprecedented choice, scope, and value. From the beginning the business model was purely customer-centric. By building the online shopping platform, Amazon radically reinvented the traditional retail business model and the fundamental dynamics of how consumers shop. While the company started as a bookseller, it later began manufacturing and selling electronic devices (including Kindle e-readers, Fire tablets, Fire TVs, and Echo, as well as Fire phones). The company is continuously looking for scale effects. Therefore, Amazon acts as a reseller for high-demand products but also as a multisided platform for long-tail (low demand) products, which are available on the site from independent sellers.

An activity lesser known in the public eye is that Amazon offers Amazon Web Service which encompasses fulfillment, publishing, digital content subscriptions, advertising, and co-branded credit card agreement services. AWS indeed has a first-mover advantage. It was built from the company's core technology infrastructure and makes web-scale cloud computing cheaper and more accessible and turned out to be very profitable.

Since 2004 Amazon has offered its loyalty program Prime, an annual membership program with a fee of $99 (US) per year ($79 in 2005). The loyalty program provides free shipping of various items, access to unlimited streaming of movies and TV episodes, and other services. It was estimated, that at the beginning of 2016, Amazon Prime has reached 54 million members. Prime membership is an efficient growth tool since it tends to cause subscribers to stop shopping anywhere else. Consumers who know Amazon are aware that prices indicated on the platform are competitive. When customers decide to become a Prime member, shipping costs are no longer an issue. Subscribers automatically defer to shopping at Amazon first because they know shipping is free and fast, due to express service. Amazon covers all the shipping on Prime orders. A 2011 investigation estimated that the average Prime member used $55 worth of shipping and $35 in digital content annually. In other words: Amazon was "losing" $11 annually by collecting its $79 membership fee (Tuttle, 2013). But this did not include the main trigger of the customer relationship. Amazon's share of the wallet is strongly increased, as well as customer loyalty and, thereby, future contribution margins across its customer base.

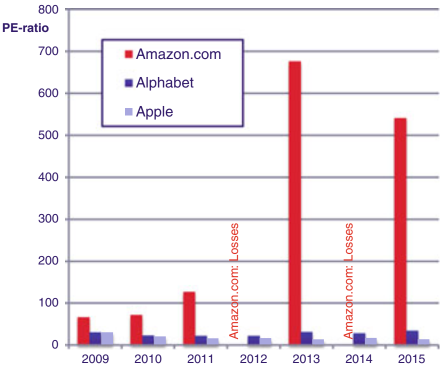
For years, Amazon has been obsessed with growth. Total revenues tripled from $34 billion (2010) to $107 billion (2015). Amazon made clear decision long ago to trade off short-term profit against long-term cash flow. Its key strategy is to be able to capture the largest market share and scale possible that will allow it to drive down costs and increase profitability in the future.

This is reflected in Amazon's financial performance indicators. In 2012 and 2014, Amazon generated losses while at the same time revenues strongly increased. In 2015 the price earnings ratio amounted to more than 500, compared to 250 for Alphabet and 20 for Apple, the most valued firms in terms of brand value (see Fig. 6.3). Even in 2015 when Amazon profits after taxes raised to $0.6 billion, the overall return on sales was only 0.6 %. Retail giant Wal-Mart reached 3.4 % at the same time (profits of $16 billion related to revenues of approximately $485 billion).

6.3.2 Building Customer Equity Based on Trust and Customer Centricity

As Simons (2014) stated, Amazon devotes maximum resources to pleasing consumers, even if that means sellers or content providers sometimes feel short changed (sellers whose storefronts are hosted on the Amazon platform have been known to sue Amazon for more resources). This is a side effect of customer centricity

Price-Earnings Ratio of leading Internet Companies



Amazon.com: Revenues and Profits (2010-15)

Year	Revenues ($bn)	Profits after taxes ($bn)	Profits in % of revenues
2010	34.2	1.152	3.4%
2011	48.1	0.631	1.3%
2012	61.1	-0.039	-0.1%
2013	74.5	0.274	0.4%
2014	89.0	-0.241	-0.3%
2015	107.0	0.596	0.6%

Fig. 6.3 Amazon.com: financial performance indicators

innovation such as Prime free shipping, detailed product reviews (including negative ones), look inside this book, and the listing of lower-priced products from onsite competitors. While competitors have often criticized these practices, Amazon has continued to improve its competitive position and success story due to unparalleled customer loyalty and stratospheric stock valuations.

Prime was introduced in 2004, as a result of Amazon searching for the right loyalty program for many years. An Amazon software engineer named Charlie Ward first suggested the idea of a free-shipping service via a suggestion box feature on Amazon's internal website. One direct effect that comes with the Prime membership is an increase in spending at Amazon. Consumers shift budgets from other retailers to Amazon, leading to a strong sales growth. It is estimated that Prime members increase their purchases on the site by about 150 % after they join and may be responsible for as much as 20 % of Amazon's overall sales in the USA. According to a study by RBC Capital Market, 39 % of Prime members had expenditure of more than $200 in the past 90 days, and for 25 % expenditure was between $101 and $200. While almost 67 % of prime members spent more than $100 in 90 days, the corresponding figure for non-Prime customers was 28 %.

A study conducted by the authors reviewed in which elements customers see Amazon's performance superior to its competitors. During the survey 500 consumers from an age of 18 years were interviewed in Germany (Online Study, September 2015). From the perspective of Amazon's customers, the most important performance characteristics are the wide product range (85 %) and fast delivery (80 %), followed by a clear account (55 %). Astonishingly, the factor "low price" ranks only in fourth place in the top performance with 53 % (Fig. 6.4). This reflects the fact that German consumers are not primarily focused on getting the lowest possible price on Amazon, but rather that service elements receive clear preference. Particularly the customer account that provides transparency with respect to its previous orders is seen as beneficial by Amazon customers.

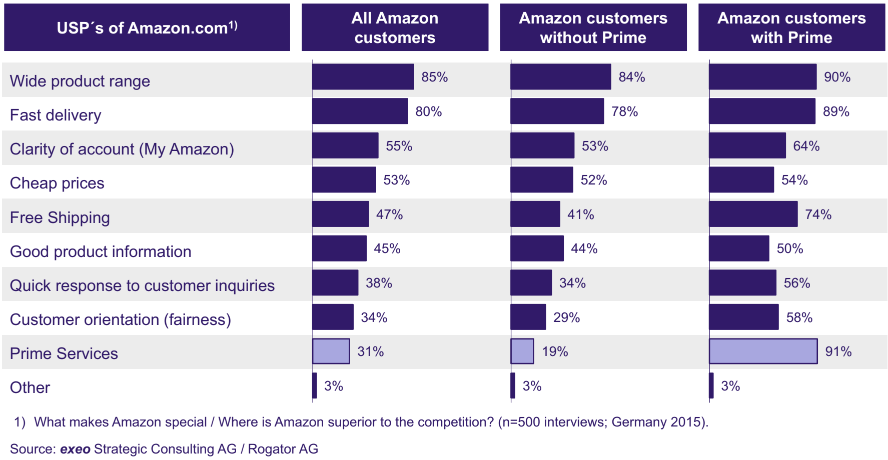


Fig. 6.4 Amazon's unique selling proposition

These findings correspond to the results of a study that compared Amazon's pricing with that of its main competitors (Boomerang Commerce, 2015) and show that Amazon isn't always the cheapest place to shop. The giant online retailer uses its vast computing resources to monitor and analyze the prices of many thousands of items sold by competitors. Popular items are quickly discounted, while items that are less attractive may actually cost more than they do on rival sites. In almost two thirds of all observed products investigated in the study, Wal-Mart's products were exactly the same price as on Amazon.de; for products that are core to Amazon, Wal-Mart turned out to be less competitive and vice versa.

Customers with Prime status basically show a similar preference structure. However, results indicate that Prime members particularly value services such as free delivery and other prime features provided exclusively for them.

In addition to the information provided to customers about their accounts, Amazon still has a variety of customer-specific information. As Villas-Boas (2014) points out, sales are recorded, as are browsing and "click through" patterns for each personal computer accessing Amazon.com, which enable Amazon to understand demand much better than the competition. Amazon does this by tracking not only what customers bought but also what else they looked at; how they navigated through the site; how much they were influenced by promotions, reviews, and page layouts; and similarities across individuals and groups. Since the business model was fully digitally driven, customer and data analysis have been core competencies of Amazon from the beginning, providing all the information needed to pursue all kinds of price discrimination. Competitive pricing requires data, intelligence, and strategy, played at high speed and at a high level.

6.3.3 Research on Price Discrimination at Amazon.de

According to a study conducted by price monitoring provider Minderest, it was found that Amazon made more than one million price changes on Valentine's Day alone (Minderest, 2015). For each product, prices fluctuated within a few hours by up to 240 %. The reason for this variation in the price is the algorithm of "dynamic pricing," which is currently being developed by Amazon. As previously mentioned, this tool will maximize profits depending on the market price and economic viability. Changes can be made in a short period of time in order to increase competitiveness. To date, Amazon is the leader in using this business intelligence tool. To illustrate this with a clear example—the camera "Nikon D610 SLR" was truly remarkable as the price fluctuated between EUR 700 and EUR 1.687. This meant a difference of EUR 987 or 240 %. These savings could have been achieved, if the camera had been ordered on Feb 12 at 10:00 am, instead of on Feb 13 at 9:26 pm.

Whether prices at Amazon vary or not, how strongly they differ, and what forms of price differentiation are applied was reviewed based on an experimental study. Here, prices for selected products were recorded on the websites of Amazon and competitors, and compared. This was done simultaneously by using different types of devices. In this way, it could be examined whether, for example, customers with iOS devices were shown higher prices than consumers using other types of devices. The investigation also included an analysis of mid- to long-term price developments, which was executed using the website www.mein-wunschpreis.com. The results showed significant fluctuations in price in the long term, e.g., by up to 300 EUR for the camera (Nikon D610) as well as for the coffee machine (Krups Nespresso 3006X). In contrast, little price variations were evident on the individual consumer level (Fig. 6.5). However, variations in price were observed, e.g., on one day the coffee machine was offered cheaper when requested via smartphone with operating system iOS compared with other types of devices (including laptop with iOS).

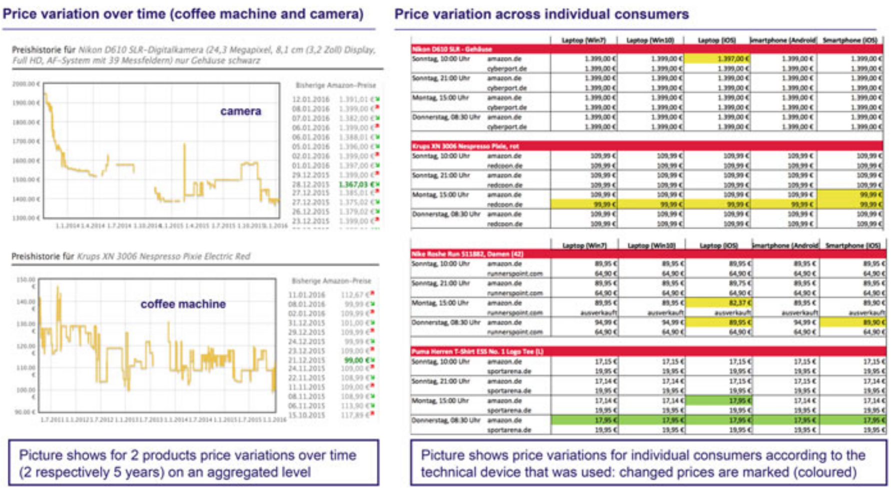


Fig. 6.5 Research on Amazon's price discrimination

6.3.4 Customer Perspective on Amazon's Price Discrimination

While the price monitoring aimed to generate objective results in terms of price variations in online retail and to determine forms of price differentiation, a consumer survey examined how the Amazon customers evaluate different forms of price discrimination. First, during the survey a form of dynamic pricing was presented in which the seller changes the price of a product according to demand. Consequently, prices for one and the same product may vary, sometimes being higher, sometimes lower. In this case the customer's perception was rather indifferent; the share of respondents that agreed (25 % top 2 rating on a scale of 1–6) was overcompensated by customers with negative ratings (34 %). Although, one has to appreciate that this ignores the fact that a certain proportion of consumers will probably not notice any price differences in practice. Only 23 % of the Amazon customers agreed to the statement "When I search on Amazon, I can be sure to get offered the lowest possible price" (12 % of non-customers).

Secondly, another form of dynamic pricing was discussed; describing a scenario where different prices are offered to Amazon customers, depending on how they are shopping and which device they use. 44 % of the Amazon customers believe that Amazon cannot afford to offer customers different prices depending on whether a PC or a smartphone is used. More than 50 % think this would be a reason not to purchase on Amazon in the future.

As the analysis shows, dynamic pricing based on rapid price adjustments over time depending on demand is less problematic from the customer's perspective. However, a large majority of Amazon customers feel uncomfortable in the dynamic pricing world based on the customer profiles that is if prices vary for individual customers. If customers comprehend that a retailer misused their personal data for a "better" pricing, customer confidence as one of the biggest company assets is potentially forfeited. Then the damage for the company could be worse than the benefits of a one-to-one pricing (Fig. 6.6).

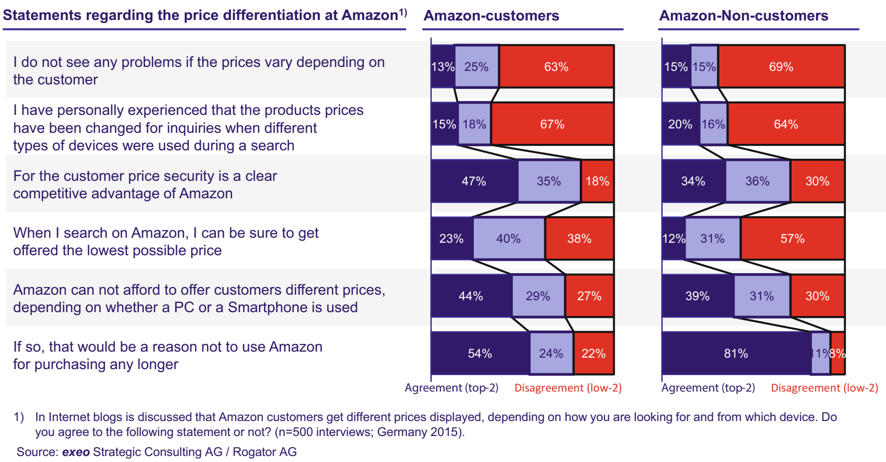


Fig. 6.6 The customer perspective on price discrimination at Amazon (Krämer and Kalka, 2016)

6.4 Outlook: Chances and Limitations of Pricing in a Digital World

Digital disruption with its new technical possibilities, big data, changes in customer behavior, and competitive pressure have implications for positioning and the pricing strategies and models of enterprises. Four pricing models are predominately implemented in the new digital world, which have redefined the rules of the game in pricing. Each of them follows other objectives, opportunities, and risks. The use and value depends, of course, on the specific product and customer characteristics. With reference to the "for free" and "freemium" model, success factors are mainly to be seen in the re- and cross-finance instruments, whereas the "subscription" model focuses on optimizing capacity utilization while keeping an eye on the variable costs. These three models are driven principally by the objective of quickly acquiring new customers and building up loyalty among users.

In contrast, the fourth model "dynamic pricing" is not openly communicated to the customers and tries to fully exploit what the target group is willing to pay for the product or services due to time, behavior, customer profile, used devices, and so on. With the help of algorithms, different approaches can be used in almost real time to change prices in order to maximize profits. While the first three models cannot be combined with each other, it is theoretically possible to combine the "dynamic pricing" model with the "freemium" as well as with the "subscription" model, because an offsetting effect is not foreseen. Nevertheless, psychological effects always have to be considered if the company wants to create a value for or of the customer, especially with regard to the one-to-one pricing policy, which some companies see as the biggest opportunity for the future pricing on the basis of big data. When evaluating chances and risks of new or changed price models, key elements must be the perception and psychological price evaluation by the customer as well as the potential damage to the brand image. If the customer feels unfairly treated, the main risks of all four models are customer dissatisfaction and customer churn, both leading to negative effects for the customer lifetime value.

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Part III
Mobility

Chapter 7
How Digitization Affects Mobility and the Business Models of Automotive OEMs

Tim Kessler and Christoph Buck

Abstract Digitization has affected almost every industry during the past decade. The unprecedented pace at which digital technologies spread and penetrate society, individual life, and businesses specifically puts mature companies at risk. Within the automotive industry, digitization brings new players to the table, shifts the technological focus from physical to IT, enables customers to bring in their changing understanding of mobility, and makes them an ever more valuable source of information. Moreover, digitization affects the value creation process and emphasizes the importance of multilateral cross-company cooperations. This is also highlighted by the fact that most automotive companies currently lack the necessary competences to succeed in an increasingly software- and IT-dominated environment. The companies BMW, Porsche, and Tesla serve as examples for how car manufacturers deal with the digitization challenge and how they adapt their technological and service portfolio accordingly. We seek to enrich the understanding of how the rise of digital and networked technologies affects the business and business models of car manufacturers and provide suggestions on how they should react to turn these disruptive forces into business advantage. In this context we take a look at how automotive OEMs can integrate themselves into digital business models and mobility concepts of the future.

Keywords Automotive • Mobility • Digitization • Business model

7.1 Introduction

Private and business life are in the middle of a digital revolution. Industries like media, telecommunication, and the banking sector have largely changed over the last decade. Terms like "Web 2.0," "Internet of Things," or "Industry 4.0" are at the center of attention. Digitization shapes our industries in a way that a growing number of enterprises adopt business models and processes based on digital and computer

T. Kessler (✉) • C. Buck
University of Bayreuth, Universitätsstraße 30, 95447 Bayreuth, Germany
e-mail: tim.kessler@uni-bayreuth.de; christoph.buck@uni-bayreuth.de

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technology (Brennen & Kreiss, 2014). What makes digitization a challenge on its own is the fact that it "sets enormous change in motion" (Gimpel & Röglinger, 2015, p. 3). The unprecedented pace at which digital technologies spread and penetrate society, individual life, and businesses specifically puts mature companies at risk. The opportunities arising from digital technologies create new demands on side of the customer which require enhanced product and service attributes and foster digitization on their part. This means that cause-effect relations become blurry and induce complex interdependencies which trigger effects of enormous disruptive power. As these are very hard to foresee, it leaves companies with a high level of uncertainty related to future development (Gimpel & Röglinger, 2015).

The reason why we speak of a digitization megatrend is because it affects all industries and branches, and although not each business might inherently depend on digital technologies, there is none which can neglect the effects of digitization. As soon as companies do so, they put themselves in an operating situation with high risk to be outperformed by competitors (Berman, Marshall, & Leonelli, 2013). If companies want to survive in the digital economy, it is vital to develop strategies on how to meet the requirements imposed on them by changing business rules and changing consumer needs in a dynamic environment (Krings, Neely, & Acker, 2016). Consequently, firms have to reevaluate and to adapt their value propositions to the customer (Teece, 2010). Furthermore, new businesses emerge and existing business models have to be realigned. Those who succeed in effectively managing digital technologies are able to improve their customers' experience and engagement, to streamline their operations, and to create new lines of business and business models (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013).

As the need for continuous innovation is particularly prevalent in the automotive industry, original equipment manufacturers (OEMs) see themselves pressurized to react and adapt their businesses accordingly in order to remain competitive (Rese, Sänn, & Homfeldt, 2015). Hence, the focus of automotive business models shifts toward digital offerings, increasingly based on customer-centric needs. Digitally sold and delivered services in the automobile industry, such as multimodal travel services, remote vehicle health diagnostics, and driver health services, have a major impact on business processes and models (Berman et al., 2013). Investigating the impact of digitization on predominant business models reveals that "trends related to social media, mobile, big data and cloud computing are driving automobile manufactures to extend, revise, terminate, and create business models adding a digital layer upon the physical mobility infrastructure" (Hanelt, Piccinini, Gregory, Hildebrandt, & Kolbe, 2015, p. 1313).

The current mobility (r)evolution is linked to a shift in customer needs, legal regulations, and technological requirements triggered by technical progress. "We stand on the threshold of what can realistically be described as the largest and most important shift in transportation in a century" (Matus & Heck, 2015). Digitization teams up with the so-called sharing economy as a societal driver for change in the automotive sector, where the willingness to share gains growing attention with more and more OEMs entering the car-sharing market (Daimler's Car2Go, BMW's

DriveNow, Ford's GoDrive). Vehicle ownership is no longer the only possibility to make use of automotive mobility solutions. The way how people perceive and utilize mobility is changing and the subsequent challenges need to be met. Today's teenagers have managed to decouple the idea of freedom from the idea of car ownership. Snapchat and Facebook are solid substitutes for hanging at the mall with friends, and Uber, Lyft, RideWith, and BlaBlaCar are cheap and always-on ways to get around. This development is not lost on carmakers. The American dream of freedom through car ownership was the backbone of their business, and today it's taking a backseat to concepts like "mobility as a service," "cars on demand," and "data-driven infrastructure" (Dadich, 2015).

These challenges express the necessity of rethinking the way automotive players make sustainable profit and create a compelling value proposition. Traditional vehicle manufacturers will have to adapt, develop, and update business models and implement flexibility with new critical business competencies (Wedeniwski, 2015). Digital technologies are changing the products, brands, corporate communication activities, and the work environment. However, Hanelt et al. (2015) stated that "what is missing to date is an understanding of how digital transformation manifests itself in industries in which the core products are primarily physical […]." Therefore, there is a need for car manufacturers to gain a more in-depth understanding of how the rise of digital and networked technologies affects their business and how they should react.

Changes resulting from digitization are relevant for all car manufacturers and have to be analyzed systematically. In this paper we will outline the major challenges caused by digitization and changing consumer needs and help to answer the question how digitization impacts business models in the automotive sector. Furthermore, we take a look at how automotive OEMs can integrate themselves into digital business models and mobility concepts of the future. By providing company examples covering BMW, Porsche, and Tesla, the paper illustrates the current situation and highlights the disruption of the traditional business models of automotive OEMs. Understanding digitization helps a firm master digital change and answers the question of how to turn these disruptive forces into business advantage.

7.2 Digitization and Digital Transformation in the Automotive Industry

A company that thoughtfully manages the process of digital transformation will be able to turn questions arising from challenging issues related to digitization into chances for business value creation. Digital transformation generally hints at a management competence companies need to develop in order to align business models and processes with the application of IT systems and software which calls for a comprehensive digital transformation strategy (Gimpel & Röglinger, 2015). The need to adapt to changes triggered by digitization particularly concerns well-established companies that are not primarily structured around or operating in the digital economy. This holds true for the automotive industry. Connectivity, for example, is not a recent development in the industry but well known to the OEMs for several years already. Yet it imposes a major challenge on automotive companies. This is mainly due to the fact that nontraditional players enter the market, and the unprecedented pace at which a need for connectivity is pushed forward by consumers.

7.2.1 How Digitization Affects Car Manufacturers

The first major challenge is that digitization opens established industry borders and lets powerful nontraditional players such as IT companies like Apple or Google enter the automotive ecosystem (Gimpel & Röglinger, 2015). This development enlarges market opportunities and therefore enforces competition. The varied setting of competitive structures triggers an emergence of new business models as well as new modes of innovation and leaves automotive companies with the challenge to serve unknown customer segments in redefined markets (Gao, Hensley, & Zielke, 2014). Keeping track of changing customer needs requires automotive companies to maintain a continuous dialogue with stakeholders in order to be able to develop answers to the current problems society is facing (BMW, 2015d). Delighting customers is the key to make the grade in the digital economy, and companies need to be well aware what constitutes the excitement factors of their product or service. As a result, enterprises can no longer build a competitive advantage only on product innovation but rather on great customer experience.

Another substantial challenge results from the fact that traditional preferences such as car ownership have been replaced by a more general need for mobility. This demand can take on many different forms which, for example, vary by region. Especially people living in urban areas seek alternatives to private car usage and create a demand for car-sharing services. Together with a multiplication in transportation modalities, this triggers a growing need for on-demand mobility. The challenge for automotive companies mainly results from building the ecosystem around this need (Siemssen & Hahn, 2015).

Autonomous driving is one of the major trends emerging from digitization which shapes the evolution of the automotive industry on a large scale. OEMs face difficulties in solving related issues on safety questions and insurance coverage and find themselves confronted by a limitation of potential market launches in this field as regulatory guidelines and liabilities prevail. However, semiautonomous driving is already possible, and all-autonomous driving is merely a matter of time (McHugh, 2015).

The reason why the automotive industry is particularly affected by the changes caused by digitization is that core elements of product functionality which are traditionally mechanical and performance-oriented features change in a sense that expectations are increasingly geared toward computer- and communication-related functionality. One question arising from issues related to the growing importance of digital technologies is on how to reshape the traditional infrastructure to incorporate these new functionalities in the designing, manufacturing, and servicing processes (Gao et al., 2014). Automotive manufacturers might no longer have the competences for developing products and services on their own. Cooperations, e.g., with companies like Google, will be important in terms of being able to offer individual products at all.

7.2.2 Digitization and the Product

Digital technologies heavily impact passenger cars, resulting in fundamental changes to an OEM's products. Initiatives, strategic cooperations, or innovative technical solutions concerning the connected car are in the focus of international news. The Internet is ubiquitous as is the interconnection of technologies and products. This compels for a corresponding adaptation of the product and service offerings (Mikusz, Jud, & Schäfer, 2015).

Further trending topics result from the increasing intelligence and communication ability of vehicles. Car-2-x communication is on the rise and opens up completely new possibilities (Hanelt et al., 2015). The basic technologies necessary for these changes are already in place. Dynamic navigation and information transfer on the availability of parking lots could be based on car-2-car communication. Moreover, wearables and portable devices in the automotive industry and new forms of vehicle control, e.g., gesture control, eye tracking, haptics in automotive, natural language question answering, smart fabrics, and biometric driver identification, are gaining in importance (Berghaus & Back, 2015).

Another factor with rising significance concerning product-related changes is the prevalence of software in cars. While the average software life cycle currently accounts for 6–12 months, the life cycle of a passenger car accounts for approximately 6 years (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). As a result, cars are equipped with outdated software during the largest part of their life cycle. Over-the-air software updates, which are put in practice by some car manufacturers already today, are seen as the best possible way to solve this problem and will gain in importance (McKinsey & Company, 2015a).

Lastly, the current changes in the automotive industry encompass even more aspects than those mentioned above. Mobility services become more and more important and "many of the major brands are realizing that the future of their business is probably not in selling cars, but in providing mobility services" (Botsman, 2015). These services also build upon digital technologies. However, the resulting changes in the vehicles themselves are neglectable—changing business models are rather talked about in this context (Kane, Palmer, Phillips, Kiron, & Buckley, 2015; Kessler & Stephan, 2013).

7.2.3 Digitization and Value Creation

"In a digitally intensive world, firms operate in business ecosystems that are intricately intertwined such that digital business strategy cannot be conceived independently of the business ecosystem, alliances, partnerships, and competitors" (Bharadwaj et al., 2013, p. 474). The most important value chain partners for OEMs are the suppliers. While in 2002, the OEMs on average still created 35 % of the value in-house, their share fell to less than 18 % in 2015 (Brauchle, Kostron, & Schlesner, 2015). There is a trend of focusing on core competences and of increasingly outsourcing everything which does not fall into this category. Far-reaching technological change, such as digitization, further reinforces this tendency (Proff, Fojcik, & Kilian, 2015). We can expect to see an increasing number of multilateral cross-company cooperations. These will be based on digital networks that change the way traditional business processes function and make coordination and the exchange of data across multiple companies a critical success factor (Pagani, 2013).

7.2.4 Digitization and the Resource and Competence Base

As the product and the production of an OEM undergo dramatic changes, there also have to be corresponding adaptations in the resource and competence base of the firm. Digitization comes with a technological change in general that "leads to a decline in importance of the existing competencies in the old technology" (Proff et al., 2015, p. 24). New technologies gain in importance and hence competencies in these new areas have to be built up. If companies do not react appropriately, their value added deteriorates. OEMs currently experience blurring industry borders between the automotive and IT industry. In-vehicle information technology and consumer IT find their way into cars and electronics, and software development becomes a decisive competence of OEMs (Hanelt et al., 2015). Furthermore, electronics and sensors are enablers for information gathering from both cars and customers. Making use of big data becomes crucial and competences especially in this field gain in importance (Siemssen & Hahn, 2015).

7.3 Digitized Car Manufacturers in the Spotlight

BMW, Porsche, and Tesla Motors are forerunners in automotive digitization. We will briefly introduce their product and service offerings and will compare the companies' underlying business models especially with regard to electric mobility.

Founded in 2003, Tesla Motors is devoted to making electric cars and is making major car manufacturers rethink their strategy in the electric car market. Tesla's first model, the Roadster, hit the market in 2008. The model that has been making headlines repeatedly, however, is the Model S, which Tesla launched in 2012. This premium electric sedan can drive 265 miles on a full battery charge and received several awards (Tesla Motors, 2015). What makes Tesla stand out in the electric car market is its charging technology and the infrastructure. The so-called supercharger stations constitute the most advanced electric charging infrastructure in the world. The Model X is Tesla's third Model and in 2017, the Tesla Model 3 is due to go on sale. It will be Tesla's first car aimed at the mass market, priced at $35,000 and offering 200 miles of range (Voelcker, 2015). A major step in terms of digitization at work was made by Tesla in late 2015 when they introduced the self-driving function via an over-the-air update (McHugh, 2015). Tesla provides many distinguished services and implements several highly innovative features into their cars.

BMW is arguably one of the most technologically advanced OEMs in the car industry. BMW's two electric cars are now entering their second year of production; however, both are in niche markets. The small battery-electric city car named i3 with a range of 81 miles isn't suited for driving long distances (Voelcker, 2015). BMW's other vehicle in their i-Project is the i8. The car is not all-electric but rather a plug-in hybrid. With a full 30 L fuel tank and a fully charged battery, it can drive at least 350 miles. The hybrid versions of BMW's cars are equipped with intelligent energy management software which autonomously decides when to use the electric power and when to use the gas powered engine (BMW, 2015b). This is a big step toward digitization and optimization of energy consumption. BMW introduced many technological feature like gesture control and a remote control via which the user can give the car commands to park itself, a parking assistant that helps with searching a parking lot and assists with parallel parking and a drive assistant that keeps a safe distance from other cars (BMW, 2015c, 2015d). BMW is the only manufacturer out of the three who officially provides car-sharing services. Together with the car rental company Sixt, they created the joint venture DriveNow in 2011, and now this venture operates successfully in several large European and American cities (Sixt, 2014).

Porsche was perhaps the one OEM most worried when the Tesla Model 2 arrived in late 2012. Not only did Tesla receive praise by buyers and media, but the German automotive press also complimented Tesla on its electric luxury sedan, suggesting it offered a combination of qualities no German carmaker would be able to offer (Voelcker, 2015). There is no electric car by Porsche out on the market just yet, but a "Mission E" pure electric concept was introduced at the Frankfurt Motor Show in September 2015, which is now officially going into production and to be launched at the end of the decade (Crothers, 2015). It will have 600 horse power, be capable of achieving 0–62 mph in less than 3.5 s and reach a range of more than 310 miles on a fully charged battery. It is also noteworthy that the battery should be recharged to 80 % within 15 min which would make it more than twice as powerful as Tesla's superchargers (Davies, 2015). Porsche also has plenty of modern offerings that increase the comfort of the driver, including a Wi-Fi hotspot in the car, multi-touchscreen with similar interface as a smartphone, modern voice control, and navigation with 3D maps (Porsche, 2015b).

While Tesla is more daring when it comes to innovative ideas, it does not mean that BMW or Porsche cannot provide the same services. German manufacturers are just more careful and hesitant when it comes to changing some of the car features, but when they see that the demand for the features is there, they can provide quite quickly (Byron, 2015). With regard to the digitization and optimization of internal processes, the Germans have a huge head start. BMW maintains a balanced global value chain presence, with about half of the cars manufactured abroad (BMW, 2015a). Porsche also makes constant progress in this field; they constantly increase their production output and introduced new energy saving plans for their facilities (Porsche, 2015a). Overall, both companies enjoy well-developed supply chains and production techniques which give them the edge over new manufacturers like Tesla which still has a long way to go before it can challenge the automated supply chain and manufacturing of established manufacturers.

Still, the presented companies can be compared in other aspects, related to their technology as well as their performance in the markets. And while superior technology certainly contributes to an increase in market share, if the gap in technologies becomes negligible, brands will play a much bigger role in the consumers' choices. BMW and Porsche can still rely mostly on their names and are not forced to adapt to modern marketing approaches as swiftly as Tesla. It's also important to note that the big players in the automotive industry are still by and large generating massive profits by selling internal combustion engine cars. In contrast, Tesla's motivations for building electric cars are entirely different. Not only do they produce electric cars exclusively, but as a matter of fact, profits aren't even Tesla's primary mission (Musk, 2013).

It is not possible to pick a clear winner out of these three companies. They can all be considered as very innovative and as front-runners in the digitization trend within the automotive industry. Tesla has clearly the most compelling company presentation and modern customer interaction, but when it comes to digitization within the actual car, all three companies provide roughly the same services. The Germans have a stronger global presence and optimized manufacturing and delivery services. Moreover, BMW is currently the most daring competitor when it comes to the introduction of new business models. Therefore, all three companies are likely to successfully embrace digitization and remain fierce competitors in the future.

7.4 Implications

The question of how automotive companies can turn the disruptive forces of digitization into business advantage has different layers. Automotive manufacturers might no longer have the competences for developing products and services on their own. Cooperations, e.g., with companies like Google, will be important in terms of being able to offer individual products at all. In the future, automotive and IT industries will be forced to work closer together because of integrated mobility concepts. The automotive industry needs to open up, share resources, and put more effort in IT talent acquisition (McKinsey & Company, 2015b). The interconnectedness of products and IT will grow in the future. This is the reason why IT is becoming a (co)shaper of future innovations and therefore maturing into a fundamental element of the value chain with its own independent services and business models (Brauchle et al., 2015). The connected car has developed into an app on wheels; the networks in digitized cars are employed to predict problems, distribute upgrades and even make new functions available. This requires the use of minimum standards, like process and interface standards, in order to improve intercompany cooperation. Here companies can follow the example of successful IT platforms like iOS or Android which might foster innovation (Koushik & Mehl, 2015).

Currently, the focus of car manufacturers regarding the business expertise in IT is on the coordination and administration of software development (Wedeniwski, 2015). In order to stay competitive, the next big issue for companies in the automotive sector will be the ability to quickly develop new software. They should follow the example of IT companies like Apple or Google, which update their operating systems every few weeks. That's why traditional OEMs should introduce a two-speed innovation model. As a result of this model, customers are allowed to benefit from small, quickly produced, and larger, less frequent updates. By offering customer-tailored additional features for a fee, the automotive industry could also generate a new revenue channel and integrate themselves into new digital business models that go beyond mobility services. The monetization would no longer end with the sale of the car or the after-sales services, but continue, e.g., by offering engine power upgrades on demand (McKinsey & Company, 2015b).

If the members of the automotive industry want to expand their business models toward the currently in vogue car-sharing offerings, they should always include the customers and their needs in their strategies and will have to find suitable business models to make this a sustainable and profitable market (Kessler & Brendel, 2016). The analysis of big data helps to understand the requirements and offering specific product configurations (Chakravarti, 2013). Hence, cybersecurity is another challenge for all companies in this context. Data and knowledge need to be protected from unauthorized access. One problem regarding those security standards are cultural and legal differences. Companies need to create solutions within an end-to-end digital operating model or by applying the required governance.

In order to respond to digitization, companies will also have to align their culture. The automotive industry needs to develop another mindset, in order to create innovations at the intersection of IT. Companies need to be more open referring to creativeness and the willingness to take risks and integrate such parameters into their existing structures (Brauchle et al., 2015).

Another important factor to keep in mind is that digitization is a moving target; the business models need to be adjusted over time. It's a relentless experience and opportunity for a repositioning of companies in a new era of competition and growth (Hirt & Willmot, 2014).

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Chapter 8
Disruption Technology in Mobility: Customer Acceptance and Examples

Robert Bongaerts, Marta Kwiatkowski, and Tatjana König

Abstract Important things become part of our language. "Do not reinvent the wheel" is an old German proverb, which refers to one of the most important "break-through" inventions (the wheel) in the area of mobility—a need of still increasing importance in today's societies. The history of mobility knows many more examples of disruptive technologies—all of them changed and shaped our world as we know it today.

Recent disruptive innovations within the mobility refer to:

- Simple and cost-effective access to mobility: The example of Uber shows how motorized private means of transport can become part of public transport.
- Technological development: Tesla demonstrates impressively that eco-friendly electric cars with sporty design can beat traditional car technology. Self-driving cars are on their way and even telekinesis (steering by thinking) seems possible.
- New mobility dimensions: Companies like Space X work on commercializing space travels for private consumers, thus opening the door to interplanetary tourism and super-high-speed traveling.

For every innovation there are two challenges: The first challenge is to invent it, i.e., all about engineering and technology, and the second one is to market it, i.e., all about mind and design that shape the customer perspective. And both of them do not just consist of make-or-break leaps but are continuous processes—on the way to the breakthrough and beyond. The "map of disruption" combines these two perspectives and provides a useful visualization on what is technically feasible and what is profitably marketable.

R. Bongaerts (✉)
exeo Strategic Consulting AG, Wittelsbacherring 24, 53115 Bonn, Germany
e-mail: robert.bongaerts@exeo-consulting.com

M. Kwiatkowski
Gottlieb Duttweiler Institute (GDI), Langhaldenstrasse 21, 8803 Rüschlikon, Switzerland
e-mail: marta.kwiatkowski@gdi.ch

T. König
Saarland Business School, HTW, Waldhausweg 14, 66123 Saarbrücken, Germany
e-mail: tatjana.koenig@htwsaar.de

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We start off by illustrating major trends in mobility and the challenges emerging from them. Section 8.2 provides the theoretical basis for the market acceptance of disruptive innovations: value theory as a general framework for consumer decision-making and the technology acceptance model (TAM) as a particular framework for technological innovations. In the third step, we introduce the map of disruptions. Finally, we integrate examples of disruptive technologies in the mobility business in the map of disruptions. We conclude by providing explanations why some technological innovations in the area mobility are accepted by the market and become potentially disruptive technologies, whereas others don't succeed.

Keywords Mobility • Technology acceptance model • Sharing economy • Self-driving car • Map of disruption • Disruptive technology and consumer acceptance • Simplexity

8.1 Challenges for Mobility

More than 2000 years ago, Heraclitus (540–480 BC) mentioned:

> All life is motion.

At least in the western world mobility has become a more or less basic need. Mobility is part of most people's lives. Mobility is a real success story, but unsolved problems still exist and new challenges arise. We want to discuss these problems and challenges by integrating different perspectives: the user or consumer perspective, the supplier perspective, and the governmental/societal perspective.

Key challenges for the mobility of the future arise from the megatrends of our time: demographic change, urbanization, increasing environmental awareness, and shifting mobility behavior:

- Looking at the demographic trends, the mobility industry has to face two major issues: Firstly, according to the UN, in the next 30 years, the total population of the earth will grow to ten billion people. In consequence an overall increase both of passenger transport (individual or public) and—even more—of freight traffic will challenge existing mobility capacities. Secondly, especially in the industrialized countries, the aging of societies is likely to be a key issue. In Germany, for example, the share of people at the age of 65 years and older will have doubled by 2060 and will amount to one third of the population (StBA, 2015). Rising age might sooner or later limit physical mobility of the human body and therefore raise the requirements and challenges for most suppliers in the mobility sector. On a worldwide basis, some 50 % of the population live already in cities. This portion is expected to rise to more than 65 % by 2050 (UN, 2014). In Europe, this ratio has already been reached, and it is expected to further rise to amount to some 85 % in the long run. Urbanization will have a strong impact on infrastructure. To prevent traffic collapse of cities and a further rise in cost of infrastructure, mobility solutions are needed that optimize the utilization of existing infrastructure and achieve a higher efficiency. Public passenger transport is already testing alternatives in rural areas: e.g., Swiss-based PostAuto is testing self-driving busses (PostAuto, 2015).

- Rethinking ownership: At least in the triad markets, car loses its significance as a status symbol or a statement of personal expression (Rossbach, Winterhoff, Reinhold, Boekeis, & Remane, 2013). This is especially true for the young, educated consumer in metropolitan areas. Even though car numbers are still growing on a worldwide basis, we see declining numbers in some countries and especially in some bigger cities indicating that the "peak car" has been exceeded (Newman & Kenworthy, 2015). In big cities in Germany, the percentage of households without a car increased from 22 % in 2003 up to 30 % in 2013 (StBA, 2014). Alternative mobility concepts such as car sharing experienced unprecedented customer acceptance.
- Connected mobility: In addition, a new trend called intermodality, i.e., the flexible and individual combination of different modes of transport, is increasingly gaining relevance. What is important to the customer is the most efficient way to get from A to B, not the means of transport used or who owns them. Connected mobility aims at integrating various means of transport into one comprehensive transport system instead of competing against each other. A key element is the flexible choice of the most appropriate combination of transport means for a transport purpose. Separate information, booking, and ticketing systems for the various competing modes of transport belong to the past. A mobility integrator assumes the role of a comprehensive mobility service (Fraunhofer, 2016). Mobility consumers are increasingly expecting one-fits-all solutions and connected mobility (Henkel, Tomczak, Henkel, & Hanauer, 2015). However, in this area integrated solutions from the supplier side seem to lag behind.
- Living in a digital world: Thanks to smartphone and wearable devices, permanent access to the Internet has become standard. The triumph of smartphones changes how and when we access information and buy, sell, use, and communicate about products or services. As a side effect, customer needs are growing in the dimensions of simplicity/convenience, real-time solutions, and ubiquity. Messenger apps are the most growing social platforms, becoming soon the way to communicate with friends and family but also with business (Wolf, 2015).

From a governmental/societal perspective, the challenges concerning mobility are:

- Rural depopulation: Urbanization leads to higher costs of infrastructure not only in the fast-growing megacities of the world. Road congestion incurs economic losses in the USA, Great Britain, France, and Germany that amount to more than USD 200 bn per year (CEBR, 2014). Another analysis estimates economic costs up to USD 266 bn per annum due to paralyzed traffic flows in the world's 30 biggest megacities (Rossbach et al., 2013).
- Global pollution: Reducing global warming and pollution are major challenges for politicians on a worldwide basis. Private and public transports induce about 20 % of all greenhouse gases in the European Union. The aim to decrease these

emissions is particularly difficult in an age of increasing mobility. People in many cities already suffer from particulate pollution (European Commission, 2011).
- Security issues: In the age of terror, attacks often target transportation systems at peak times such as subways, trains, and airports. Needless to say that the need for secure mobility increases.

States and municipalities have already started to regulate mobility. Bonus and tax penalty systems have been developed to limit access to urban areas, especially for cars with high emission. In Paris, Beijing, and Sao Paulo, only cars with even or odd endings of the license plate are alternately allowed to drive when particulate loads are high. In Shanghai a license plate costs almost as much as a compact car.

However, public transport is revitalized in many urban or metropolitan areas. In Shanghai the largest metrosystem worldwide (500 km of metro) has been built within the last 10 years. Even in the USA, 40 larger projects contribute to the renaissance of the light rail system (The Transport Politic, 2016).

Suppliers of mobility solutions must address both the changing customer requirements and the governmental/societal issues. But there are some more challenges:

- Growing energy costs: They are among the most vital challenges in the mobility industry, especially when looking at the individual car transport. A lot of work is already done to reduce the consumption of fossil fuels. As an alternative form of propulsion, electric cars still cannot compete against conventional drives as they are still more expensive. But the announcement of the new Tesla model "Tesla 3" priced at 35,000 USD shows that the price competition has just started, potentially enabling Tesla to make electric cars a success story of disruptive technologies in mobility.
- Internet of Things (IoT): IoT is another technical challenge. It will provide more and more data about products and services, even for companies with traditionally little end customer interaction. However, generating Big Data is one issue, transferring it into smart data the other: the challenge is to get the right results out of the data. Companies solving this analytical challenge will achieve a clear competitive advantage.
- Blockchain technology: Another technological development with huge potential for future disruptions is the blockchain technology. The main idea of blockchain is to exchange values without further instances like banks. Thus, it is a sort of distributed consensus system, in which none of the individual persons involved controls all the data (Webb, 2015). A maximum of transparency can be achieved with simultaneously low susceptibility to manipulation (Kuhn, 2015). Blockchain technology can be used for anything requiring signatures or authentification, and thus it potentially eliminates the need of all intermediaries in most transactions (Webb, 2015). In the mobility business, the use of intermediaries is very common—even disruptive business models like Uber are intermediaries as they basically provide a connecting platform for supply and demand. Thus, further developments of blockchain technology might render these intermediary business models in the mobility sector obsolete.

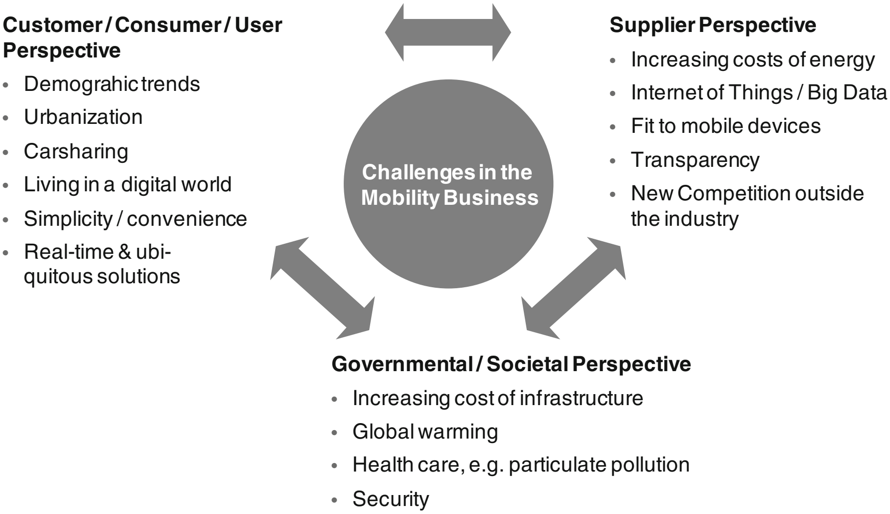

Fig. 8.1 Challenges concerning mobility

- Changing communication channels: Any mobility solutions must fit to mobile devices as customers require using smartphones for the entire process chain of searching, booking, ticketing, and billing of mobility services. New communication channels will change the way of interaction with end customers: As few apps are regularly used by consumers, Messenger apps like WhatsApp, Facebook Messenger, or WeChat will become the appropriate communication channel (Wolf, 2015).
- Competition: Sudden appearance of new competitors from outside the mobility industry. Unexpected by incumbents, new competitors from outside the industry enter the market. Google Car (self-driving) and Tesla (electric mobility) are typical examples from the automotive industry.

Figure 8.1 shows all challenges at a glance. Disruptive technologies can play a big role to get sustainable answers to solve these challenges—solutions are needed anyhow.

8.2 Using the Technology Acceptance Model to Understand Disruptive Technology

While technology becomes more powerful, better, faster, and cheaper, people change their behavior and attitudes only slowly. The different rates of development of man and machine creates a “reality gap” indicating that the technical possibilities might grow beyond average human capacity to imagine, accept, and to adapt—they sometimes seem to become overwhelming (Rushkoff, 2013). If what is technically possible exceeds the adaptability of people, the technological progress in societies increasingly becomes dependent on the acceptance of the population, i.e., whether people understand, demand, and use the new technology.

Before looking at disruptive technologies in the mobility industry, we first turn to value theory and the technology acceptance model (TAM) to provide a theoretical framework to explain the adoption of disruptive innovations. In order to do this, the technology acceptance model (TAM) will be adapted to provide determinants for ease of use in the mobility sector.

Value is one of the core concepts explaining why people buy or adopt a new product. The classical economic view took products or services as sources of value. Lancaster (1966) interpreted products as "bundles of characteristics" and thus shifted the focus of value creation to the individual characteristics of an offer that form the aggregated product or service value. Whereas many product or service characteristics are perceived as beneficial by the customer and therefore contribute to the aggregated value in a positive way, some characteristics like price may rather diminish the perceived overall value of a product or service. Price management therefore often illustrates the price as the "sacrifice" a customer has to make in order to enjoy the benefits of a product or service (Monroe, 2003).

Transaction cost analysis (Williamson, 1979) suggests that there is not just price to be added to the sacrifice side but all costs incurred during searching, negotiating, contracting, using, and even disposing of a product. Moreover, risks associated with a product or service could diminish the overall value. The difference between the positive and the negative value attribute evaluations forms the net value. Customers form their choice typically on the basis of the highest net value among the given alternatives. However, they might not necessarily be aware of it. Net value as the key determinant for product or service choice serves as a basis for understanding when and why new products are adopted by the customers at large. However, in a technology-driven market environment, the technology acceptance model provides some deeper insights for the adoption process of technological innovations (Davis, 1989). Therefore, we adapt this model to the acceptance of new technologies in the mobility sector.

Originally, the technology acceptance model was conceptualized to explain the adoption of new IT systems by users in a work context (Fig. 8.2). However, adaptions to explain the adoption of new technology in a variety of fields exist (Davis, 1989).

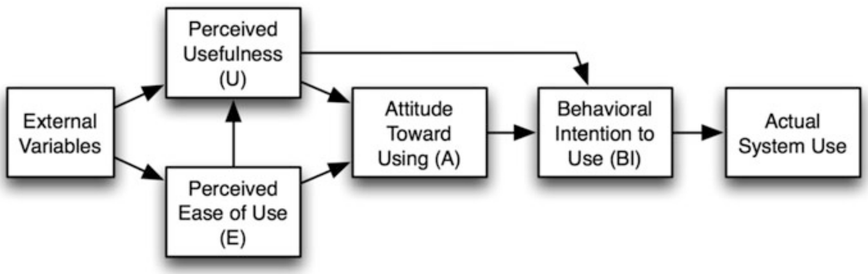

Fig. 8.2 Technology acceptance model

Main drivers of technology acceptance are the perceived ease of use (PEU) and the perceived usefulness (PU) of the new technology which affect the attitude toward usage and therewith the behavioral intention to use and eventually the actual use.

Perceived usefulness is influenced in this model by perceived ease of use, relevance, output quality, and social factors like status enhancement and social norms as well as demonstrability of results (Venkatesh & Bala, 2008). Perceived ease of use itself is triggered by the perception of self-efficiency enhancement and by the perception of external control, anxiety, as well as playfulness and perceived enjoyment coupled with objective usability, i.e., the effort required to use a new system. To transfer these factors to a mobility context within a net-value framework, we likewise distinguish between perceived ease of use and perceived usefulness for accepting new mobility technologies.

Perceived ease of use is defined as the degree to which an individual perceives the new technology to be usable with minor effort (Davis, Richard, & Warshaw, 1989; Venkatesh & Bala, 2008). One influencing factor that determines ease of use is the degree of self-confidence a user has in being able to handle a new technology (technology self-efficacy). For a mobility context, this might transfer into having the right technical equipment (smartphone, app, etc) to be able to use a mobility service like Uber.

Perceived ease of use is further enhanced with the perception of external control (Venkatesh & Bala, 2008), which is described as "degree to which an individual believes that organizational and technical resources exist to support the use of a system." In a mobility context, we might rather refer to this factor as "external support" which could refer to government support of, e.g., electromobility. Conceivable examples are subsidies for buying e-cars or tax reduction when driving e-cars as well as free parking for e-cars in inner-city areas as in Norway or fast-lane access.

Computer anxiety (Davis et al., 1989) could transfer into perceived risk associated with using new mobility technologies. Among the perceived risks often named as reasons why consumers refrain from buying electric cars are high price (economic risk), low ranges and missing availability of electric chargers (functional risk), catching fire that is nearly impossible to be ignored (safety risk), low speed of driving (time risk), or even doubt about data security and potential misuse (information risk). Furthermore, the potential loss of self-determination in self-driving/ autonomously driving cars/devices could be considered an additional risk (risk of loss of control).

Perceived enjoyment (computer playfulness) as factor of influence on ease of use refers to the degree to which a system or technology seems enjoyable irrespective of any functional or efficiency enhancement through the technology. In a mobility context, this might refer to the joy that is generated from the mode of transport itself. For example, space travels, once they become accessible to a larger number of consumers, might provide a unique experience that cannot be compared to any other mode of transport.

Objective usability as driver of ease of use refers to the actual effort required to use a new system (not so much the perception) in comparison to the established system. In a mobility context, this could refer to time efficiency for booking, waiting

Table 8.1 Determinants of "ease of use" transferred to new mobility technologies

Determinant according to Venkatesh and Bala (2008)	Determinant mobility context	Example
Computer self-efficacy	Owning/able to use new technologies	Smartphone usage confidence, access/ usage of apps required
Perception of external control	External support	Subsidies, tax reductions for new technologies (like e-cars), free parking, fast lanes
Computer anxiety	Perceived risk of using the new technology	Functional risk of e-cars because of low range
Computer playfulness	Perceived enjoyment	Enjoyment of space travel
Objective usability	Efficiency, flexibility, and convenience of usage	Smartphone payment of travel tickets
Cost	Low cost	Low-budget overnight stay (Airbnb)

for and using a mode of transport as well as the steps required in the process to book and use a mode of transport. It could be encapsulated in the terms efficiency, performance, or even convenience of the mode of transport.

The drivers of ease of use contribute as value-generating features to the overall evaluation of a new technology. They do so in a positive way, except for the perceived risks associated with the new technology. The diverse risks associated with a new technology typically diminish the net value of the new technology and have to be taken into account as potential barriers to diffusion. However, disruptive technologies are often characterized by very low price positioning in comparison to established technologies. Typically, disruptive technologies benefit from comparatively low-cost structures, for example, by accessing/using spare capacities (e.g., Airbnb). With price as the number one denominator of negative value contributions, disruptive technologies might have the most powerful leverage on net value. Table 8.1 depicts the transfer of the technology acceptance model to a mobility context.

8.3 Map of Disruption

For every innovation there are two challenges: It must be made, and it must be accepted. The first challenge is all about engineering and technology, and the second one is all about acceptance by the customer. And both of them do not just consist of make-or-break leaps but are continuous processes—on the way to the breakthrough and beyond. The GDI introduced in 2014 the "map of disruption" (GDI, 2014). IT combines these two dimensions and gives us a useful framework about what is technically feasible and what is acceptable by society (Fig. 8.3):

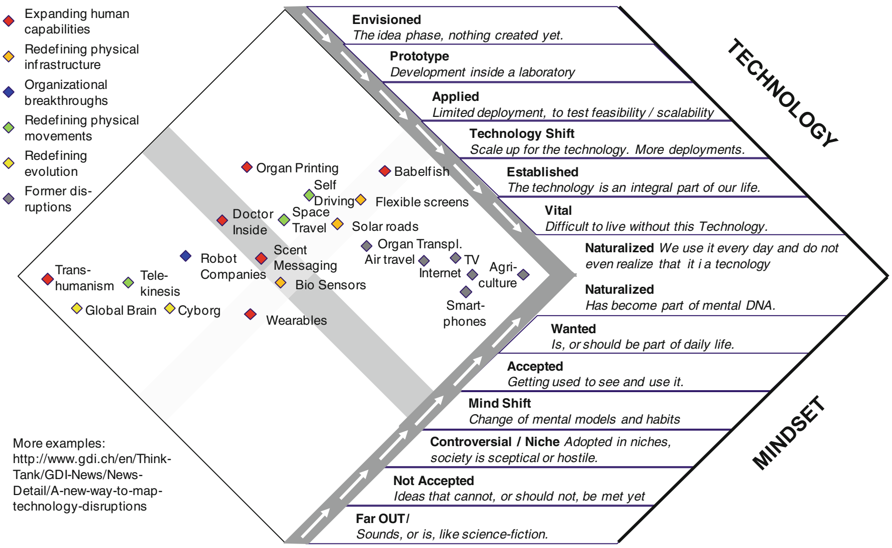

Fig. 8.3 Map of disruption

> The map … is inspired by a concept of the Dutch futurist Koert van Mensvoort (www.nextnature.net). His "Pyramid of Technology" is made of seven stages from vaguely envisioned up to completely naturalized. "Moving through the seven stages" Mensvoort says, "we will learn that new technology may seem artificial at first, but as it rises from the base of the pyramid toward the top, it can become so accepted that we experience it as a vital or even a natural part of our lives. (GDI, 2014)

The Gottlieb Duttweiler Institute (GDI) added a second dimension to this concept to create the map of disruption. The seven stages of technology development are completed by seven mind-sets representing different technology acceptance stages (GDI, 2014). The developments in both dimensions are interrelated: the more sophisticated a technology is, the higher the chances that it will be broadly accepted. Yet, this is only true if perceived usefulness and perceived ease of use are high. In other words, for the consumer a technology needs to be convenient to accept it. This contrast of complexity on the technological side and the simplicity required by the customer to provide ease of use is encapsulated in the term "simplexity" (Wippermann, 2006). Some technological innovations would make our lives a lot easier (high perceived usefulness); however, the technological feasibility seems to be lacking behind (self-parking cars in cities, automated translation à la Babelfish). Yet, other technologies are ready for use but far away from being accepted e.g., in vitro meat.

The map shows some 30 of (potential) ground-breaking disruptive innovations. As GDI (2014) pointed out, "the map might equally be useful as a framework to better understand the innovation processes of the past and the future, or of specific industries, regions, epochs or companies." We would like to pick up the map as a

Table 8.2 Mobility technologies and their stages in the map of disruption (adopted from GDI, 2014)

Technology	Stage of technology	Stage of mind
Air travel	*Vital*: difficult to live without this technology	*Wanted*: is or should be part of daily lives
Self-driving cars	*Applied*: limited deployment, to test feasibility and scalability	*Accepted*: getting used to see and use it
Commercial space travel (planetary tourism and super-high-speed round the world travel)	*Applied*: limited deployment, to test feasibility and scalability	*Mind shift*: change of mental models and habits
Telekinesis (thought-control, activate machines and move objects by thought alone)	*Prototype*: deployment inside a laboratory	*Not accepted*: ideas that cannot and should not be met yet

framework for the mobility industry. In Table 8.2 some mobility-related technologies are categorized along the two dimensions of the map of disruption.

8.4 Examples for Disruptive Technologies in the Mobility Business

> Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate. Something interesting is happening. (Goodwin, 2015)

In this section, we present company breakthrough examples that represent disruptive technologies in the mobility sector. These aim to provide solutions to needs specifically driven by the megatrends depicted in the introductory section. Furthermore, we integrate those examples into the map of disruption. The examples are taken to the map of disruption and shown simultaneously which address the aforementioned trends and challenges.

New technologies are not necessarily disruptive technologies. This is only true for technologies that succeed in capturing the mass market and don't stay in a niche market. Looking at the mobility business, Carl Benz invented the car, but it took Henry Ford's mass production—decades later—before traditional transportation became disrupted (Uphill, 2016). The established technology, in contrast, is displaced in the mass market and becomes niche market product. The common characteristics of disruptive technology are to be cheaper, simpler, smaller, and providing ease of use (Christensen, 1997). In this sense, some of the examples presented here actually are not disruptive technologies as will be shown for better understanding.

8.4.1 Uber

Uber has been one of the most popular disruptive technologies in the last years. The business model is being copied by a large number of other companies. The phenomenon has become so prevalent that it is commonly referred to as "Uberification" or "Uber-Principle." The San Francisco-based ride-hailing company Uber was founded in 2009. It operates in more than 58 countries and is valued approx. USD 61.5 bn (Eric Newcomer, 2015). Reuter estimated Uber revenues in 2015 to roughly reach USD 2 bn, a number that is assumed to more than double by 2016 (Zhang & Shih, 2015). In a number of countries, however, the legality of Uber has been questioned by governments and taxi companies, who allege that its use of drivers who are not licensed to drive taxicabs is unsafe and illegal. In Germany, for instance, Uber has reduced its operation to currently two cities only.

Business model: Uber uses the basic idea of the sharing economy to better utilize spare capacity. The idea of the sharing economy is to replace ownership by renting or sharing spare capacities for part-time usage or access (Frick, Hauser, & Gürtler, 2013). Within the mobility sector, this idea has led to a lot of new business models like car sharing, bike sharing, and nowadays even plane and drone sharing. Without smartphone and Internet, it was hardly possible in particular for individuals to market their spare capacities like private cars. The average spare capacity of cars is estimated to be more than 23 h a day (Plouffe, 2015). Digital transformation brings together both excess supply and demand, simply (via smartphone) and at low cost. Uber acts as a provider and earns a commission fee. The business model might be questionable, since the supplying taxi driver is not participating from profits. However, the interesting part is the concept of platformization and other examples like Israel-based "La'Zooz," where the drivers make the profits using the blockchain technology show how interesting this concept is for the future.

8.4.2 Lyft

Lyft, like Uber, is a transportation network company based in San Francisco. It was launched in 2012, as part of Zimride, the biggest US-ridesharing company. Whereas Zimride focuses on city-to-city rides, Lyft concentrates on inner-city rides. The company is valued approx. USD 2.5 bn. Like Uber it faces more or less the same regulatory and legal issues.

Both Lyft and Uber attract not only private passengers but also business travelers (Peltier, 2015). Uber and Lyft meet the criteria for being characterized as disruptive: They are cheaper, simpler, and smaller and provide ease of use. In the technological dimension of map of disruption, Uber and Lyft reach the stage "established." The customer dimension mind-sets for these business models range between "accepted" and "wanted." With reference to the challenges discussed in the introductory section, these companies serve to both needs: the need for flexible mobility at low costs and disburdens the infrastructure.

8.4.3 Airbnb

Another well-known example in the world of travel and leisure is Airbnb. It is an online marketplace for vacation rentals (instead of cars like Uber and Lyft) and connects users with property to rent with users looking to rent the space. The company was launched in San Francisco in 2008, valued in 2015 approx. USD 20 billion. The service is offered more or less worldwide. Recent data shows that Airbnb is the number one booking site in the USA and UK (Clampet, 2016).

Thus, Airbnb can be categorized within the map of disruption as naturalized in both dimensions (technological as well as consumer mind-set).

The Uberification especially takes place in the mobility industry. Other examples are (GDI, 2015) flight sharing by “JetSmarter,” drone sharing by “Sky-Cath,” and tow away service by “Tow-Choice.” “Justpark” is another example: the UK-based company matches drivers with spare parking spaces through its website and mobile application.

8.4.4 Car Sharing

Car sharing is not a really new or disruptive business model, but some interesting changes are to be seen. car2go (founder: Daimler and Europcar, approx. 1 m customers), DriveNow (founder: BMW and Sixt, approx. 300 k customers), or multicity (founder: Peugeot and DB Rent) are car-sharing providers in big European and North American cities. Unlike traditional car-sharing companies, those companies do not require their customers to pick up and drop off the cars at designated parking areas. Rather, the cars are parked everywhere and can be located via smartphone app. Users are charged by the minute, with hourly and daily rates available.

Compared to traditional taxi business, the common characteristics of disruptive technology are met: car2go, DriveNow, and multicity are cheaper, simpler, smaller, and provide ease of use. Looking at the disruptive map, their classification is similar to Uber and Lyft. Both from a technological perspective and the customer mindset perspective view, the stage of car-sharing solutions can be described as “naturalized.”

8.4.5 Self-Driving Cars

The next step in the technological development of individual transport is the deployment of self-driving cars, like the Google driverless car. More or less the whole automotive industry is working on automatic driving systems or driverless car technology. Driver assisting systems like parking assistance or precrash alarm can be categorized as established. Completely self-driving cars are presently in the test

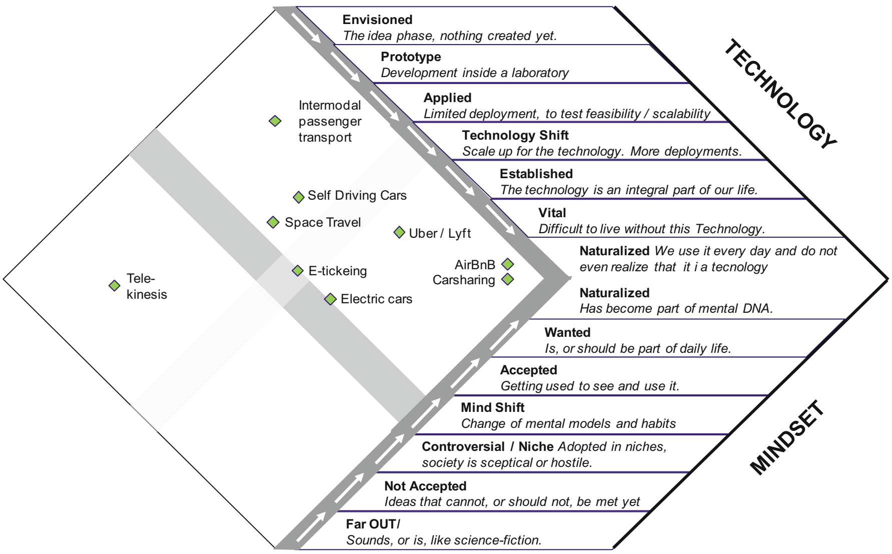

Fig. 8.4 Discussed case studies in the map of disruption

phase. Though Tesla founder Elon Musk already considers steering wheels as gadgets when buying a car, a lot of regulatory and legal issues have to be settled first. From a technological point of view, self-driving cars seem feasible by now. From a customer perspective, they seem to offer large benefits; however, perceived loss of control may pose a risk to the acceptance or use of autonomous driving.

On a macro-perspective self-driving cars are expected to reduce the number of accidents via vehicle-to-vehicle communication. Subsequently, the cost for vehicle liability insurance should drop significantly. Especially the aging societies of Western industrialized countries might be able to increase mobility for old people that are not able to walk, cycle, or drive themselves. MIT research shows that the combination of self-driving cars and car-sharing concepts could generate the existing traffic volume in cities like New York with 80 % less cars (Claudel & Ratti, 2015). Correspondingly the cost for infrastructure will decrease.

As already shown in Fig. 8.4, self-driving cars view the stages “applied” from a technical view and “accepted” from the customer perspective.

8.4.6 Tesla/Electric Cars

Despite the advantages of electric cars regarding pollution and at comparatively low energy costs, the market acceptance is still poor. The abovementioned reasons why consumers refrain from buying electric cars are high price, low range and low speed, and missing recharge possibilities. Up to now Tesla managed to build electric cars with a wide range at a high speed and furthermore established a grid of electric chargers. With the announcement of a price around USD 35,000 for its new model "Tesla 3" in March 2016, Tesla targets the mass market, especially when looking at total cost of driving due to hardly no energy cost, tax reduction, or even public subsidies.

We expect that this announcement will lead to change in the stage of mind-set in the map of disruption toward "accepted" or even "wanted." The market reaction after start of selling was tremendous: Within 36 h 253,000 vehicles were ordered valued more than USD 10 bn.

8.4.7 E-ticketing System at Public Passenger Transport

But what about disruptive technologies within the public passenger transport? A lot of projects show that traditional paper tickets are replaced by electronic ticketing. In closed systems like air travel or some long-distance passenger rail like French SNCF, this is not a technical problem at all. But most public short-distance passenger transport systems are open, which means you can get on or off the train wherever you want. This implies that advanced technical problems have to be solved. One solution is called CICO (check-in check-out): Customers are provided with a chip card or a mobile device with near-field control (NFC) enabling them to actively register electronically each time when stepping into or out of a bus or train (check-in check-out)—an example is the Dutch smart card introduced in 2004. Another possibility is called BiBo (Be in, Be out): customers also are provided with a chip card or a mobile device but are registered automatically when entering or leaving the transport system. SBB, the Swiss railway company, launched the SwissPass, a chip card that is being used as a discount card at the moment but with the purpose to develop it to become part of a BiBo system. Part of e-ticketing is monthly payment and a best-price guarantee.

Customers rank lack of transparency of pricing schemes among the major problems and difficulties in public passenger transport (Krämer, 2016). When combining e-ticketing with best-price guarantees, customers don't have to bother about the transparency of pricing scheme anymore, while the biggest advantage for mobility providers is to gather real-time travel data to optimize the supply of transport capacity or the pricing schemes.

Looking at the disruptive map, e-ticketing solutions can be described as "technology shift" and the customer mind-set perspective as "mind shift" or "accepted."

But still one problem is not addressed: the easy and convenient use of combinations of different transport means or systems as we know from intermodal freight transport still does not exist for passenger transport, especially when thinking about including a combination of private and public means of transport. One of the few examples is where customer acceptance is supposed to be rather high ("wanted") but at least on a higher stage than the technological feasibility described as "Prototype."

In Fig. 8.4 the abovementioned examples are integrated in the map of disruption.

8.5 Conclusion

The mobility industry is facing a number of major challenges, e.g., urbanization, aging societies, pollution, global warming, increasing cost for energy, and infrastructure.

Drivers of technology acceptance in the case of mobility are discussed by using the technology acceptance model (TAM). In combination with the technical perspective, the map of disruptions (GDI, 2014) is a useful framework to better understand disruptive technologies. It helps anticipating both new customer needs and wants and to create new or to review existing business models.

Mobility is more than ever influenced by digital innovations that change quickly and directly the behavior of the end users. Examples of technically feasible and market-accepted disruptive technologies in the mobility business are Uber, Lyft, Airbnb, and car-sharing models. All of them try to better utilize existing spare capacities. The market acceptance of electric cars will be increased, if the main reason for not buying, i.e., the high price, will be addressed. It is expected that autonomous car driving in combination with car sharing will dramatically change the amount of cars in bigger cities, with positive effects on the climate, infrastructure, number of accidents, and cost of energy.

E-ticketing increases the convenience in public passenger transport, but intermodal solutions (combination of different mobility systems/providers) are still to mature, though they are widely accepted by customers. Established industries like the mobility business need to be more flexible in their organizations (holistic and not top-down) to let new ideas within the organization happen. The industry should work more experimentally to fail faster and therefore learn in faster cycles. That's the way how disruptive business models are establishing today.

The development of blockchain technology might result as a new impulse to further think in connected mobility. Traditional intermediaries might not be needed anymore, as the so-called smart contracts between user and supplier carry out their actions themselves. However, a platform is needed that searches for the best possibility to go from A to B. The platform itself includes all possible transport means (private and public) and suggests the best combination. Customers just use the offered transport means, everything else runs in the background.

As mobility in the twentieth century was car mobility, in the twenty-first century, it will be connected mobility. Users/consumers seem to be ready for radical changes. Thus, the acceptance of new technologies regarding connected mobility is higher compared to other industries. The digitization can reduce complexity in the mobility business and maybe manage the connected mobility wanted by users and customers.

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Chapter 9
Electrification and Digitalization as Disruptive Trends: New Perspectives for the Automotive Industry?

Jochen Wittmann

Abstract Climate change, growing urbanization, and technological developments like digitalization and electrification ("diglectrification") change societal requirements and customer preferences toward motility and mobility in the future, especially automotive mobility. The international automotive industry is under pressure because of these tectonic shifts. There is a strong societal and political push caused by the climate change issue and the strategies as well as measures mitigating the climate change.

Traditional OEMs are in a sandwich position between societal requirements and customer needs. Therefore "low-emission and zero-emission vehicles," "connected car," and "autonomous driving" have been on the agenda of the automotive industry since several years. The drivers of these trends are partly newcomers in the automotive industry, like Tesla Motors, Google, or Apple. The growing role of disruptive innovations is in the focus of politics, business, and academia.

The leading idea of this paper is to design a conceptual framework, whereby open and discrete innovation approaches as well as cost of ownership approaches as key elements are applied to strategies and measures for "diglectrical" disruptive innovations in the automotive industry.

Keywords Diglectrification • Game changer • Discrete innovation approach • Emotionalization • Connected car • Autonomous driving

9.1 Introduction

Climate change, growing urbanization, and technological developments like digitalization and electrification ("diglectrification") change societal requirements and customer preferences toward motility and mobility in the future, especially automotive mobility. The international automotive industry is under pressure because of

J. Wittmann (✉)
Global Panel Foundation, Prague, Czech Republic
e-mail: jochenwittmann@yahoo.com

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these tectonic shifts. There is a strong societal and political push caused by the climate change issue and the strategies as well as measures mitigating the climate change. Bellmann and Khare (2008) give an overview of the CO_2 reduction programs. Further on, they recommend an integrated approach including regulations, a changing customer behavior, and a new business development by OEMs to bid farewell from individual mobility as prerequisite of sustainable mobility. The IPCC (2007) favors a modal shift toward public mobility and motility. According to a Continental study (2015), 83 % of the interviewees in Germany and 94 % in the USA drive their own cars, underlining the high preferences toward individual mobility. In contrast, Winterhoff (2015b) forecasts a smaller interest of younger generation in owning a car switching to shared mobility solutions.

Traditional OEMs are in a sandwich position between societal requirements and customer needs. Therefore "low-emission and zero-emission vehicles," "connected car," and "autonomous driving" have been on the agenda of the automotive industry since several years. The drivers of these trends are partly newcomers in the automotive industry, like Tesla Motors, Google, or Apple. The growing role of disruptive innovations is in the focus of politics, business, and academia.

The leading idea of this paper is to design a conceptual framework, whereby open and discrete innovation approaches as well as cost of ownership approaches as key elements are applied to strategies and measures for "diglectrical" disruptive innovations in the automotive industry.

9.2 Basics of Electrical and Digital Disruptive Innovations in the Automotive Industry

9.2.1 Disruptive Innovations

"Disruption" as a synonym for discontinuity and breakthrough (Dobbs, Manyika, & Woetzel, 2015, pp. 8, 35), "disruptive technological innovation" (Christensen, 1997, p. xvi), "disruptive technologies" (Köhler & Wollschläger, 2014, p. 252), and "digital disruption" (McQuivey, 2013, p. 9) are common terms to describe the transformation of market or industry and service sector by basic (transformational) innovations (Foster & Kaplan, 2001).

Dobbs et al. (2015) identify four disruptions which develop simultaneously and empower the effects to change "long-established patterns in virtually every market and every sector of the world economy—indeed, in every aspect of our lives" (Dobbs et al., 2015, p. 8). These disruptive forces are the urbanization; the responding to the challenges of an aging world; the greater global connections of trade, finance, people, and data; and the accelerating technological change (Dobbs et al., 2015).

These effects have also a huge impact on the automotive business and industry. The core technological trends, "electrification" and "digitalization," in the automotive industry are in the focus of this paper. They have an increasing disruptive impact on the traditional industry sector (Roland Berger, 2015; Continental, 2015), because they can dissolve the discrepancy between societal requirements and customer preferences for sustainable mobility. But societal and customer requirements are still not congruent, which up to now is observable in the low attractiveness and demand of electric cars (EAFO, 2016).

9.2.2 *Disruptive Electrical Innovations: Trends of Electrification in the Automotive Industry*

In 1881 William Ayrton (1847–1908) and John Perry (1850–1920) invented in England the first roadworthy electric vehicle (tricycle) (Seiler, 2011), 5 years before Carl Benz (1844–1929), the vehicle with combustion engine. Over several decades there was a severe concept competition between vehicles with electric drive, combustion engine, as well as hybrid drive, invented in 1900 by Ferdinand Porsche (1875–1951) in cooperation with Ludwig Lohner (1858–1925) (Parr, 2001).

German Emperor Wilhelm II (1859–1941) stated during this contest that “the automobile is just a temporary phenomenon. I believe in the horse” (Wimmer, Schneider, & Blum, 2010, p. 231). Nevertheless, the combustion engine was the winner of this contest over 100 years, and the German automotive industry has won a strong reputation and a core competence with its combustion engine engineering.

A turning point seems to be the Volkswagen scandal concerning the worldwide manipulation of more than 11 million vehicles with diesel engines, which finally was uncovered in September 2015 (Smith & Parloff, 2016). Rupert Stadler, CEO of Audi—a subsidiary of Volkswagen Group—stated in April 2016 (Freitag, 2016) that Audi would stop the new development of combustion engines in 2025. The revival of the zero-emission electric drive is observable, supporting strategies and measures mitigating climate change as societal goal. This trend is boosted by start-up OEM Tesla Motors, producer of battery electric vehicles (BEV), “a powerful statement of American startup ingenuity” (Consumer Reports, 2015, p. 3), and second in the US market of luxury vehicles in the first half of 2015 (Gerster, 2015).

What Is Electrification? Electrification in the automotive industry is defined as the provision of infrastructure with grid and storage to guarantee the electric power supply inside and outside the vehicle.

The core trends of vehicle electrification focus on the electric drive and the driver assistance systems. Core topics are the electric drive by battery and by fuel cell. The battery concept is still realized by several automotive companies in the volume as well as in the premium sector. The battery concepts are already in serial development and production, e.g., Tesla Model S, Toyota Prius Hybrid, and the Porsche Panamera S Hybrid. Different grades of electrification of the power train by battery are possible (see Table 9.1).

Tesla Motors is a pioneer and the game changer in the industrial sector. Tesla Motors also vertically integrates the installation of destination chargers and battery

Table 9.1 CO_2 reduction and electrification of power trains (Continental, 2016)

Modes of drive	Micro hybrid 12 V	Mild hybrid 48 V	Full hybrid	Plug-in hybrid	Electric vehicle
Electrification (range of electric power) (kW)	<5	5–13	20–40	50–90	50–90
CO_2 reduction (in European drive cycle) (%)	3–4	13–21	20–30	50–75	100

charging stations in key markets like the USA and Germany. For example, in Manhattan, a borough of New York City, Tesla Motors owns 100 battery charging stations and there are still 40 classical gas stations left (Vetter, 2016).

In contrast, the fuel-cell concept is still in the pre-serial development phase, despite the Hyundai ix35 Fuel Cell and the Toyota Mirai presented at the International Motor Show 2015 in Frankfurt (Eck & Weigel, 2015). The expansion of the fuel-cell concepts also heavily depends on the very expensive hydrogen distribution infrastructure, which does still not exist in the industrial countries (Schatzmann, 2015).

The two electric drive concepts have different strengths and weaknesses concerning costs, range, performance, and availability, but the battery drive now is in the lead of market acceptance (Evannex, 2016). The focus of this paper is therefore on the battery electric vehicles.

Driving assistance systems in the automotive industry start with the introduction of the speed control system, invented in 1948 by R. R. Teetor (1950). These are additional devices and items to assist the driver in conducting the vehicle during specific driving situations, e.g., acceleration and braking of the vehicle. These systems belong to the car IT. Over the decades more and more (electrical) driving assistance systems have enlarged the product program of the automotive industry, which range, e.g., from the traditional speed control system to anti block system (ABS), electronic stability program (ESP), adaptive cruise control (ACC), and tire-pressure monitoring system (TPMS) (Schöne, 2013). Some of these systems already work semiautonomous and are a prerequisite to the development of a digital car. Driving assistance systems are a focus of first-tier suppliers like Bosch, Delphi Automotive, and Continental.

9.2.3 Disruptive Digital Technologies: Trends of Digitalization in the Automotive Industry

McQuivey (2013) focuses on the digitalization and its impact on disruption, where often low financial and intellectual input generates high leverages of financial output and global access to customers. The rising relevance of the digitalization is strongly connected with the development of the information and communication technologies (ICT). The driving assistance systems and the communication systems are prerequisites for the digitalization of the vehicles.

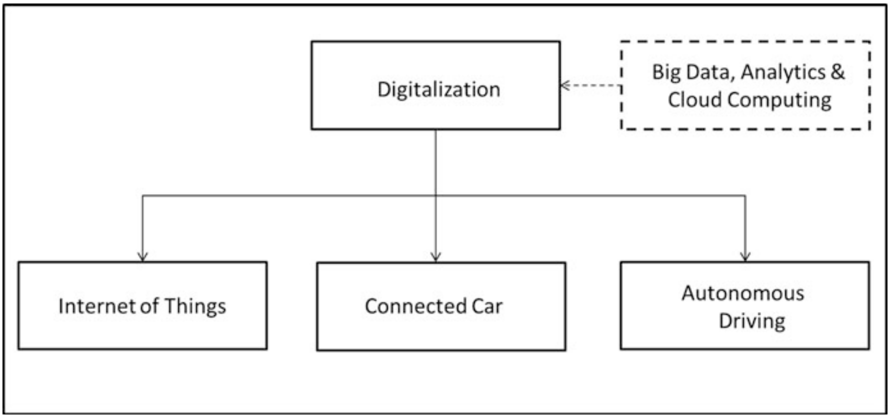

Fig. 9.1 Core topics of digitalization in the automotive industry (Köhler & Wollschläger, 2014)

What Is Digitalization? Digitalization in the automotive industry is defined as the transfer of analog data into a digital form with support by ICT inside and outside of a vehicle.

The forerunner industry was the photographic film industry, which disruptively changes the business models of traditional silver halide photographic film producers like the Eastman Kodak Company (Christensen, 1997).

Digitalization in the automotive industry has the following three core topics (Köhler & Wollschläger, 2014) (see Fig. 9.1):

1. Connected car
2. Internet of things
3. Autonomous driving

Big data and analytics as well as cloud computing are considered a supportive issue in contrast to Köhler and Wollschläger (2014). Winterhoff (2015a) identifies automation, digital data, connectivity, and digital customer interface as determinants of digitalization.

9.2.3.1 Connected Car

Connected car (see Fig. 9.2) is about the interconnectedness of vehicles with the environment (Car-to-X Communication (C2X)) (Schöne, 2013), specifically with:

- Other vehicles (Car-to-Car Communication (C2C))
- Traffic infrastructure and other components of infrastructure (Car-to-Infrastructure Communication (C2I))

The interconnectedness of vehicles with other infrastructure components enables OEMs to use diagnosis tools for after-sales and maintenance services “by air” and to upgrade product items “by air” (Kieler, 2015) according to the pay-as-you-upgrade principle.

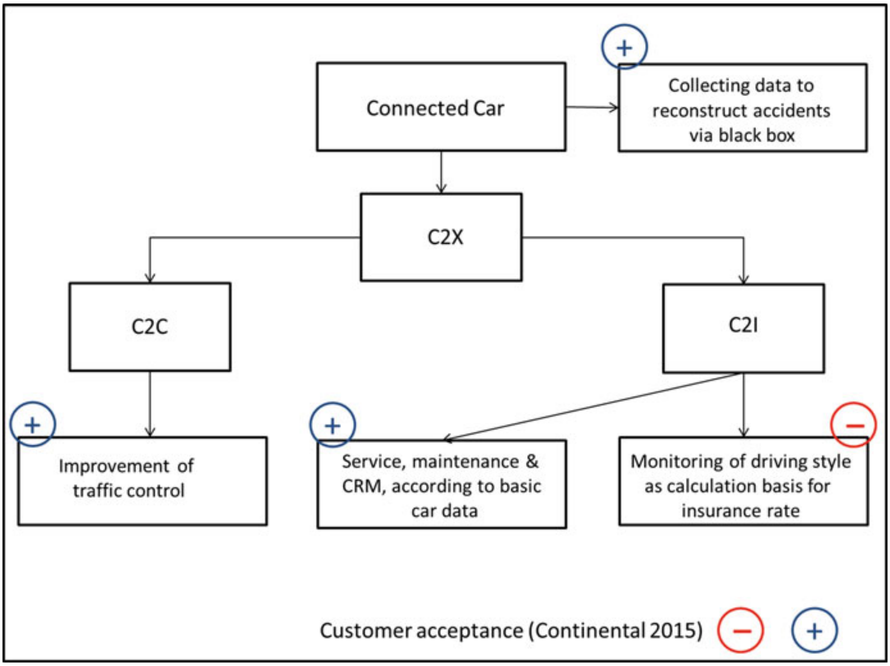

Fig. 9.2 Connected car and acceptance of connectivity applications in Germany and the USA (Köhler & Wollschläger, 2014; Continental, 2015)

A study by Continental (2015) underlines that the acceptance of connected car-based services in Germany ranks the improvement of traffic management before the integration of black boxes documenting driving data followed by the service and maintenance based on vehicle data. In the USA the service and maintenance based on vehicle data ranks before the integration of black boxes and the improvement of traffic management.

9.2.3.2 Internet of Things

The electronic interconnectedness of things (Internet of things) is an integral part of the upcoming sharing economy combined with the approaches of "smart city" and "smart home" (Köhler & Wollschläger, 2014) (see Fig. 9.3). According to the pay-as-you-drive principle, car owners can rent their car to others including a separated insurance service, which typically in average "remains unused for 23 of the 24 hours in a day" (Winterhoff, 2015b, p. 14). The application of the pay-as-you-use principle is suited for renting the own garage or the parking space management in conurbations, for example. But in the USA and Germany, only 1 % of the interviewed persons use car-sharing services (Continental, 2015). It is just a small niche business with low expectations of profitability (Köhler & Wollschläger, 2014; Freitag, 2016).

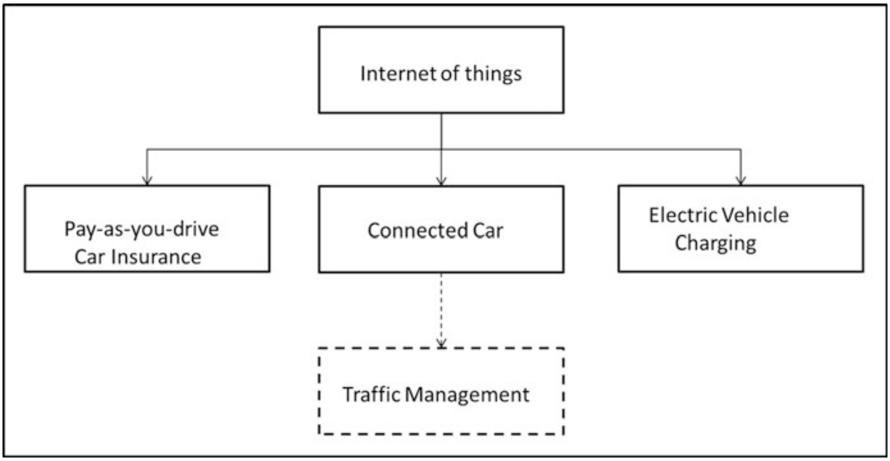

Fig. 9.3 Internet of things

9.2.3.3 Autonomous Driving

Autonomous driving means driving a vehicle without interference of a person who is compulsory inside the vehicle on the driver's seat. In contrast, there is the motion of drones and robots with exclusively external central control. A pioneer of autonomous driving is Ernst Dickmanns, former professor at the University of the Federal Armed Forces in Munich. He started in the 1980s in cooperation with Daimler-Benz AG with highly and fully automated driving tests based on Mercedes vans and S-Class vehicles (Vieweg, 2015; Dickmanns, 1998). There are five development steps to autonomous and driverless driving (CEDR, 2014):

- Level 0: driving without any driving assistance system (not automated)
- Level 1: driving with driving assistance systems, e.g., speed control
- Level 2: partially automated driving, e.g., park distance control system
- Level 3: highly automated driving, e.g., autopilot driving
- Level 4: fully automated driving with possible interference by a driver
- Level 5: driverless driving, which is not autonomous, but robot driving

The Continental study (2015) reveals that customers appreciate the relief of discomfort and stress by monotonous and stress-causing driving situations. These are rational buying arguments, which underline the rational characteristics of autonomous driving. Other arguments focus on safety and comfort characteristics, which are also of rational nature. But around a half of the interviewed persons in Germany and the USA doubts about the reliability of autonomous driving. Another pitfall is the cyber security issue of autonomous vehicles.

Big data and analytics as well as cloud computing are supportive elements of digitalization. The extraction of a huge amount of data and the application of data mining should lead to new knowledge about customer behavior, preferences, and needs. Volume, velocity, and the variety of data are important characteristics of big data.

Winterhoff (2015a) places big data and analytics to the category of digital data together with customer relationship management (CRM) and new business models as results of insights about customer needs. Big data and the insights of its analytics are also a prerequisite of the digital customer interface, which fuels multichannel activities, marketing and sales, and new mobility services with customer-related information (Winterhoff, 2015a).

Cloud computing covers Internet-based services for (Köhler & Wollschläger, 2014):

- Provision of computer capacities
- Services
- Memory capacities

Cloud computing is supportive for the other topics of digitalization and a prerequisite for the expansion of them. A pioneer of cloud computing is Salesforce (2016) specializing in "software as service," "platform as service," and CRM.

According to the studies of Winterhoff (2015a) and Continental (2015), customers identify the autonomous driving and the interconnectedness most interesting.

9.2.4 *Profile of Requirements of Societal- and Customer-Focused Strategies and Measures for Electrification and Digitalization in the Automotive Industry*

The trends of electrification and digitalization are technology-driven developments (technology-push) by companies from the ICT as well as automotive industry. These trends will cause tectonic shifts in the automotive industry by new competitors. They have an immense impact on the business models of the traditional automotive industry, especially OEMs, including their customer bases, customer needs, as well as political and societal impacts in the coming years.

9.2.4.1 Customer Requirements

On the customer side, it is interesting to anticipate the shifts in customer needs. A study of Arthur D. Little (ADL, 2009), a consulting firm, about mobility in 2020 identifies different customer types of mobility in triad markets (three developed markets of Japan, North America, and Europe) (Wittmann, 2013, pp. 118–119):

- Greenovator (27 %) reflects/internalizes socio-ecological impacts on mobility and demands for innovative and sustainable mobility solutions.
- Family cruiser (11 %) counts for growing demand for mobility in a rising fragmented personal environment (family, friends, peers, colleagues).
- Silver driver (24 %) starts proactive, motivated in the third phase of life. He is experienced in mobility products and favours high quality consciousness/product awareness.

- High-frequency commuter (24 %) is coined by high everyday mobility distances/frequencies and is focussed on mega-cities in the future.
- Global jet setter (2 %) is dependent on global mobility needs because of his job requirements/demands and counts on exclusive premium mobility services/support.
- Sensation seeker (4 %) considers mobility as a symbol of (personal) freedom, fun and life-style, status and prestige.
- Low-end mobility user/consumer (8 %) has rigid mobility budgets, a need of affordable mobility solutions. He is ready to downgrade his mobility demand.

In BRIC (Brazil, Russia, India, China) markets other customer types of mobility are representative. These are basic, smart basic and premium customers:

- Basic customer (48 %) demands basic mobility and needs simple and cheap mobility solutions. He focuses on local products.
- Basic smart customer (43 %) prefers affordable mid class products, which he can individualize on his needs and requirements.
- Premium customer (4 %) is focussed on status, reputation, prestige and comfort and intends to differentiate as a societal winner and to be considered as a successful person.

It is necessary to mirror the customer types of mobility with financial restrictions, which occur in buying decisions of products and services related to mobility. The price sensitivity and the preferences for mobility are important aspects for further analyses. The different segments of triad and BRIC markets count the following share in total (ADL, 2009) (see Table 9.2).

The customers of mobility recognize the relevance toward electric drive according to their preferences (see Table 9.3).

The trends of digitalization have different levels of relevance for the customers of mobility (see Table 9.4).

In Germany around 30 % of the purchased cars in 2015 belong to the premium segment (KBA, 2015, own calculation), which as an example can cover the customer groups: Greenovator (50 %), Silver Driver (50 %), Global Jet Setter, and Sensation Seeker. They have low price sensitivity; a focus on sustainable, individual mobility; and significant acceptance toward digital trends. These are important customer characteristics and requirements of customer-focused strategies and measures for electrification and digitalization in the automotive industry.

9.2.4.2 Societal and Political Requirements

Governmental initiatives like the National Platform for Electric Mobility (NPE) in Germany focus on research accelerating the development and mass introduction of electric vehicles (NPE, 2010). In parallel to governmental initiatives, like the NPE, many Western countries support the purchase of electric vehicles with financial and other incentives.

Table 9.2 Customers' mobility preferences and price sensitivity (virtual example) (Wittmann, 2013)

	ADL study (2009)		Estimate of price sensitivity	Preference for		
	Customers of mobility	Share (%)		Individual mobility	Public mobility	Shared mobility
TRIAD markets	Greenovator	27	Low-medium	Medium	Medium	Medium
	Family cruiser	11	Medium-high	High	High	Low
	Silver driver	24	Low-medium	High	Medium	Low
	High-frequency commuter	24	Medium-high	High	High	Low
	Global jet setter	2	Low	High	High	Low
	Sensation seeker	4	Low	High	Low	Low
	Low-end mobility	8	High	Low	High	Low
BRIC markets	Basic	48	High	Low	High	Low
	Smart basic	43	High	Medium	Medium	Low
	Premium	4	Low	High	Low	Low
	Miscellaneous	5				

Table 9.3 Customers' preferences for modes of drive (virtual example)

	ADL study (2009)		Modes of drive				
				Combustion engine			
	Customers of mobility	Share (%)	Electric	Hybrid	Gasoline/ diesel	Natural gas	Biofuel
TRIAD markets	Greenovator	27	x	x	(x)	x	x
	Family cruiser	11	(x)	x	x	(x)	(x)
	Silver driver	24	(x)	(x)	x	(x)	(x)
	High-frequency Commuter	24	(x)	x	x	x	x
	Global jet setter	2	x	x	x	x	x
	Sensation seeker	4	x	x	x	x	x
	Low-end mobility	8	–	–	x	–	–
BRIC markets	Basic	48	–	–	x	–	x[a]
	Smart basic	43	–	–	x	–	x[a]
	Premium	4	x	x	x	x	x
	Miscellaneous	5					

Legend: x relevant, (x) partly relevant, [a]In Brazil

Table 9.4 Customers' preferences for digitalization use (virtual example)

	ADL study (2009)				
	Customers of mobility	Share (%)	Connected car	Internet of things	Autonomous driving
TRIAD markets	Greenovator	27	x	x	(x)
	Family cruiser	11	x	x	(x)
	Silver driver	24	x	x	x
	High-frequency commuter	24	x	x	x
	Global jet setter	2	x	x	(x)
	Sensation seeker	4	x	x	x
	Low-end mobility	8	x		(x)
BRIC markets	Basic	48	x		(x)
	Smart basic	43	x		(x)
	Premium	4	x	x	x
	Miscellaneous	5			

Legend: x relevant, (x) partly relevant

Norway is a leading example to successfully adjust to electro-mobility with incentives (Schwan, 2015). Fifty thousand electric vehicles already exist in Norway with a population of 5.2 million people. Twenty percent of newly purchased vehicles are electric vehicles. Very helpful are incentives granted by the Norwegian state, which are exemptions of vehicle and value-added taxes. Additionally, the use of toll roads, bridges, and tunnels as well as of ferries often is free of charge for electric vehicles in Norway. Critics demand to waive the incentives for premium cars like the Tesla S in Norway. According to a study of the University of Oslo (Figenbaum & Kolbenstvedt, 2015), 62 % of the electric vehicles are in the ownership of multi-vehicle households, 18 % in the ownership of single-vehicle households, and 20 % in the ownership of fleets. The sociodemographic composition of electric and conventional car owners is nearly congruent in Norway. The customer satisfaction is very high; 91 % of 7,500 interviewees are satisfied or very satisfied with their electric car. The range of the electric vehicles is not a customer problem anymore, because the average daily commuter distance is less than 60 km and within the range of fully loaded electric vehicles. Also 97 % of the electric vehicle owners have access to home charging facilities, which underlines the high relevance of multi-vehicle households and fleets as customer bases for electric vehicles in Norway.

Six other aspects cover further requirements of strategies and measures for electrical and digital disruptive innovations in the automotive industry:

- In a research study of long-term vehicle in the 1970s, which was initiated by former Porsche CEO Ernst Fuhrmann (1918–1995) (Kortzfleisch, 1980), feasibility analyses underline that long-term vehicles with 20-year technical obsolescence or 300,000 km driving performance have despite the life-cycle enlargement a constant demand in contrast to conventional vehicles (Bellmann, 1990). The reasons why these long-term vehicles were not produced were poor customer acceptance and different buying behaviors. Wittmann (1998) forecasts that the more ecological items are relevant for customers, the more the demand of vehicles with longer model life cycles grows.

- The goals for a long-term vehicle (Bott & Braess, 1976) are similar to goals for electric cars: preserving energy supplies, reduction of environmental burden, increase of reliability of operation, perpetuation of classical vehicle concepts, reduction of total costs, and preserving raw material supplies. Consequently electric vehicles are convenient for long-term usage.
- The strong emphasis on environmental issues in the automotive industry traditionally leads to a focus on rational car features (and services) in the automotive planning and development process focusing on small- and midrange vehicles. The premium car segments in the traditional automotive industry represented by emotional items like styling, engine power, driving pleasure, sportiness, and prestige (Wittmann, 1998) do not have a focus on the introduction of electric drive, which is viewed as an environmental, rational item by the regular customers over a long time (Continental, 2015). This is an open flank for new competitors, who combine environmental items with emotional items like excellent design, sportiness, and driving pleasure, in order to charge the electric vehicle with emotions ("emotionalization"), e.g., Tesla Motors with its Model S (Consumer Reports, 2015).
- Another development in society on environmental issues postulates new usership concepts of the automotive industry, which concentrate on new mobility services, like car sharing, carpooling, and mobility platforms for modal transport (Canzler & Knie, 1999). This movement grounds on ideas around sustainable economic development concerning prosperity with growth fulfilling important social benefits while improving sustainability (Meadows, Randers, & Meadows, 2004), concerning prosperity without growth and innovation (Jackson, 2011; Paech, 2012), or concerning smart growth (Coble, 2013).
- The electric drive replaces the combustion engine and its peripheral systems, like exhaust systems, in the vehicle concept. Currently, costs and weight of electric cars often are higher than of conventional cars because of the battery costs and the weight of the batteries. But in the midterm, significant cost and weight reductions are realistic, which rapidly increase the competitiveness of electric cars, especially in the price-sensitive volume segments.
- Another aspect of electric vehicles is the strong reduction of the amount of wearing parts now just focusing on the battery, the brakes, and the tires. A long-term usage is appropriate in contrast to conventional cars. This has impacts on maintenance and running costs as well as of the resale values of the electric cars. New service, warranty, and maintenance models, based on insights of customer research methods, can compensate the higher technical obsolescence and value losses of first-generation batteries.

The framework takes the relevant aspects into account and summarizes as follows (see Fig. 9.4).

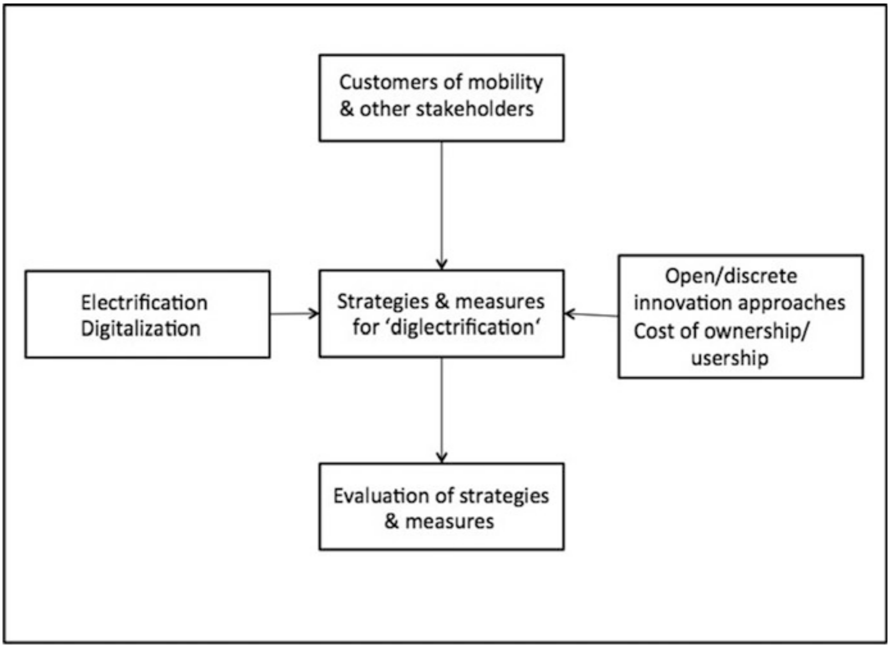

Fig. 9.4 Framework for strategies and measures for "diglectrical" disruptive innovations in the automotive industry

9.3 Key Elements for Strategies and Measures for "Diglectrical" Disruptive Innovations in the Automotive Industry

9.3.1 From Open-Innovation Approaches to Discrete Innovation Approaches

The identification of customer requirements and needs for products and services is essential for designing effective strategies and measures for disruptive innovations in the automotive industry. Wittmann (2013) recommends open-innovation approaches to solve the problem of customer integration and participation, which are categorized in an open-innovation matrix based on the criteria "amount of users" and "level of integration". The digitalization trend of "big data and analytics" enhances research methods of innovation and marketing management. In contrast to open-innovation approaches and traditional market research methods, big data analyses only require customer raw data, e.g., about individual customer behavior, from companies and organizations without direct contact to (potential) customers. Therefore the big data analyses characterize discrete innovation

Table 9.5 Research methods

Research methods	Level of integration	Amount of users	Content of interaction
Open-innovation approaches			
Lead users	High	Low	Knowledge
Crowdsourcing	High	High	Information
Innovation with communities	High	High	Information
Traditional market research methods			
Focus groups	Low	Low	Information
Panel	Low	High	Information
Discrete innovation approaches			
Big data analyses	None	High	(Raw) data

approaches, which enable insights toward new product and service trends and improvements as well as new business models and the identification of new customer needs. The anonymous data deliveries can range, e.g., from periodical deliveries of customer profiling (digital footprints) to real-time technical driving data of vehicles. Stahl (2016) considers big data analyses as new approaches of market research (see Table 9.5).

9.3.2 Concepts of Cost of Ownership and of Cost of Usership

According to Continental (2015), driving is more a question of budget than of seniority and residence. An essential prerequisite is the financial budget restriction, which influences buying decisions. In this context the concepts of cost of ownership and of cost of usership receive relevance. The concepts of cost of ownership and of usership are able to identify and to evaluate strategies and measures for electrification, digitalization, and new business models in the automotive industry:

> In the cost of ownership model an ecological price premium exists when the product bears competitive advantages in ecological features in comparison to a competitor's product. This premium can be justified by savings on fuel costs and taxes related to mobility, for example. This is also important for the owner's view of the life cycle of the product, when significant cost, tax and fee reductions can be realized over time because of the ownership of an ecological vehicle. (Wittmann, 2013, p. 126)

The cost of usership model covers different individual and public services, offered by public and private organizations, like taxi companies, bus and railway companies, car and bike rentals, as well as by new competitors like Uber favoring on mobility on demand services (Wittmann, 2013). Equivalent to the cost of ownership model, competitive advantages like savings on fuel costs (ecological service feature) or ad hoc availability of the service (digital service feature) can justify the price premium.

9.3.3 *Customer-Focused Strategies and Measures for "Diglectrical" Disruptive Innovations in the Automotive Industry*

Christensen (1997, pp. 219–220) points out that "the electric vehicle is not only a disruptive innovation, but it involves massive architectural reconfiguration as well, a reconfiguration that must not only occur within the product itself but across the entire value chain."

Several strategies and measures seem appropriate to guarantee the adequate reconfiguration of the automotive value chain, too. Cost of ownership and of user-ship concepts exemplify and visualize the financial impacts of a conventional and of an (battery) electric vehicle from a customer and OEM perspective:

- The top-down introduction of innovations into the product program is a characteristic of premium OEMs (Wittmann, 1998), and it is also an appropriate *strategy to diffuse* "*diglectrical*" *innovations*, especially because of the high costs of electrical batteries. The "emotionalization" of electric vehicles works easier in a premium vehicle positioning, where emotional items, like prestige, sportiness, and driving pleasure, dominate. The ecological price premium combines environmental aspects (CO_2 free mobility) as well as emotional vehicle characteristics like driving pleasure (see Fig. 9.5).

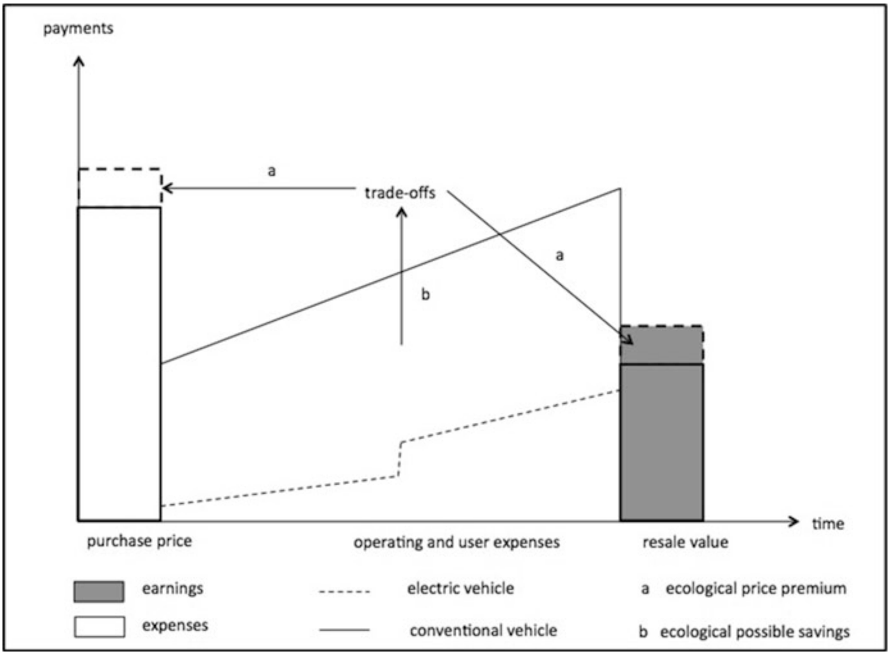

Fig. 9.5 Cost of ownership concept: conventional vs. electric vehicle

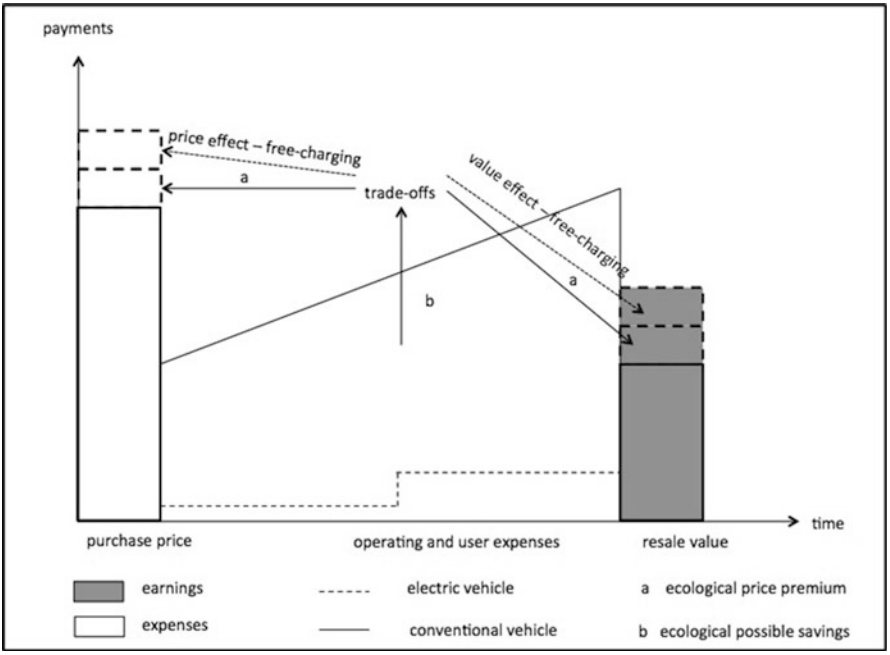

Fig. 9.6 Cost of ownership concept: conventional vs. electric vehicle—vertical integration of charging stations and free charging

- A *strategy of vertical integration* can also support an ecological price premium. Tesla Motors, e.g., offers free charging of electric energy for specific Tesla S customers at its own charging stations (see Fig. 9.6).
- A *long-term strategy*, especially of electric vehicles, underlines reliability and quality, which enables an ecological price premium, too (see Fig. 9.7).
- A *hybrid strategy of electrification and digitalization* (*strategy of* "*diglectrification*") helps in offering a bundling of features and services to upgrade the product over the life cycle. Different pricing strategies are possible, which support an ecological price premium position as well as a higher resale value. Tesla Motors, e.g., upgrades product functions, like autopilot function, "by air" and free of charge (see Fig. 9.8).
- Last not least, *mobility service strategies* drive an innovative form of individual and sustainable mobility in conurbations. They probably compete with car rentals, taxi companies, and new forms of mobility on demand services, like Uber (see Fig. 9.9). An ecological price premium is arguable, when, e.g., fuel cost savings, ad hoc availability, and electric drive are service characteristics.

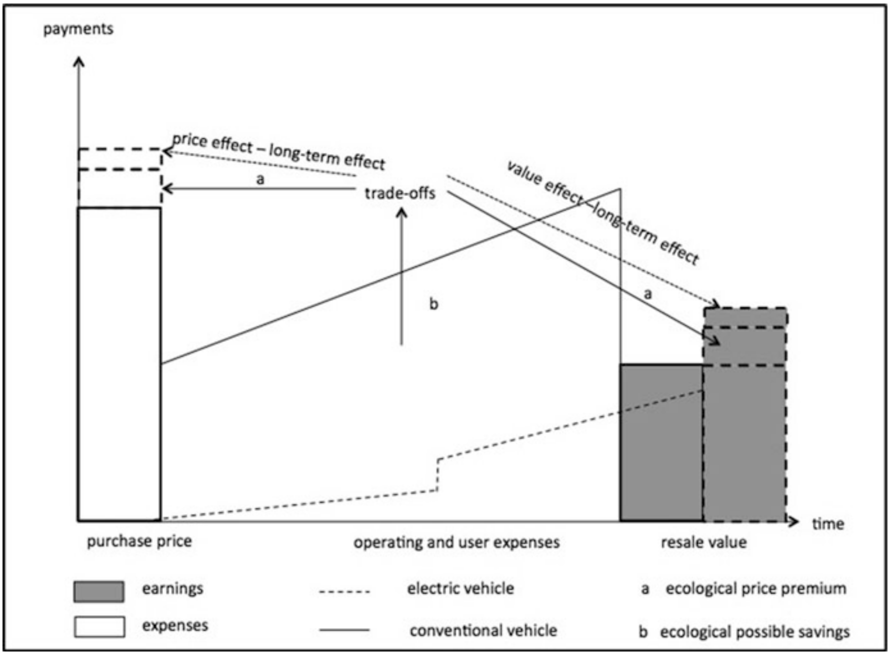

Fig. 9.7 Cost of ownership concept: conventional vs. electric vehicle—long-term effect

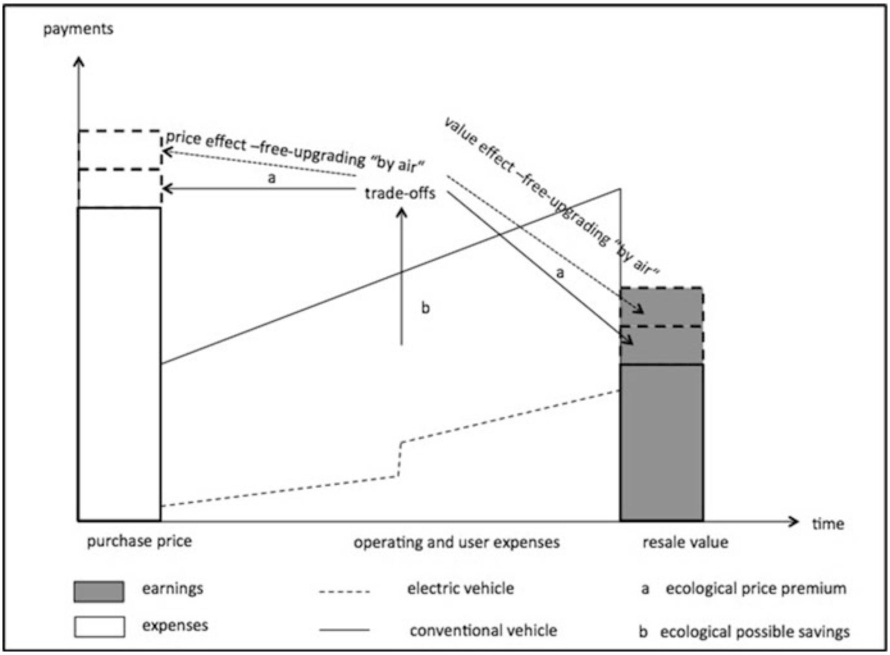

Fig. 9.8 Cost of ownership concept: conventional vs. electric vehicle—digital upgrading "by air" and its effects

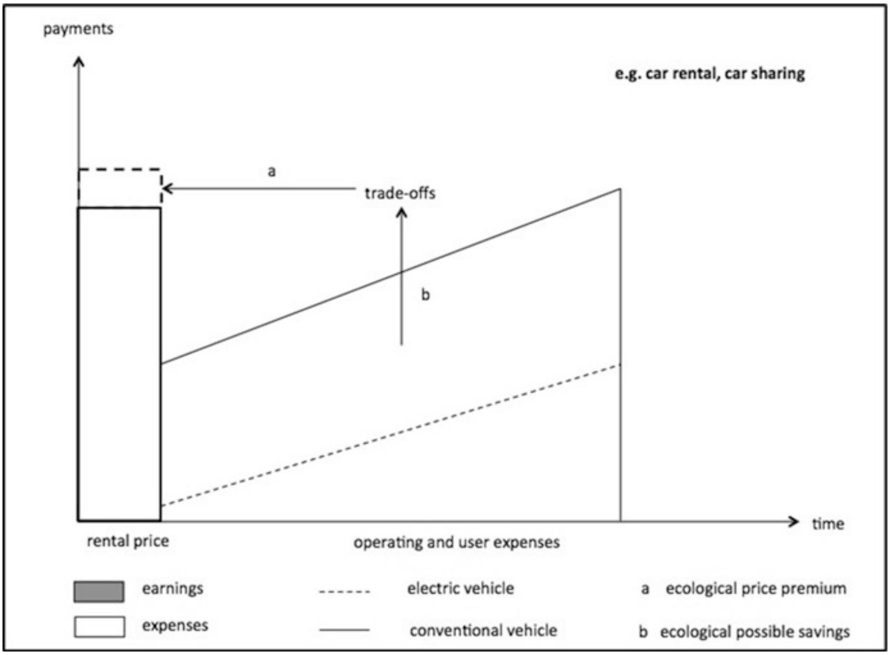

Fig. 9.9 Cost of usership model (Wittmann, 2013)

9.3.4 *Societal Strategies and Measures for "Diglectrical" Disruptive Innovations in the Automotive Industry*

Strategies and measures mitigating climate change focus on societal goals (NPE, 2010). The development and use of clean technologies rank first of the strategies and measures mitigating climate change (see Table 9.6). It is obvious that the disruptive innovation of electric drive changes the automotive value chain dramatically. It is the only alternative, which guarantees sustainable CO_2 free automotive mobility.

The IPCC defines in 2007 key technologies, which are the bases for strategies and measures for the transport sector mitigating climate change as societal goal. The disruptive nature of the electrification in the automotive and transport industry leads to an acceleration of the development (Evannex, 2016; Vetter, 2016), where an update of technology-driven strategies and measures is necessary as follows (see Table 9.7).

The rising success of electric vehicles is only possible, because digital innovations support this development and they significantly enlarge the customer and societal value of electric vehicles, e.g., through upgrading of items "by air" (Consumer Reports, 2015; Vetter, 2016).

Table 9.6 Modes of drive and societal strategies and measures mitigating climate change

Strategies and measures mitigating climate change	Mode of drive				
	Conventional	Hybrid	Electric	Natural gas	Biofuel
Development and use of clean technologies			x		
Development and use of less GHG-emitting technologies	(x)	(x)		x	x
Increased attention on energy efficiency	(x)	(x)	(x)	(x)	(x)
Increased use of renewable energy		(x)	(x)		x

Legend: x relevant, (x) partly relevant

Table 9.7 Key mitigation technologies and practices by sector "transport" (IPCC, 2007, p. 20) and update 2016

IPCC (2007)	Sector	Key mitigation technologies and practices currently commercially available	Key mitigation technologies and practices projected to be commercialized in 2020	Key mitigation technologies and practices projected to be commercialized before 2030
	Transport	More fuel efficient vehicles; hybrid vehicles; cleaner diesel vehicles; biofuels; modal shifts from road transport to rail and public transport systems; nonmotorized transport cycling, walking; land use; and transport planning		Second-generation biofuels, higher efficiency aircraft, advanced fuel-cell vehicles with more powerful and reliable fuel cells
Update 2016	Sector	Key mitigation technologies and practices currently commercially available	Key mitigation technologies and practices projected to be commercialized in 2020	Key mitigation technologies and practices projected to be commercialized before 2030
	Transport	More fuel efficient vehicles; hybrid vehicles; cleaner diesel vehicles; biofuels; modal shifts from road transport to rail and public transport systems; nonmotorized transport cycling, walking; land use; and transport planning	Advanced electric and hybrid vehicles with more powerful and reliable batteries, first-generation fuel-cell vehicles	Second-generation biofuels, higher efficiency aircraft, advanced fuel-cell vehicles with more powerful and reliable fuel cells

9.3.5 Evaluation of Strategies and Measures: New Perspectives the Automotive Industry?

Electrification and digitalization sustainably influence the business models of traditional OEMs as well as market newcomers. In Fig. 9.10, OEMs face challenges concerning the potential of profitability and the focus on technology or customer. Traditional premium OEMs have to defend their technological leading position, which is challenged by start-up OEMs, like Tesla Motors or Google and Apple, planning autonomous, electric niche cars for conurbations. The start-up OEMs face on the one side commercial problems, like Tesla Motors, because of high investments and low volumes and sales. On the other side, future niche OEMs like Google and Apple, which belong to the ICT sector, lack technological automotive know-how and depend on external automotive support.

Technological and commercial advances in batteries, fuel cells, electric charging, and light weighting push the electric car to higher profitability, which enables the mass introduction of this vehicle type. This supports traditional OEMs in their transformation toward electrification and digitalization. Start-up OEMs get the business opportunity to establish themselves in the highly competitive automotive markets.

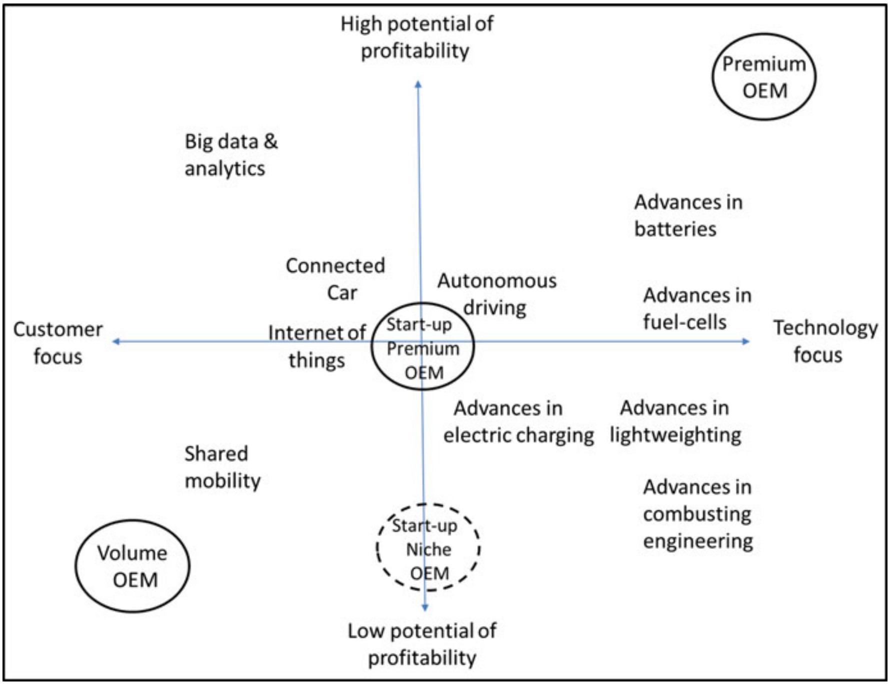

Fig. 9.10 Potential of profitability of OEMs and of "diglectrical" measures

9.4 Conclusion and Outlook

Bellmann and Khare (2008) recommend the farewell from individual mobility as prerequisite for sustainable mobility, probably underestimating the disruptive nature of electrification and digitalization in the automotive industry. But they are not the only ones. Customer behavior seems to change, but not toward public or shared mobility as forms of sustainable mobility postulated by IPCC (2007), too. The technological and market revival of the electric drive makes sustainable individual mobility combined with driving pleasure possible and attractive. The technological trends of digitalization thereby accelerate the customer acceptance of electric vehicles. In the future, the societal goal of mitigating climate change and individual mobility preferred by the customers will not be a discrepancy anymore. There are new perspectives for the automotive industry.

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Part IV
Technology

Chapter 10
3D Printing: Challenging Existing Business Models

Mervi Hämäläinen and Arto Ojala

Abstract Technologies labeled as "disruptive" challenge conventional business procedures. The development of 3D printing technology and additive manufacturing (AM) is expected to transform product design and manufacturing. 3D printing technology makes it possible to produce complex and unique physical products from digitally designed CAD models. It is estimated that the effects of 3D printing on business will be diverse and far reaching. Hence, it is vital for business owners to observe how 3D printing may impact on business models and business networks, considering also the effects on stakeholders' value propositions and on value creation. This chapter reports on the potential impact of 3D printing technology on business models within the metal and machinery industries.

Keywords Business model • Value delivery • Value networks • 3D printing

10.1 Introduction

It is estimated that the digitization of manufacturing will transform the way goods are made. 3D printing has been referred as the third industrial revolution, involving not only the way products are manufactured but also how they are designed (The Economist, 2012). 3D printing offers the potential to design forms and structures that are impossible with traditional methods. In addition, it is expected that 3D printing will accelerate product development cycles, shorten product delivery time, modify the profit structures of companies, and possibly reshape future professions and jobs (Cohen, Sargeant, & Somers, 2014; The Economist, 2012). The diffusion of a new technology is a slow process, but it can ultimately have immense consequences (Davis & Venkatesh, 2000). It seems likely that business managers will have to reevaluate their business models, here bearing in mind the circular process by which the reinvention of a business model can itself accelerate the

M. Hämäläinen (✉) • A. Ojala
University of Jyväskylä, Agora Center and Faculty of Information Technology, Mattilanniemi 2, 40014 Jyväskylä, Finland
e-mail: mervi.a.hamalainen@jyu.fi; arto.k.ojala@jyu.fi

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adoption of a new technology (Ardilio & Seidenstricker, 2013). It appears that the overall digitization of manufacturing will be a factor accelerating the diffusion of 3D printing. Business managers would be well advised to understand the change-producing agents at work in 3D printing and to anticipate how the technology may impact on business models. Due to a limited number of research on how 3D printing impacts business models (Rayna & Striukova, 2014), business network, and value creation, the aim of the study reported here was to determine how 3D printing influences and might shape an existing business model and its components, including the product, the value network, the value delivery, and the revenue model.

10.2 3D Printing

Three-dimensional printing can be taken to include rapid manufacturing, rapid prototyping, or additive manufacturing. It utilizes methods of adding materials, such as stereo lithography and laser sintering. Various materials—including metal, composites, polymers, and ceramics—are used in 3D printing processes (Cotteleer et al., 2013). The technology used with metal 3D printing follows laser sintering or laser melting principals. The laser beam melts thin metal powder layers and the product is produced by adding the material layer by layer. As a result, durable and hard product is printed (AM Finland, 2013). Petric and Simpson (2013) note that 3D printing and additive manufacturing are perceived as synonyms, since both refer to a layer-by-layer production method.

Petric and Simpson (2013) describe 3D printing as a disruptive technology. By this they mean that 3D printing has impacts on how products are designed, built, and delivered. Also the traditional economies of scale of the conventional manufacturing are challenged by economies of one (Petric & Simpson, 2013). 3D printing technology is based on digital computer-aided design (CAD) (Liu & Zhou, 2010). It involves the creation of a series of digital images of an object, which are then transferred to a 3D printer (Ford, 2014). A physical model is formed from the digital image by adding materials cumulatively (Liu & Zhou, 2010). The greatest advantages of 3D printing are cost-effectiveness, reduced time to the market, a movement from mass production to more customized or tailor-made products, and environmental benefits. Users have also mentioned the features of variety in materials, flexibility in design, and improved accuracy (Cotteleer et al., 2013; Ford, 2014; Mertz, 2013). Some authors (e.g., Petric & Simpson, 2013) have gone so far as to suggest that almost anything that can be imagined can be produced by 3D printing.

During the recent years, 3D printers and materials have improved, as have 3D software and digital platforms. 3D scanners and software compatible with 3D printing have been developed for a variety of applications. Platforms such as Autodesk and Spark offer 3D design services, optimized for 3D printing. The main industries to benefit from 3D printing have been in the consumer sector and in the fields of electronics, automotive industries, space, and medical instruments (Mertz, 2013; Petric & Simpson, 2013). For instance, the automotive industry has benefited from

3D printing in terms of producing tool prototypes and small customized parts. The aerospace industry, for its part, uses 3D printing to produce lighter and stronger components and to print small numbers of geometrically complex parts from materials such as titanium and plastic (Ford, 2014). NASA (2015) recently announced 3D printing as a key technology for improving space vehicle design and manufacturing; indeed, it indicated that it is coming closer to building an entire rocket engine with a 3D printer. The medical industry has increasingly benefited from 3D printing; thus medical instrument companies can often manufacture unique products and set up small runs of complex parts (Ford, 2014; Mertz, 2013; Petric & Simpson, 2013).

10.3 Business Models

Business models have attracted academic interest for decades (Zott, Amit, & Massa, 2011). Scholars have studied business models from various perspectives to determine many aspects, including how firms can organize their activities (Magretta, 2002), create value for partners and end users (Teece, 2010), make a profit (Morris, Schindehutte, & Allen, 2005), and enter foreign markets (Ojala & Tyrväinen, 2006). To advance our understanding on business models, scholars have developed models and theoretical frameworks that explain how business models can be planned and developed. For instance, Osterwalder and Pigneur (2010) have developed a business model canvas that can be used as a tool to develop a new business model or to advance the existing one. The canvas is a very useful chart for the purposes of explaining business activity in the context of given organization. However, the recent theoretical framework by Ojala (2016) takes a wider perspective, explaining business model creation and development in the context of a whole industry or ecosystem. Because Ojala's framework includes the aspect of change, it was selected as a theoretical model for this study.

The business model framework by Ojala (2016) includes four different components that might change when a firm develops its business model further. The first component, the product/service, is linked to how the product creates value for other actors in the business ecosystem, i.e., the network of partners. The second component is the value network. The value network includes all the key actors that the firm cooperates with, either directly or indirectly. The third component, value delivery, refers to the actors in the second component, and how the value, based on the product or service, is exchanged between them. The fourth component, the revenue model, explains how the revenue is created among the partners in the network.

In the framework by Ojala (2016), the components of the business model change constantly when a firm operates in the market. The first business model is created through the enactment of a business opportunity. This new business model is "tested" in the market to see how it works and how partners and customers react to the model created. Based on actions in the market, the model might require reassessment, since there can be changes in technology, market conditions, and so on.

This leads to the business model development phase, in which the model is developed further to better respond to the needs and requirements in the market. In the final phase, new elements are added.

10.4 Research Method

This study applied a qualitative research method and a semi-structured interview procedure, since the aim was to explain contextual information and to understand the interpretations and perspectives of the actors. A qualitative study allows actors to articulate their perceptions of situations in the past and to evaluate the elements affecting their development in the future. In addition, a qualitative research method examines the study phenomenon with a view to understanding people operating within a certain social context (Myers & Avison, 2002). For its part, the semi-structured interview is flexible, with good possibilities for in-depth data collection and a detailed understanding of the research phenomenon (Gillham, 2005).

The study covered face-to-face interviews with two companies. One interview was conducted with the CEO of a metal 3D printing company, and two interviews were conducted with the project manager in tractor manufacturing company. Additional information was collected via email communication and from company web pages and brochures.

The themes and structure of the interviews were preplanned, and the same questions were asked of all the interviewees. The interview questionnaire was divided into three themes: (1) the company's background and current use of 3D printing, (2) 3D printing's impacts on the existing business model and its elements, and (3) estimations of the impacts of 3D printing on future business model development. The interviewees were able to give comments freely and to provide feedback. The interviews were audio recorded for later transcription and analysis. The average interview length was approximately 40 min.

10.5 Research Findings from Case Companies

10.5.1 A Metal 3D Printing Company

The metal 3D printing company offers products for customers in various industries. The owner, who has a background in metal additive manufacturing, considered metal 3D printing to be a promising business. He executed the first market survey in the dental sector and a second survey some years later in the jewelry industry. Because respondents in the survey indicated an interest in 3D-printed metal crowns, bridges, and superstructures, and subsequently prototypes for items of jewelry, the company created its first business plan for dental products and jewelry products.

However, obstacles came up immediately, since financial institutions were not willing to fund the still unknown 3D printing technology; the institutions would advance only 25–30 % of the cost of 3D printers, whereas the lending value for CNC (computer numerical control) machines is 80 %. Despite some promising signs, it was difficult to get the new business off the ground, and it took another year for the company to find funding. Finally, a German 3D printing machine manufacturer offered a financing solution. The machine was acquired, and the project was able to continue. In addition, the business manager found several private capital investors who were willing underwrite the new 3D printing business operation. In October 2014 the company received its 3D printer, and the first 3D-printed metal components were delivered to customers a few weeks later:

> It was a long and rocky road to bring the new technology and business to Finland. Since financial institutions do not understand what 3D printing is about and what is done with the machine, they are unwilling to take risks (T. Heikkinen, personal communication, October 27, 2015).

After this bumpy start, the first business model evolved (Table 10.1). All the business model components (*the product*, *the value network value delivery*, and *the revenue models*) have undergone improvements. The first and the second business model included products only for the dental and jewelry sector, but the company

Table 10.1 The business models of the metal 3D printing company

Business model	Products made of steel, cobalt-chrome, silver, and bronze	Value networks	Value delivery factors	Revenue model
Business model #1 and #2	Metal dental bridges, crowns, and superstructures Metal components for the jewelry market	Investors, 3D printer manufacturer, customers, trade associations	Rough product versions Delivery time Cost efficiency	B-2-B customers
Business model #3	Metal dental bridges, crowns, and superstructures Metal components for the jewelry market Wide selection of metal components and prototypes for various customers Spare parts for cars Miniseries production, 1–60 items Demand for finishing services	Investors, a 3D printer manufacturer Customers Trade associations Other 3D printing companies 3D designers Educational institutions	Rough product versions Delivery time Cost efficiency Finished products Dimensional and quality accuracy Local service better than in low-cost countries No interruptions in the customer's normal production process	B-2-B customers Collaboration with other 3D printing companies

currently offers a wide selection of 3D-printed metal components for final and prototype use, providing them to various B-2-B customers in a range of industries. The new business areas seem likely to include metal spare parts to cars. The number of printed products has steadily increased, and in addition to single products, the company also delivers miniseries, such as 20–60 items of product orders. Since customers increasingly require finished products, or products resembling end-use items, the company is considering extending finishing services as part of its product portfolio.

During the years of operation, the value network has evolved from investors, 3D printing manufacturers, and customers, to include also other 3D printing companies, 3D designers, and educational institutions. The company is actively participating in industry-related workshops and seminars, and it collaborates closely with national trade associations and city administrations, aiming to increase 3D printing knowledge and the business opportunities surrounding it.

In addition, the business model's value delivery component underwent improvements. The first product versions lacked refinement; however, the company is now able to provide larger and better metal 3D-printed components. Customers have indicated that local 3D printing company provides better metal 3D printed products in terms of materials, dimensional accuracy (20–60 μm), overall quality, and delivery time, as compared to products from low-cost countries. Product accuracy and delivery time are particularly highly valued, since these save costs and benefit the customer's total production time. Other value delivery elements mentioned included the point that the customer should pay only for the materials and time used to manufacture 3D products; furthermore, if a customer occasionally needs single parts, the customer's normal production line should not be interrupted due to delays in 3D printing:

> Two weeks ago one customer made the point that the product material must be exactly what he has ordered. The customer said that in ordering from low-cost countries, you never know if the strength values or weldability will be correct. Even though the product may be cheaper, the final result is not the same if the material is wrong. This is important. In addition, our delivery time is 3–7 working days, which means added value for customers (T. Heikkinen, personal communication, October 27, 2015).

The company is willing to deliver more miniseries for end use, so long as the quality meets the customer's requirements. Miniseries increase the value experienced by the customer, bearing in mind that having the manufacturing tools and other instruments for small numbers of pieces can prove extremely expensive.

As regards the revenue model, the company earns revenue from products delivered to the customer. The first operating year ran at a loss; however, due to customership and to extension of the product portfolio, the yearly turnover has increased. It is estimated that the turnover will be 4–5 times higher within the next 5 years. However, the company is still searching for a "cash-cow" product range, i.e., one that would have a truly dramatic impact on revenue. To minimize the business risk, the company prefers to collaborate and cocreate value with customers. In the future, finishing services will extend the revenue model.

10.5.2 A Tractor Manufacturing Company

The second case company, a tractor manufacturer, belongs to a corporation providing solutions for the agriculture industry on a global basis. The company's core business is the production of customized tractors worldwide. The company recently established its own facility called the *Unlimited Studio*, which provides customers with even more precisely tailored and specialized solutions. The studio attends to the customer's individual needs by providing customer-specific accessories and equipment, i.e., items that are not available directly from the production line. Examples include special lamps and painting finishes, tailored automated extinguishing systems, and alcohol ignition locks. The annual need for special accessories is about 10–300 units per year. The company has used 3D printing for prototype and mold purposes (Table 10.2) as part of its R&D for several years, but in 2015 the company decided to acquire its own plastic 3D printer for R&D, allowing industrial designers to study the 3D printing technology more closely. The research areas of special interest include the capabilities and restrictions of 3D printing and how it can be applied to miniseries production. The company is investigating the utilization of 3D printing at its Unlimited Studio.

The company's value network consists of internal and external actors. The external actors consist of customers, plus various domestic and international stakeholders and 3D printing subcontractors. The external 3D printer manufacturer complemented the value network when the company acquired own 3D printer. If the quality of the 3D printing fulfills end-use product requirements, the company is interested in using 3D printing subcontractors for Unlimited Studio's production of special accessories. The reason for using subcontractors is that they have the best expertise, notably in printer use, in materials and material properties such as thermal expansion and in finishing and pricing.

One of the value delivery elements the company mentioned was the designers' ability to outline the whole product easily and to detect design errors at an early stage. In addition, the designers were able to examine the product structures, dimensions, and ergonomic aspects. Sculptured samples are no longer needed when prototypes are digitally designed, with the 3D product emerging precisely as designed:

> Industrial designers no longer need to sculpt the prototype from wood; instead, the product is digitally 3D designed and 3D printed. The designed product is tested and modified if necessary. 3D printing accelerates the design process (S. Rauhaniemi, personal communication, October 19, 2015).

With 3D-printed prototypes, it is easier to illustrate the sketched product with the customer and to run functional tests before the final products. This improves mutual understanding and thus reduces the time and costs applicable to the final product. 3D-printed prototypes are less expensive than molds produced traditionally, and the delivery time is a few days instead of several weeks. This has impacts on the final product costs. By possessing its own 3D printer, the company has been able to

Table 10.2 A tractor manufacturer's business models

Business model	Product material: plastic and aluminum	Value networks	Value delivery factors	Revenue model
Business model #1	Customer-specific accessories 3DP used internally for mold and prototype purposes by R&D + industrial users	Internal industrial designers and R&D personnel Customers Various domestic and international stakeholders External domestic and international 3D printing service providers Would benefit from metal printing, if the service was available. Plastic materials are too fragile for the final product	Easier to outline the entire product and to detect design errors in the early phase. Ability to execute functional tests in the early development phase Cost effective compared to traditional mold costs Easier to demonstrate the sketched product to the customer. Improves product quality 3D printing is utilized increasingly. Depending on the product volumes, decompression molds have greater utility. If 3D printer prices fall and if materials develop, it will be possible for final products to be printed. This will affect the business model	Reduced cost structure Quicker production time
Business model #2	Own printer for R&D and for industrial designers	Internal industrial designers and R&D personnel Customers Various domestic and international stakeholders External domestic and international 3D printing service providers Domestic 3D printing manufacturer	Own 3D printer has improved product development and project schedules 3D products are ideal for examining product dimensions and durability	Reduced cost structure Quicker production time
Business model #3	3D printed special accessories at business unit called *Unlimited Service*	Same as business model #2, complemented with subcontractors, who offer marginal 3D printed accessories for Unlimited Studio	Marginal accessories cost effective compared to current methods More unique accessories	Reduced cost structure Quicker production time

improve project schedules and the overall efficiency of the product development process. Even though the superficial quality of the product surface remains low, it is considered good enough to examine product dimensions and durability:

> For example, if we need to validate, if the feel of the handle is sufficient for the fingers; it is difficult to observe this in a display. The 3D printed prototype thus accelerates the schedule for the project (S. Rauhaniemi, personal communication, October 19, 2015).

As a result of 3D printing, the customers receive individual tractors more quickly. For the company, 3D printing has reduced the final product costs and the time used in design, molds, and materials. This has impacted positively on the revenue model. The marginal accessories offered through Unlimited Studio are currently fairly expensive to produce. However, customers are willing to pay extra for individual and tailored parts. Provided that the cost structure for 3D printed special accessories is reasonable, and provided quality expectations are met, 3D printing can prove to be a solution. The company is actively investigating this option, since it will affect the future revenue of Unlimited Studio.

10.6 Discussion

Considering the impacts of 3D printing technology on company business models, we would argue that 3D printing is connected to changes in the *product*, *value network*, *value delivery*, and *revenue model* components of the business model (Ojala, 2016). The manner in which 3D printing impacts on the products relates first of all to the way in which the technology gives greater freedom for product design. For industrial and R&D designers, this means possibilities to design and produce new prototypes with new forms and structures, including items which can be difficult or even impossible to produce via traditional methods. As an example metal 3D printing enables to print nested forms and internal funnels for metal nuzzles. With traditional method this would be challenging or even impossible. This has a positive influence on product innovations and on improvements to old products. 3D printing has also extended the product range, both for existing and new customers. The companies' product portfolios have improved so that they cover a range of prototypes, molds, metal components, and end-use products. It appears 3D printing is important in machinery industry as the costs of 3D printed molds are fractional compared to molds produced traditionally. Both case companies expressed a demand for finishing services, but from different perspectives. The tractor manufacturer indicated an interest in external finishing services if the company were to initiate 3D special accessories for its customers. The metal 3D printing company is evaluating the provision of finishing services, in line with constant customer demand.

The value network varied between case companies, since they represented different business roles in the market. As a private family business, the value network of the metal 3D printing company has evolved to include other 3D printing service providers, in addition to investors, B-2-B customers, and 3D printer manufacturers. For the tractor manufacturer, the most significant actors in the 3D printing value network have been customers, 3D printing subcontractors, internal designers, and a

3D printer manufacturer. The reason for preferring 3D printing subcontractors was they have the best expertise regarding printer use and in materials and material properties such as thermal expansion, finishing, and pricing.

The value expectations of 3D printing are seen as bound up with a movement from mass production to mass customization (Berman, 2012; Ford, 2014). The need for unique and tailored products is increasing; however, with traditional production methods, such tailoring is limited due to the cost structure. 3D printing makes it possible to produce unique and tailored products with affordable costs and time, since the customer pays only for the materials and time used in the printing process. 3D printing is also suitable for miniseries, since the unit costs remain reasonable. Both of the case companies preferred to have customers involved with the product design and development process. This is because 3D printing makes it easier to illustrate the sketched product for the customer and to experiment with its structures, surfaces, and dimensions. Cocreation of the product with the customers increases the experienced value, since it improves communication and mutual understanding of the final product. It thus strengthens the trust between the firm and the customers while at the same time deepening the customers' role in the value network. The metal 3D printing company integrated customers with product cocreation, noting that this reduced business risks. It was found that customer involvement reduces the overall project time and costs.

3D printing impacts on the final business model component—the revenue model—in line with more or less traditional revenue models. The metal 3D printing company's revenue model was based on customer invoicing per orders. Cooperation agreements and the number of products ordered have an impact on pricing. In any case yearly turnover is expected to increase, due to new customers and to the possibility of providing larger components through partner companies who do 3D printing. For the tractor manufacturer, 3D printing has streamlined and reduced the overall costs of projects. This has an indirect positive impact on the revenue model. In the future, 3D special accessories, tailored for end use, will foster changes in the revenue model and also in the other business model components.

10.7 Conclusions

3D printing technology has experienced dramatic growth, with increasing exploitation by various industries. One significant reason for companies to use 3D printing is that it liberates product designers; they can now design and produce personalized and tailored products that previously have been impossible. In addition, 3D printing makes it possible to produce individual items and small-volume miniseries in a manner that is cost and time effective. It appears that with localized 3D printing, the value perceived by customers improves, due to better product quality, delivery time, and service. Local production improves communication, and it allows the cocreation of product innovations between the customers and the 3D printing companies. This helps the company to be more flexible and agile in adapting or renewing its business model.

Even though 3D printing is now applied in many industries, there are numerous industries and companies that have not yet realized the hidden potential of 3D printing. 3D printing technology is improving rapidly. Combined with other emerging technologies (such as IoT), 3D printing technology could have huge (and still largely unexamined) potential for product innovation and value delivery. This will provide multiple new perspectives for the business models adopted.

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Chapter 11
The Pac-Man Principle in the Healthcare Market

Robert Bongaerts, Harald Henn, and Anshuman Khare

Abstract Google, Amazon, and Apple have a billion-strong market targeted: the healthcare market. Fitness apps, assistance systems, wearables, and activity tracker, which measure the number of steps or running activities, are booming. The main impetus for the proliferation of new digital services is not from doctors, hospitals, health insurance companies, or politics, but by consumers and patients.

Additionally, devices that not only help us with our fitness but can monitor and manage disease and its treatment like ingestibles and even implantables are right around the corner.

Aging society, rising health consciousness, and more personal responsibility—these are the key drivers behind the rapid spread of small, digital helpers. And not to forget: the devices are ease of use and in many cases apps are offered for free.

Like the Pac-Man game in the 1980s, the apps and digital helpers walk through the healthcare market by eating outdated, time-wasting less customer-oriented processes—and there is food plentiful for years to come.

In the first step, the paper examines—based on analyzing general and health-specific trend—the challenges in the healthcare market. In the second step, it shows various examples how digital transformation changes the healthcare market, especially at the interaction between the consumer and the different actors in the healthcare system. In the third step, key learnings are explored and suggestions are made regarding healthcare providers.

Keywords Digital transformation • Pharma • Healthcare • e-Health • Healthcare service

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R. Bongaerts (✉)
exeo Strategic Consulting AG, Wittelsbacherring 25, 53115 Bonn, Germany
e-mail: robert.bongaerts@exeo-consulting.com

H. Henn
Marketing Resultant GmbH, Hinter der Kapelle 20, 55128 Mainz, Germany
e-mail: henn@marketing-resultant.de

A. Khare
Athabasca University, 201 - 13220 St. Albert Trail, Edmonton, AB, Canada, T5L 4W1
e-mail: anshuman.khare@fb.athabascau.ca

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11.1 Trends and Resulting Challenges in Healthcare Market

Unlike other industries, the healthcare market is characterized by a variety of stakeholders. They all are facing general and specific healthcare trends, but the challenges are different (Fig. 11.1). In the following sections, the major challenges in healthcare are explained.

11.1.1 Addressing the Needs of a Growing, Connected, Aging World Population

Providing a sustainable healthcare is getting more and more challenging due to population growth, aging society, and urbanization. The world population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, and to increase further to 9.7 billion in 2050 and 11.2 billion by 2100 (United Nations, 2015). Especially countries in the Western world have to deal with a population which is aging rapidly. In a few years, for the first time in history, people aged 60 years and older will outnumber children younger than 5 years. The UN expects that by 2100 almost one billion people will be aged 80 or over (United Nations, 2015). In Japan, now more diapers are sold for adults than for children. But this is not just that there are more elderly people but also due to a more active leisure behavior which raises the need for incontinence diaper (Baltzer, 2016). More challenging aging society has led to an increase in lifestyle-related diseases such as diabetes, cancers, and heart disease. This has a strong impact on rising health costs reaching a level which makes the current system almost unsustainable. Urbanization leads on one side to a more efficient healthcare supply in the cities, but on the other side, more and more suppliers of healthcare in the country are failing as well which cuts off the access to medical service for the remaining population.

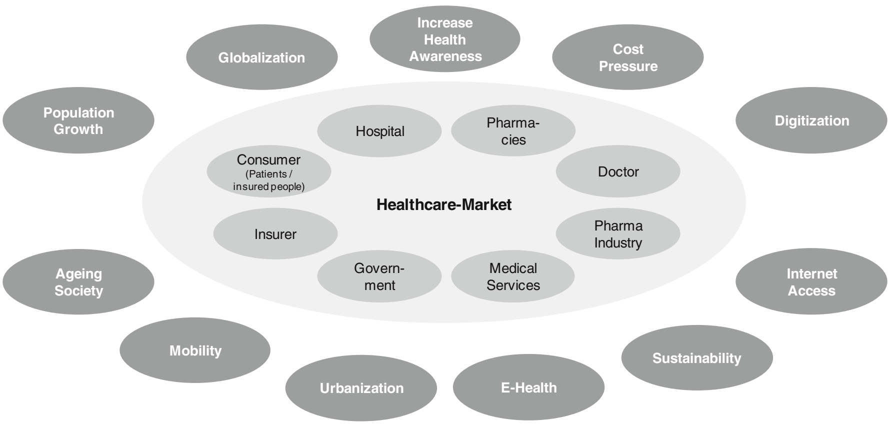

Fig. 11.1 Trends and stakeholders in the healthcare market

In many countries, digitization initiatives have been launched in the healthcare market in recent decades; often the full potential is not recognized or utilized. For example, an electronic health card was introduced in Germany. Mainly privacy concerns on the part of insurers and the doctors are alleged, so the card can only be used for identification. Two of the main targets—better healthcare and cost reduction—were not achieved (Baltzer, 2015).

The healthcare market in Europe is a trillion euro industry (OECD, 2015) in which more than 90 % of the expenditures are being spent on treatment rather than prevention (Vyganix, 2016). More and more people are health conscious and beginning to take care of their own health. They are already comfortable using apps to track their fitness level and take more control of their personal health. One of the main drivers for change in any given market is the level of customer dissatisfaction with the existing situation or service (Muldowney, 2015). Long wait times at the doctor, having to arrange for a personal consultation weeks and months ahead, travel time, and monthly health insurance fees are cost and time expensive. Instant or ad hoc availability of a doctor when needed is rarely possible in the current structure of our health system.

Smartphones and Internet access at any time—regardless of where people are—lead to a connected world and will shake up the healthcare market dramatically. People are busy these days and time is a precious commodity. As a result, consumers are constantly connecting via smartphones. Communication with a doctor however still isn't easy. The more channels and touchpoints of communication between a patient and a doctor there are, the easier it is for patients to use their preferred method to keep in touch. Apps, services, and the omni-channel capability of the smartphone are bridging the gap by allowing for contact by phone, email, text, chat, and even social media from a single system—the patient's smartphone. Another convenience factor is that apps allow data to be documented for later review. The ability to automate appointment reminders is also a convenience for both the health provider and the patient.

However, communication with the doctors is not the only thing getting more convenient. Pharma companies with strong brands but traditionally limited contact with the patient as a user of their product, now in the era of perpetual Internet access via smartphones and the increased health awareness, see this situation as completely changed. It is a big chance for pharma companies to get in touch with the patient through providing medical information or service apps related to the specific illness.

11.1.2 Patients: The Main Driver for Smart Services in the Healthcare Market

The main characteristics of this connected healthcare market—an e-Health market—is its potential to be a catalyst of change and its ability to shift the power from healthcare providers, health insurance companies, clinics, and doctors to the patients. e-Health will democratize information understanding and access to health information and service. e-Health will extend the traditional healthcare model with patient-driven services that extend and/or replace existing services and empower patients. Furthermore, e-Health smart services will provide for an increased level of information. The flow of information between all healthcare stakeholders, e.g., patients, doctors, health insurance companies, and care providers, is currently being interrupted due to incompatible and disparate systems, nonexisting interfaces between systems, and a mixture of analog and digital processes and protectionism behavior. Smart services will support the partnering and collaboration between patients, healthcare professionals, care providers, and insurance companies by speeding up and facilitating the information flow process. An increasing amount of patient data will be generated by the patient himself/herself on his/her smartphone, thus putting the patient in the driver seat for his/her own data. A paradigm shift, which along with new services and apps accessible through the smartphone, will end up in a new role allocation between patients and doctors and clinics and care providers.

11.1.3 Apple and Google Will Fire Up the e-Health Market

This dynamic development is being accelerated by the e-Health market entry of companies such as Apple or Google. DeepMind, a Google-owned company located in London, is developing a software in partnership with some British hospitals to alert staff to patients at risk of deterioration and death through kidney failure. DeepMind, famous for its innovative use of artificial intelligence, is being provided with data of up to 1.6 million patients from three hospitals in Great Britain (Hodson, 2016). Google's strength in data analysis gives them a strong competitive position in the healthcare market—better diagnosis and improved understanding of disease at population level.

Apple's CareKit is an open-source software development framework for medical care apps. Apple's CareKit is designed to help app developers build software focused on medical care (Apple Inc., 2016). Based on this framework, new software can be expected for the iPhone and Apple Watch that enables patients to monitor ongoing medical conditions, track medicine intake, and exercise and share the data with their doctors.

11.2 e-Health: The Disruptive Power of Apps and New Services

The following examples show the disruptive power of apps and new services for the traditional healthcare market demonstrating an unprecedented dynamic. The examples are only a small selection of the ever-growing range of e-healthcare solutions but demonstrate the general principles of how disruptive technologies will change the healthcare market.

11.2.1 Blood Diagnostic Test

Accel Diagnostics (http://www.acceldx.com) offers pScreen™, an easy-to-use, convenient blood diagnostic test—a lab test at the patients' fingertips. The system itself is small as a credit card and allows anyone to perform a medical diagnostic test anytime, anywhere. The test requires only a tiny amount of sample. According to Accel Diagnostics, two drops are more than enough. The app stores and shares test results with the patient's doctor. No visits are necessary, and time to result is dramatically reduced. Apart from cost savings, pScreen™ shows the general benefits of smart digital e-Health services residing on the patient's smartphone: reduced waiting times, anytime-anywhere execution of the test, patient's control over data, and access to professional advice from the connected doctor.

Even ingestible like nano-sensors, which can travel the bloodstream, record blood data, and send messages to a smartphone, are under development (Aspler, 2014).

11.2.2 Monitoring the Heart's Health

Kardia from AliveCor (https://www.alivecor.com/) allows patients to quickly access, track, and analyze their heart's health. The system is following the same principles as the abovementioned pScreen™ app. Tests can be performed by the patient himself/herself; results will be shared with the doctor. This provides for a proactive and professional care for the patient's heart. Data can be captured anytime anywhere at the patient's convenience and the doctor will be able to diagnose and develop individual treatment plans. Kardia Mobile from AliveCor is smaller than a credit card and connects to most smartphones. In less than a minute, the system records a medical-grade EKG, which then can be relayed to the doctor for analysis and diagnosis.

11.2.3 Monitoring the Medication Plan

Care4Today (https://www.care4today.com/) is built on the power of mobile technology to help patients manage their medication. The medication reminder function contains the patient-entered dosing information. With a need to regularly take their medicaments, older people will benefit from an improved adherence to medication. Family members, nurses, or doctors can be connected to support the prescription rules. Connecting all relevant health partners for a patient will generate additional benefits not possible to achieve in our today's analog world. Medication errors and intolerance based upon several prescriptions from various doctors for one patient could be discovered early and health risks could be eliminated.

Proteus Digital Health provides an even more advanced technology to monitor the medication plan starting with a sensor-enabled "smart" pill (http://www.proteus.com/how-it-works/). After reaching the stomach, the sensor sends a signal to a patch placed on the body. The patch itself is a sensor and records the medication-taking and other data like steps, activity, rest, and heart rate. The patch passes on the data via smartphone to a special discover app and discover portal which allows the medical team to monitor the patient's health.

11.2.4 Transparency on Health Record

Medical records are traditionally paper work and remain at the doctor, not at the patient. If a patient is visiting another doctor, often the same analyses are performed as the results of former test are not accessible. Patients2go, a product of Germany-based Xonion, replaces the paper files and makes them available digitally on a tablet or smartphone. The patient becomes the owner of his/her data. The electronic health record keeps all medical records and critical data such as blood pressure, heart rate, and medication plan. This transparency leads to faster treatments and reduces costs. On the other hand, interactions of drugs which may lead to intolerances are recognized early and easily.

The efficient use of existing data is estimated—based on a field trial in Germany—to reduce the overall expenditure on healthcare by up to 20 %. Another result looks at life expectancy: it could be extended by one and a half years (Baltzer, 2015).

11.2.5 The Role of Sensors: The Doctor in Your Smartphone

Smartphones already serve as the central hub for communication for day-to-day tasks: checking reservations or bookings, making appointments, updating a status, and gathering information. Data exchange with doctors, upload of pictures, chat, instant messaging, video chat, and reminders will become a cakewalk, no changing of devices or communication channels and no worries about where information is stored. And sensors such as EKG, blood pressure, and skin temperature devices can be connected to a smartphone, and data can be captured, stored, and transmitted, thus further expanding the health capabilities of a smartphone. The connection and integration of sensors in the smartphone generate a powerful combination which is able to replace a lot of routine tasks of a doctor. Two examples will show how the smartphone evolves into a "pocket doctor."

11.2.5.1 Managing Ear Infections

Oto (https://www.cellscope.com/oto) is a smart device that attaches to an iPhone and lets parents take a video of the inside of a child's ear. The app enables them to share the video with a doctor for an immediate answer. Thinking this development further in the future, an app might give advice to the patient based on big data analysis. No doctor would even be involved in the process. Patients will become independent from a doctor for routine tasks, monitoring specific health parameters. Doctors will have more time spending on severe issues rather than checking measurements or routine tasks.

11.2.5.2 Measuring Body Temperature

Kinsa Health (https://kinsahealth.com/) is a start-up company based in New York. It has received FDA 510(k) clearance for a smartphone connected thermometer. The thermometer can be used like a regular thermometer to measure the temperature under the tongue, in the rectum, or under the arm. The device connects to a smartphone through the headphone jack and benefits from the processing capabilities of the phone for recording or displaying the temperature.

11.2.6 Multipurpose Health Tracker

Digital diagnostics are coming to the patient at his/her home. In addition to the abovementioned examples, the services will range from eye, ear, and throat exam to cardiac exam. These services are using devices/sensors connected to the smartphone. Future services will even do "intelligent" analysis and interpretations based on big data algorithms. Another advantage of such connected sensors over the classical approach of measuring data is the possibility of continuous measurement rather than one-time measurement at the doctor's office or a clinic. Kito (https://azoi.com/) is one example of such a multipurpose health tracker. Doctor and clinics not only would be relieved from time-consuming measurement procedures but would also gain a way better and complete picture from their patients. Continuous measurement furthermore can serve as an early warning system.

11.2.7 Telehealth: The Virtual House Call

Telehealth services consist of a variety of technologies to deliver virtual and remote medical, health services. Telehealth is significantly enhancing and improving the service for disabled persons and elderly people with no access to bus or trains to get to the doctor's office. Patients living in rural areas today would be able to communicate with their doctor at least via video chat. Such services by no means would completely replace a personal appointment. However, aftercare or follow-up consultation, disease monitoring, and other tasks could be enhanced. They also help to reduce costs and avoid unnecessary appointments. First pilot projects by two major German health insurance companies show excellent adoption rates and high satisfaction ratings.

11.2.8 The Healthcare Future Is Interconnected

A major difference between today's world of healthcare and future e-Health services is the way patient data is exchanged between the various healthcare partners and the interconnection of those partners with the patient at the center.

Future data exchange in a digital healthcare market will allow for:

- Patient to patient (community)
- Patient to doctor
- Patient to pharmaceutical company
- Patient to clinic
- Patient to health insurance company data exchange

11.2.9 Connecting Patient to Patient and Patient to Pharma Company

Consumers will benefit from this in many ways and offer new opportunities to manage their health conditions and communicate with like-minded people. The community PatientsLikeMe, a social network-based community bringing together people with interests in health and care to support each other, shares learning and even provides a platform for tracking health data. The app "MS und ich" is an example for the connection between the patient and a pharmaceutical company. But due to regulation issues, there is no real data exchange possible.

11.3 Key Findings and Learnings

The adoption of IT in healthcare systems has, in general, followed the same pattern as other industries. Firstly, IT was used to automate highly standardized tasks; secondly, IT connected different processes inside a company or between companies; and thirdly, what is called disruptive technology tries to understand first what customers really wanted (Biesdorf & Niedermann, 2014).

So it is not surprising that the examples in Sect. 11.2 show that the customer needs are the starting point. The rising expectations of patients using new technologies and their own devices to manage diseases are met. The examples show that digitization in healthcare is not a substitution of traditional healthcare but a complement which makes life easier and more over saves money. Like the Pac-Man game in the 1980s, the apps and digital helpers walk through the healthcare market by eating outdated, time-wasting less customer-oriented processes—and there is plentiful "food" for years to come.

The patient is in the driver seat. e-Health will extend the traditional healthcare model with patient-driven services that extend and/or replace existing services and empower patients. It is a myth that people don't want to use digital services for healthcare or that only young people would use it as a patient survey showed in 2014 (Biesdorf & Niedermann, 2014). Another finding from the same survey points out that patients don't want highly innovative service offerings but "more efficiency, better access to information, integration with other channels, and the availability of a real service if the digital service doesn't give them what they need."

The transformation from traditional healthcare to e-Health is more than just digitizing certain processes. It's a revolution which can be characterized by a general change from a traditional doctor-centered to a more and more patient-centered healthcare market:

1. Power shift to patients
2. Health self-services through apps and sensors
3. Connected data and flow of information
4. Improved and faster diagnosis based on big data and continuous measurement of relevant health parameters
5. Implementation of effective early warning system
6. Establishment of effective patient communities
7. Rise of Telehealth services
8. Cost savings

Healthcare providers have to accept this change and even better should understand the underlying customer/patient needs. As pointed out before, mainly patients expect more efficiency, better information, channel integration, and the availability of a real service. Healthcare providers should meet these core requirements.

11.4 Conclusion

While this chapter looks at the future of wearable devices and their impact on e-Health and puts the customer/patient first, the discussions would not be complete without listing some of the main challenges that have to be overcome before this idea of better and faster healthcare services can be embraced by society.

Some issues that concern researchers and practitioners relate to hacking of medical devices. While some go a step further and fear future bioterrorism attacks when advances in nanorobots in our bloodstream mature, the bottom line is that cybersecurity issues have to be addressed.

Another factor that still causes intense discussions in an already interconnected world is the issue of privacy. What would protect a patient from governments or companies from misusing their health-related data? This question has often led to slowing down of new technology adoption.

Doctors also find the idea of self-diagnosis alarming. Manufacturer and seller of these devices have to ensure that these devices do not turn patients into doctors.

There are two social issues that also raise their head in discussions:

- Will this create a separation in society? Will some get and stay healthier faster than others because they can afford these technologies?
- What would be the impact on our society as technology leads to enhanced monitoring, early detection, and, therefore, extension in life span of humans?

Some of these issues are beyond the scope of discussion, but with the advancement this paper highlights, these discussions will soon be part of the adoption process for such devices. The authors hope that these discussions keep the benefits to the patient and the already fatigued healthcare system in the forefront as it needs a much-needed revitalization.

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Chapter 12
Automation, Robots, and Algorithms Will Drive the Next Stage of Digital Disruption

Chad Pankewitz

Abstract We are living in an exciting time of rapid change and massive disruption to many industries. Exponential change in technology is bringing fantastic opportunities to entrepreneurs and leaders who can take advantage of it. In addition, multiple new technologies in multiple industries are accelerating exponentially in parallel allowing new business models to emerge. These new technologies and business models are reshaping existing industries and creating whole new industries in increasingly short periods of time. Businesses will need to adopt a culture of constant innovation to maintain and win market share.

This paper will examine how this digital transformation will be driven by various types of automation, robots, algorithms, and artificial intelligence. We will learn from examples and applications of these technologies each of which has the power to disrupt not only the industry where it appears but also disrupts adjacent businesses and industries. Leaders will need to consider how these technologies will affect their business, and most importantly, their customers.

Such massive change not only affects commerce and business but has implications for other systems in society as well. For example, what jobs will be replaced by automation and what will happen to the current workforce? Regulatory and many other policy issues will also need to be considered.

This new stage of automation-driven digital disruption will affect some industries sooner and more deeply than others, but no business of any size or industry will be left untouched. Those who understand the technologies and the changes will be able to embrace them to set a course for their businesses to thrive.

Keywords Innovation • Digital business transformation • Automation • Algorithms • Artificial intelligence

There are many areas that leaders will need to ponder, so their organizations are well positioned for this new industrial revolution. In this paper, we will examine some of these changes and technologies. We will also show examples and ways that businesses can adapt to win.

C. Pankewitz (✉)
5719 Dalcastle Cres. NW, Calgary, AB, Canada T3A 1R7
e-mail: chad@innovationmavens.com

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12.1 Economy and Jobs

In its January 2016 report, “The Future of Jobs” (World Economic Forum, 2016), the world economic forum states that we are at the beginning of a “fourth industrial revolution.” The report states that “Developments in genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology, to name just a few, are all building on and amplifying one another. This will lay the foundation for a revolution more comprehensive and all-encompassing than anything we have ever seen.”

Many questions are unanswered when it comes to how robotics and automation will affect our economies. Will robots help or hinder our economies? Will the robots take all our jobs and leave large percentages of our populations unemployed? When will it happen, if ever? How long will it last? 5 years? A generation? Several generations?

Automation will replace tens of millions of jobs around the world. The question is, “How fast can we adapt?” There are two sides to the thinking about this debate. The first camp believes that the robots will take all our jobs; people will not have money to support the economy and economies around the world will remain stagnant or decline. Another group believes that there will be equilibrium. Many people will lose their jobs but many will retrain. The new generations will train in the new skills that are needed in the new technologically advanced world. It also may be a combination of the two. A period of pain where many job losses occur is likely and then it is possible that there will be an economic boom as new companies, products, and services come to market which will employ more people.

It is worthwhile doing some deep thinking on how automation will affect your industry, business, and workforce. There will be pitfalls and opportunities and leaders need to be ready to avoid or capitalize on them.

12.2 Be Wary of Popular Thought

According to Internet World Stats, there were 3.3 billion people online using the Internet as of November 2015 (Internet World Stats, 2016) which is almost half of the world’s population. With the shift from analogue news to digital, the consolidation of the newspaper industry, and the rise of the new digital giants, the citizens of Earth are already experiencing a world where a few key players can and do control popular thought. Increasingly, we are getting our news from digital giants and a handful of digital news outlets around the globe. The same articles surface and are shared with friends and other news outlets around the globe. Many TV newsrooms and newspapers are already regurgitating yesterday’s top news and stories of interest that they found on the Internet through sites like Google, Facebook, Twitter, and WeChat.

Our news is coming from and being brought to our attention by a handful of companies and websites.

The purpose of highlighting this is:

- To be aware and to not be swayed by the media and popular thought. Do your own deep thinking.
- Opportunity. This new socially connected world of prolific sharing and digital distribution of news and information provides an incredible opportunity to get the word out about your products and services. Businesses need to learn how to master digital marketing, customer acquisition, and digital public relations.

This digitization and harmonization of journalism have disrupted the news industry in a very big way. For hundreds of years, a large number of diverse companies around the world have distributed the news on traditional mediums such as newspapers and magazines. New digital mediums, companies, and business models have disrupted the old guard in a comparatively short 10–20 years.

12.3 Government: Laws and Regulations

Government laws and regulations typically lag far behind innovation. There are many recent examples of this such as:

- Companies going to other countries to test and develop autonomous airborne drone services due to restrictive American government regulations.
- Cloning and genomics technology research moving from restrictive Western countries to jurisdictions with less regulation.
- Autonomous vehicles are close to being ready today but the laws to allow them on the roads are far behind.

Industry practices and regulations will change at a quicker pace.

A good example here is how Uber's new business model for their instant car service has been moving faster than regulations in many cities around the world. This has led to many cities outright banning Uber from operating until new laws are discussed and put in place. This has not stopped growth for Uber; however, in fact it has been quite the opposite. The more bans they get, the more publicity they receive and then popularity and increased ridership follow. As of the mid-2015, the 5-year-old company's valuation was touted to be over USD $50 billion (Whitehouse, 2015). They have disrupted both the taxi and the rental car industry. To give an idea on how large Uber is compared to the traditional rental car companies, at the same time in 2015, Hertz and Avis were worth $7.8 billion and $4.6 billion, respectively (Whitehouse, 2015). As far as disrupting the taxi industry, this is evident in the frequent protests and clashes we see in the news between taxi and Uber drivers around the world.

Uber innovated and forged ahead of aging regulations and they have been rewarded. They are not only winning markets in the transportation industry; it is expected that they will be able to leverage their global fleet of on-demand cars to disrupt food delivery, package delivery, logistics, and other industries.

12.4 Government: Services

Another area to think about is government services. With the boom in technology and automation, how will the services governments provide change? Will education or healthcare be disrupted? How will that change what the government provides? Would a disruption here affect your business? It is worthwhile to look at all government services and think about how the future might be different.

There is already a realization on the part of governments around the world that citizens expect to interact with governments through digital. For example, by creating a central digital office, a digital strategy and with major investment, the UK government has been a leader in digitizing their services and improving access to information. Digitizing and improving the user experience for citizens not only benefit the citizen experience, it also has a major effect on finances. By embarking on a program of digitization, the UK government plans to save 1.7 billion pound sterling per year after 2015 (Yiu & Fink, 2013, p. 17). The financial benefit to both the government and the taxpayer is clear and well worthwhile.

12.5 Inequality

Steven Hawking has said that with artificial intelligence we could move toward a world where most people end up miserably poor and those who own the robots consolidate wealth (Hawking, 2015).

Although this is a popular news topic and scary reality to some, is it really that different to what we see today? In a 2015 report, the antipoverty organization Oxfam International released a report that said that by 2016, a handful of elites making up 1 % of the world's population will own over 50 % of all the assets of the world (Hardoon, 2015). A small percentage of companies and individuals already hold the majority of the power and wealth. With automation and the new digital economy, this will accelerate. An even larger gap between the "haves" and "have nots" will not be beneficial nor conducive to a peaceful global society. Thinking and discussion around solving this issue are important and should take place.

It can also be looked at as an opportunity to shift the balance of power and wealth from the current market leaders to your business. Again it reinforces the importance of innovation during this time of incredible change. If companies don't innovate, they will lose market share and literally be left in the dust to die.

12.6 What Is Artificial Intelligence?

Urban (2015), writer and founder of the website WaitButWhy.com, has defined artificial intelligence as

AI Caliber 1) Artificial Narrow Intelligence (ANI): Sometimes referred to as Weak AI, Artificial Narrow Intelligence is AI that specializes in one area. There's AI that can beat the world chess champion in chess, but that's the only thing it does. Ask it to figure out a better way to store data on a hard drive, and it'll look at you blankly.

AI Caliber 2) Artificial General Intelligence (AGI): Sometimes referred to as Strong AI, or Human-Level AI, Artificial General Intelligence refers to a computer that is as smart as a human across the board — a machine that can perform any intellectual task that a human being can. Creating AGI is a much harder task than creating ANI, and we're yet to do it.

AI Caliber 3) Artificial Superintelligence (ASI): Oxford philosopher and leading AI thinker Nick Bostrom defines superintelligence as "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills."

We are going to focus on the short to medium term (1–10 years) and therefore be talking about ANI and AGI. ANI and AGI are going to be responsible for changes so large it is difficult to contemplate how the future will look in 5–10 years.

ASI will no doubt bring vast changes to all aspects of life on Earth but is considered longer term, and as a matter of practicality, it will not be addressed much in this paper.

AGI is not quite ready for most companies to use today but it is coming quickly. There are several companies around the world working on AGI, several that we see in the news frequently including Apple Siri, Google Now, Amazon Echo, Microsoft Cortana, and newcomer Hound. Hound has been quietly working on its product for over 9 years, and from early demos, it is far ahead of the products from the big technology giants. AGI is very difficult to build currently and most companies will not want to attempt it due to large costs and timelines. This will change in the future as more modular AGI frameworks become available that allow putting AGI building blocks together to make a single AGI "brain."

Another exciting way for companies to leverage AGI technology in the very near future is by using existing AGIs. It is likely that the well-developed AGIs from some of these large companies will be opened up so third-party software can connect and use their features. We are already seeing this with Amazon and Hound opening up their application programming interfaces (API) to select third parties. There are also many researchers, labs, and companies across the world working on a wide range of features that are needed for AGI.

ANI however is available today; it is accessible and can be used by almost any business in many areas of their organizations. It will be the main focus of this paper. That said, other technologies should be monitored as they mature for possible use and improvement in your business.

12.7 Robots and Automation

The word robot has many meanings and connotations. To some a robot takes the form of a bipedal humanoid machine, to others it means any type of autonomous physical machine, and yet to others it might mean a piece of automated software.

We are going to define a robot as any automated physical machine or any mechanism that is guided by automated controls. Broadly this includes:

- Humanoids and human service robots
- Algorithms
- AI
- Drones (both land based and airborne)
- Task-specific robots

When looking at how automation technologies can improve our businesses, we must look at the full range of options. It will seem that we will be focusing on algorithms, AI, and software as it pertains to most businesses. That doesn't mean that we think physical robots and drones are less important. Physical robots are going to change industries as well, and businesses that can use them should also focus on evaluating ROI on these technologies as they mature.

12.8 Changing Times: The Ingredients for Massive Change Are in Place

A combination of factors has enabled an environment where artificial intelligence (AI), automation, and digital disruption are thriving today and will define many aspects of the future. They are:

- Exponential growth and declining cost of computation power
- Data storage and accessibility
- Fast networks for servers and people
- Mobile devices and connectivity
- New hardware and software technology
- Snowball effect of AI and automation progress and usage

Why does it matter that these technologies are coming to market fast and furiously now? One word explains it—disruption. We are about to witness a new world where businesses will need to innovate quickly, adopt automation, and adapt to changing markets. We are already starting to see smaller, more nimble companies leverage automation and digital technologies to take large swaths of market share from their larger incumbents. The future is bleak for companies large and small that aren't able to innovate and stay ahead of these large tectonic market shifts. Companies that rest on their laurels and stick with the status quo will wither and eventually cease to be relevant.

In addition to the factors above, there are several industries and technologies that are growing exponentially in parallel. In his book *The Singularity Is Near*, Kurzweil (2006) explains this concept very well and calls it the law of accelerating returns. The upward progression of these technologies produces products and solutions that become more and more useful with each new generation. Each generation builds upon the advancements of the last and the products become cheaper and better.

As they become more useful, they garner even more investment and attention that create an ongoing improvement cycle.

- Health
- Genomics
- Robotics and AI
- Biotechnology
- 3D printing
- Software
- Nanotech
- Energy

To understand how to innovate in our businesses, we need to start to understand what types of disruptions will be happening and what might apply to us. To imagine how the collective rise of these technologies will affect our world in the future is difficult to determine. What we can do, however, is study each technology individually and get a better understanding of the technologies, advancements, and possibilities for the future. This will help leaders get a better picture of the future and where their business fits.

12.9 New Business Models Are Emerging Quickly

Every industry is changing rapidly, but unfortunately, it is sometimes hard to see the forest for the trees. Some examples of this are:

- The music business changing from a model of record/CD sales to online distribution and a world where live performances and provision of personal experiences to fans are a major revenue source.
- The television business and traditional large networks once had the power having absolute control of audiences and advertising revenue with linear TV. Now the "on-demand" economy with new competitors like Netflix, Hulu, YouTube, Amazon, Apple, and many more has disrupted the old business model.
- A similar disruption has happened in the movie business. A good example is Blockbuster, once a powerhouse in renting VHS and DVD movies to hundreds of millions of people, which is now a well-known casualty of digital disruption.
- Airbnb, which allows billions of people around the world to rent out their rooms and houses directly with customers, is disrupting the hotel industry.
- Uber is disrupting transportation by connecting people directly with a near-instant transportation service. It is a possibility, even likely that the network of vehicles that they are creating around the world will also disrupt other industries such as logistics (package delivery), food delivery, automotive, transport, and others.
- Companies are becoming highly efficient and lean. They are able to create tremendous value with a small number of people. For example, WhatsApp, a 55-person company, created a massively successful communication platform.

In less than 6 years, the company was purchased for $19 billion dollars, and as of February 2016, it was used by over one billion people.

- Everything "as-a-service" models, several are mentioned above such as music, movies, television, transportation, accommodation, software, and many more.
- Ecommerce is changing how we buy goods. This trend is well underway and is mainstream now. Businesses need to understand new methods of digital marketing, distribution, advertising, and customer acquisition models.
- Distributed workforce—Automattic, the company that creates the number one content management software on the Internet, has less than 40 employees in their office in San Francisco. Technology and new tools enable most of their 275 employees to work remotely from their homes around the world. Automattic is valued at over USD $1 billion.
- The new giants. Digitally minded companies like Amazon, Facebook, Google, and Microsoft are becoming massive and are investing heavily in new disruptive technologies like automation, robotics, advertising, transportation, communications, infrastructure, virtual reality, and many many more. These companies are going to be increasingly hard to upset as they see more wins and disrupt other industries.

The list of new digital business model disruptions is long and it is impossible to list every example. The point is for owners and executives to expect their industry to be disrupted. The questions to think about now are:

- What changes and new business models are emerging in my industry?
- What is coming in adjacent or related industries?
- What business models (or portions of) can be borrowed from other unrelated industries?

12.10 Digital Disruption and Digital Platform

Companies with a traditional business model and platform know they need to move toward the digital age but have a hard time implementing because of legacy process, slow pace of innovation, legacy technology platforms, and culture. The intuition to move toward digital is correct, and according to Gartner, currently the percentage of revenue in the private sector coming from digital is 22 % (Gartner, 2015). In 2 years it will be 31 %, and in 5 years, 41 % of all revenue in the private sector will be coming from digital channels. Major market share is up for grabs, and companies that can move fast, innovate, and automate will take market share from bigger, slower-moving, and established companies. If the traditional companies don't move to understand new business models, automation, innovation, and digital, they will cease to be relevant in the new digital world.

Gartner also predicts that by 2020, we will be in the "post-application" era. For example, Microsoft's strategy will be focused around artificial intelligence and algorithms, Microsoft Cortana instead of Windows. This is a world where up to 40 % of interactions will be facilitated by algorithms and smart agents. This is starting to explode with AI bots and chat bots being touted as the next revolution that may bring changes as big as the Internet has over the past 20 years.

We have talked about increasing automation with the use of data and algorithms within an organization and that should still be one priority. Another priority that companies must move toward is the digital platform. It would be a mistake to believe that the digital platform sits only with the CTO in the technology department. Although the technology portion is important, there are other elements that are just as important. These include the digital business model, digital processes, an organizational structure that supports fast change, people with a digital mindset, and a culture of innovation.

So how does a business go about creating a digital platform when the risks of changing its existing business model, revenue streams, operations, technology, people, processes, and culture are so high? Realizing that on the other hand, the risks of not moving toward a digital platform are perhaps even larger, a way forward must be found. One way to do this is what Garner is calling the "bimodal model." Mode 1 is the current analogue business. It continues to run un-disrupted allowing current revenue streams to continue to flow. Mode 2 is the new digital platform. This is created from scratch and is run in parallel to the existing analogue business. This allows for the creation of new business models, new thinking, new products, new ways of selling existing products, new processes, and new innovation culture and capability. The new digital platform will take time to build, and this model will give businesses time to consider their direction while ensuring they will be relevant in the new economy where digital, instant information, automation, and algorithms will be required to survive.

12.11 Information Automation and Continual Improvement

In the last sections we looked at the big picture business model and the new digital platform; now we are going to look inward a little bit and talk about data and information within our business. The "big data" revolution has been touted as the silver bullet giving businesses better information. But every business does not have "big data." Whether the amount of data is small or large just determines what tools and methodologies are needed to gain new important insights by processing data within an organization. I like to focus on "better information" which relies on good, relevant data. Better information is making companies more competitive in their markets and industries, and as leaders, we need to strive to improve this as data alone cannot help make critical decisions. Information and insights on data can.

Selecting the relevant data points and levers that affect our businesses in a positive manner is an important first step. Once we know what to watch, we should be mining, inspecting, and monitoring the relevant data in order to make better decisions. After the main key performance indicators are set up, automated, monitored, and weaved into the organization's operational processes, then it is time to look for other places in the business where data might be turned into valuable information so that other areas of the business can be improved. This ongoing continual search for improvement will help gain efficiencies in many areas of the business. It can help reduce costs, increase revenues, get more customers, improve our workforce, and bring many other benefits. To do this, we can start with the following questions:

- What are the most important metrics to be tracking for every part of the business?
- What data do we need to be collecting?
- How do we monitor and track progress through analytics?
- How do we improve the metrics—what processes, software, algorithms, and systems can be improved or added? Can automation help? Can predictive intelligence help?

Other areas to look for improvements are:

- Hiring and retention of staff
- Technology platforms
- All areas of operations and manufacturing
- Automated marketing
- Product improvement
- Including network effect—social networks
- Optimization of all sales channels off and online
- Better customer service—better info on customers
- Financial processes

Continual improvement within an organization is not new. What is new is that it is easier to implement with the new tools of automation, algorithms, software, processing power, proven processes, analytics, and know-how. Literally every corner of a business can be tracked, automated, and improved.

12.12 Customer Centric Focus

With all the talk about digital disruption, new business models, and new fancy automation technology, it is worthwhile to mention something more important than all of these things, the customer. Companies that will succeed in the new digital age will always have a very clear understanding what their customers want and need.

Implementing a customer centric approach involves the whole organization and culture. Every department must be focused on the perspective of the customer. Best Buy, for example, took the time to research and understand what their customers wanted; they changed the way they did business and offered products and bundles that customers wanted. This allowed them to beat Circuit City and survive in the retail consumer electronics business in America.

A customer centric mindset, improving existing products and the development of new innovative products that customers want, is one important factor to staying ahead in any market and industry. Know your customers well and make sure they are pleased with your products and services.

12.13 Leadership in the New Digital Automated Age

We have talked about new business models, digital disruption, digital platforms, product improvement, using automation, gaining insights on data, continual improvement, and internal and external factors to business to consider to be able to adapt and thrive in the new digital age. What about the executives, managers, leaders, and entrepreneurs running the businesses?

If the business is to change, then the leaders of the business must be not only willing to embrace change but to be continually changing and developing themselves.

Leaders in the new digital age need to:

- Think exponentially: Understand the concept and power of exponential growth. Know what industries and technologies are currently growing exponentially and think about how multiple exponential industries and technologies will shape the world in 5, 10, 20, and 50 years. How will you position your business accordingly?
- Do continual research on new technologies and business models: Keep up to date and understand what is happening across many industries. Cross-pollination of ideas and technologies often creates the most impact.
- Be a continuous learner: Don't limit your learning to your business or industry. Always be learning about personal interests, your industry, other industries, new technologies, business models, venture capital markets, history, strategy, etc.
- Do continual self-improvement: Leaders should be continually improving all areas of their lives, not only their business skills.
- Have original thought: Don't fall into the trap of limiting yourself to the popular thought that is in the news. Do your own deep and hard thinking.
- Be aware on how to use different legal and regulatory systems to your advantage.
- Have a service mindset: Focus on how you can serve and create amazing customer moments, experiences, services, and products.

12.14 Conclusion

Exponential growth in multiple technologies and new business models are changing the business landscape at a fantastic pace. Leaders have a choice on how to view this disruption, either as a threat or an opportunity. The threat is large and those organizations that aren't able to change face obsolescence. These changes are coming whether we like it or not so our view is to see these changes as an opportunity. We are living in a very exciting time of massive change, possibly one of the most exciting times in history. It is the time for leaders to embrace change, new technology, automation, innovation, and digital. It is the time to take charge and lead their businesses into the future where new markets, customers, opportunity, and new levels of success are awaiting.

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Part V
Higher Education & Training

Chapter 13
Education, Technology and Simple Innovation

Stephen Murgatroyd

Abstract This chapter explores the current context of higher education, identifying six patterns which impact decision-making and either enable, inhibit or require innovation. Technological developments likely to have an impact on higher education are reviewed, and a model of innovation is introduced. It is suggested that, while some developments are occurring which are of interest, there are "pockets of innovation" everywhere in higher education—these are, in the big picture, not disruptive and not leading to major change in how higher education is funded, organized, managed and deployed. In short, technology is not producing the "transformation" or "revolution" in higher education which some had envisaged, at least not yet.

Keywords Demographics • Technology • Complexity • Innovation • Internationalization • Competitiveness • Risk • Transformation

13.1 Introduction

Educational technologies have been presented as a transformative force for schools, colleges and universities. Whether we are looking at the teaching of mathematics for K-12 students, access to higher education for traditionally disadvantaged groups or the transformation of universities or colleges as operating institutions, technology is seen to be "the answer". Take this example from Social Ventures Australia (2013) in an influential blog:

> For a world in a perpetual state of transformation, technology is shattering old certainties and erasing aged dogmas. It's redefining our professional systems and our personal networks. It's altering how we approach problems and is expanding the realm of what's possible. We now occupy a world that is connected on multiple dimensions and at a deeper level — a global system of systems. The same transformation is occurring in our classrooms. Gone are the days of the teacher barking orders to 30 students from a black board. In its place are carefully planned and easily adaptable lesson strategies to maximize student engagement. Technology is facilitating this shift.

S. Murgatroyd (✉)
Collaborative Media Group Inc., 7608 150 Street, Edmonton, AB, Canada T5R 1C8
e-mail: murgatroydstephen@gmail.com

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Or this from Friedman (2013) describing the "revolution" (*sic*) in higher education in the *New York Times*:

> I can see a day soon where you'll create your own college degree by taking the best online courses from the best professors from around the world — some computing from Stanford, some entrepreneurship from Wharton, some ethics from Brandeis, some literature from Edinburgh — paying only the nominal fee for the certificates of completion. It will change teaching, learning and the pathway to employment. "There is a new world unfolding," said Reif [President of MIT], "and everyone will have to adapt".

Yet a great majority of our schools, colleges and universities are not transformed or shifting to radical new approaches to teaching and learning because of technology. While blended learning is extensive, it is so precisely because it maintains the power relationships between learners and instructors: technology is helping to maintain traditional roles rather than transform them. The "revolution" envisaged by so many in 2013 is not producing the transformative behaviour or significantly improved results many expected and were confidently forecasting.

Indeed, there are signs that the educational technology revolution is faltering, at least in higher education. California's move to create an online university appears to have fizzled (Hechinger Report, 2015); many largely online universities like the University of Phoenix (USA), Athabasca University (Canada) and the Open University (UK) are struggling financially; and some private networks of colleges, such as Corinthian (also owners of WyoTech), have closed. Even Pearson Corporation, which is seeking to shift from being the world's largest publisher to being the world's learning company, is struggling (Reingold, 2015). The annual review of online learning developments in higher education in the USA published each year since 2009 shows that enrolment growth in online courses is slowing, though it still outpaces enrolment growth for more traditional programmes (Allen & Seaman, 2014).

While many primary, middle and secondary schools have embraced technology as part of their strategy to personalize and facilitate learning, there are growing cautions about the use of such technology in schools. There is a desire to leverage technology to enable choice, flexibility and individualization. Yet this desire is not matched by experience or by evidence. The advocates and vendors for technology in schools fail to fully recognize that high-quality learning environments are deeply relational, humanistic, creative, socially constructed, active and inquiry oriented (McRae, 2013).

So what is the transformative role of technology in education, and what kinds of innovation are leading to significantly improved learning outcomes for learners? What kind of changes can we expect to see which derive from developments in technology?

In this contribution Canada is used as a case study of innovation, change and development in education with a strong focus on higher education. In part, this is because Canada is an advanced nation with a high performance education system as measured by PISA and other indicators and is widely regarded for its technology developments, being the place where Desire2Learn and Blackboard were developed, the home of several major technology hubs and a place where significant investments have been made in online learning infrastructure.

13.2 Some Context

Before we explore innovation and the likely future for higher education, we need to understand the context. There are six contextual issues which need to be understood if we are to explore likely developments in colleges and universities in the developed world. In this observation the focus is Canada, but the same issues are applied elsewhere. These are:

13.2.1 Demography

Canada's demography is changing significantly. While the population will grow through to 2063, it will do so largely through immigration—Canada's birth rate is low (except amongst First Nations communities, which show the strongest birth rates, and recent immigrants). By 2030, three in ten Canadians will be from a visible minority. The most significant trend is the ageing of Canada's population. By 2030, one in four Canadians will be aged 65 or older, and the senior population will represent 22 % of all Canadians (this group currently represents 15 %). What is more, seniors will live longer as the life expectancy of Canadians continues to improve. This in turn will have major implications for the Canadian workforce. By 2030, there will be fewer people in the workforce. Not so long ago, there were almost five people of working age for every retiree, by 2030, there will be closer to two and the workforce will be expected to fund and support increased costs of health care, social services and education.

Such an analysis could also be provided for a great many countries, especially in the mature developed economies of Europe, Russia and parts of Asia. While global population will grow to some nine billion by 2050, this masks declining populations within regions of the developed world.

13.2.2 Structural Complexity

With the pursuit of massification of higher education since the mid-1960s, there has been a growing expectation that more and more individuals will attend college and universities and that educational attainment will continuously rise. Indeed, some provinces have committed to this as a strategic intention. In 2016 there are significantly more universities and colleges than there were in 1995. Canada now has 98 public universities and over 130 public colleges. Similar developments have occurred in most developed economies.

This has led to a complex system which has some barriers to learner mobility:

- Weak within and interprovincial or interstate transfer credit systems
- Weak systems for prior learning assessment

- Lack of portability for certain credentials (especially trades and certain professions), reflecting trade barriers and certification differences between provinces and states
- Weak but improving systems for the fast and efficient recognition of foreign credentials

The key issue for governments is whether, given expectation of a lower revenue base from taxation linked to demographic change, they can afford such a complex and comprehensive system. Put another way, just what portion of funding for the complex system which has evolved since the 1960s will be paid for by government and what portion by students and potential employers? It is already the case that several colleges and universities in Canada, the USA, the UK and elsewhere face technical bankruptcy.

13.2.3 Changing Student Expectations

As students pay more of the costs of their own education, they demand more in terms of quality, relevance and engagement. More specifically, students are seeking high-quality courses and programmes which are work relevant (but not solely focused on employment competencies) and engaging. They are much more critical of the quality of their education than many of their predecessors. As governments reduce their per capita expenditure on higher education (following the trend they have pursued for the last 20 years), these expectations will increase.

Students are looking for access to quality programmes, delivered with flexible options supported by coaches, guides and mentors who can personalize learning and leverage the knowledge and skills the learner brings to their studies. Many more are now looking at university and college courses, suggesting that the boundaries between such institutions will shift. By 2030 more joint or seamless programmes will be in place. They are also looking at shorter programmes with much more acceptance of credit transfer, work-based learning credit and prior learning assessment which is efficient and not cumbersome. The emergence of so-called micro-credit (e.g. badges), short courses, accelerated degrees and joint college/university integrated programmes are all responses to this need.

13.2.4 Costs and Competitiveness

As has been mentioned, several universities and colleges are facing financial challenges due to declining revenues from the government, changed market conditions and shifts in student demand. Others are looking at mergers, and there are likely, between now and 2030, to be significant structural changes in our systems of higher education throughout the developed world.

More significantly, a combination of global competitive forces in higher education and cost issues is forcing many institutions to rethink their curriculum focus and strategic intentions—they are seeking differentiation. They are also looking initially at significantly increasing the international student population in their institutions (who pay higher fees), at employer- or government-sponsored programmes, shorter programmes (e.g. micro-credentials, badges), collaborative programmes and other initiatives, all of which are intended to either sustain or grow registrations and retention while increasing revenue. Governments are actively encouraging these developments. At the same time, institutions are looking at cost reduction through reimagining their labour costs and reducing the range and breadth of activity—using differentiated programming to create competitive advantage.

The challenge here is that these developments increase the competitive nature of the market for students and staff and represent significant shifts in the way in which colleges and universities undertake their work. Union agreements, especially faculty agreements, are not designed for such shifts or nimbleness. Some institutions are now "stuck" between an old paradigm and a new one and do not seem to be able to build the bridges needed to make this shift.

13.2.5 Internationalization

Some programmes in some institutions now have 30 % or more of their students who are international students. More programmes include international study components, and more students are completing part of their programmes in countries other than those in which they are registered as programme students. More learners are coming to Canada, for example, with part of a programme completed in another country and more courses have international components and links to international research, applied research or organizations. Higher education is increasingly an international business.

The growth of a mobile international student body will continue, though it will become an increasingly competitive market as more institutions seek to capture these students. A variety of estimates suggests that, by 2030, some three million individuals will be seeking to study internationally—an increase of one million from 2015. At this time, the USA, the UK and Australia are preferred destinations, especially for postgraduate study. Indeed, the UK has become increasingly dependent on international students to fund its complex system and requires some 100,000 or more *new* international students each year to sustain the system. Recruitment depends very much on immigration rules, costs, relevance, security and quality of student life.

13.2.6 Technological Developments

Since 2000 there have been many changes in the technological landscape. Handheld devices now surpass desktop computers in terms of ownership and use. Growing access to broadband across the developed world (but still not universal) has changed access to knowledge, information, services and support. The emergence of online learning has transformed access to learning for great many students and has changed the dynamics of higher education. It is now the case that (app.) 1.5 million online courses for credit are being taken by Canadian higher education students each year[1]—7.5 million in the USA (Allen & Seaman, 2014).

By 2030 there will be further changes. These seven patterns seem the most likely:

1. Machine learning and artificial intelligence will increasingly be used to enable adaptive learning. Advances in artificial intelligence and machine learning are occurring rapidly, as can be seen in the growth of predictive systems, robotics and new analytics products. As these developments continue, "smart" devices (we already have smart thermostats, fridges, televisions) will become ubiquitous. Such smart systems will be embedded in the devices we use for learning and will begin to identify patterns of behaviour and activity which require either remediation or accelerated learning. Such adaptive systems will become more and more personalized over time, as individual patterns of activity and behaviour shape the use of content, assessment and interactions. Learning management systems designed simply as delivery mechanisms for content will be replaced by an adaptive system in which interaction drives content.
2. Handheld, mobile and integrated devices will continue to develop and become the de facto tools for learning, communication and peer networking. Handheld and mobile devices are already in the possession of close to four billion persons. New, faster devices which are also lighter and cheaper will increase adoption and use of handheld and mobile devices, which will also carry more functionality and will have intelligent "apps" to support learning. The recently launched Osmo add-on for iPad enables the iPad to support a range of games for learning in three dimensions. We can expect more third-party "add-ons" and apps which will extend the utility of such devices. We can also expect these devices to strengthen their ability to connect to social networks.
3. Predictive analytics will grow in significance in terms of student retention and learner support. Big data analytics are already in use in student recruitment centres, aiming to identify likely candidates from pools of enquirers. Such data sets are also being used to predict, from assessment data, students who are most likely to drop out or temporary withdraw, based on their patterns of attendance, assignment submission and assignment performance. These data are used to spur active intervention with a view to increasing retention and completion. But this is the top of the iceberg. We are likely to see much more use of data and analytics aimed at ensuring mastery of knowledge and skills and effective learning. Such predictive analytics will significantly improve the more they are used since the aggregated data on which they depend will be continuously enriched.
4. Interconnectivity of devices and systems will be a significant feature of the "Internet of Things" and activities. Homeowners can manage their furnaces from

[1] This is a "best guess" based on available information. Unfortunately, there are no systematic approaches to data collection across Canada which permits an accurate statement.

the other side of the world, check who is arriving at their door while in flight and make deposits with cheques at their bank without leaving home. Connectivity and integration are the buzzwords driving the Internet of Things. Look at developments in health care. Blood pressure can be monitored continuously by means of the Apple Watch and other devices; exercise trackers are embedded into smart phones; diabetes monitoring is now possible with third-party add-ons to a smart phone; and soon, we are advised, simple blood tests for a range of conditions will be possible through add-on devices for tablets and smart phones. Imagine these developments for learning—new developments in the field of study are flagged instantly, on-the-fly testing for competencies and skills, instant connection to global expert presentations on topics studied in a course, and real-time viewing of skills in action for apprentices.

5. Gamification and virtual reality will enable significant advances in teaching a range of subjects, especially laboratory-based subjects. Simulations already exist in chemistry, physics, biology, engineering and other sciences. What is likely to occur is the significant advances in gamification and simulation and the development of easier to use, faster and more innovative "creation engines", making the development of simulations and games easy for those without significant experience. Some of these already exist, but others are in development. We can expect some of the resultant simulators and games to be available as open education resources (OER), but many will also be proprietary. It is also likely that many of these games and simulations will be designed to test skills and competencies, so that apprentice electricians, for example, can be tested on their abilities largely through simulators. Some of these developments will make use of virtual reality environments, also now quickly emerging.
6. Translation engines will continuously improve and become embedded in a great many applications. Buckminster Fuller created the "Knowledge Doubling Curve"; he noticed that until 1900, human knowledge doubled approximately every century. According to IBM, the build out of the "Internet of Things" will lead to the doubling of knowledge every 12 h. To make sense of this growing knowledge "mine", translation is required. The faster we are able to translate from one language to another—say, from English to Mandarin or Cantonese and vice versa—then the more we can make use of this knowledge for learning, development and change. Translation engines have been with us since the early 1980s, but are becoming progressively better and more useful, with wearable simultaneous devices becoming available in 2016. Given the extent of learner mobility and the growth of the international student body, these developments may make learning easier for many students.
7. Collaborative technologies and social media—enabling rapid connectivity between learners, instructors and global experts—enable knowledge sharing for all forms of learning. During the last five years, mainly as a result of the growth of social networking, products dedicated to collaboration and supporting the growth of communities of interest and practice have appeared. Some of these are focused on project management and business, but many are being used for educational networking, resource sharing, collaboration and learning. All of the major

learning management systems have "collaboratories" either designed in or available as "add-ons". Some specialist software—e.g. Ning, Core Community, Basecamp—have emerged as leaders in this space. Such systems provide for rapid and easy sharing of documents, videos, games and simulations, ideas as well as supporting collaborative groups and focused conversations. Given the power of peer-to-peer learning and learning networks, these developments are likely to accelerate.

While in the past, the barrier to accelerated adoption of such technologies has been the willingness of faculty members to utilize them, student behaviour and the other trends and patterns listed here will lead to more and more colleges and universities adopting these technologies not simply for competitive advantage but also for survival.

13.2.7 Global Competitiveness

All of these trends and patterns lead to one conclusion: it will get more difficult over time to recruit and retain, retain students as the market for these students becomes increasingly competitive and value sensitive. What is more, governments will assess institutional performance by their ability to sustain themselves while offering less financial support per capita: expectations will grow, while resources available to meet these expectations shift from government to more varied sources of revenue.

What is more, the competition which institutions face is not just local, regional or national: it is global. The University of Toronto, for example, is competing with all of those institutions listed amongst the top 100 in the world, not just for students but also for staff. There is a global war for talent.

This new level of learner choice requires a reimagination of what courses, programmes, credit and learning looks like. Offering the same programme in 2030 in the same way as it is being offered in 2016 is likely not to be a successful strategy. New business models, programme designs, pedagogy, uses for technology and new forms of assessment and credit granting will be found so as to enable colleges and universities to be sustainable.

13.3 Innovation and Its Challenges

Denning and Dunham (2010) suggest a simple model of innovation as a process. It involves a number of discrete phases which may run in parallel, in or out of sequence or all simultaneously. The key point here is that innovation requires a number of different processes and that, as an overall process, it is messy. The discrete phases they suggest are shown in Table 13.1.

Table 13.1 The stages of innovation following Denning and Dunham (2010)

The eight innovation processes			
The work of invention	1	Sensing	Sensing that there is an opportunity to undertake things differently—looking and seeing what others are doing, engaging with others in different parts of the world, taking a note of developments in other sectors (e.g. health, nonprofits, business) … Sensing also that there is a need to do something differently … that "we could do better". *Developing the sense of knowing*
	2	Envisioning	Being able to share a compelling story about doing things differently—"selling" a vision, opportunity and showing "how" it works for you with passion. *Showing the courage of conviction*
The work of adoption	3	Offering	Making the offer to work to change an outcome by using the process/work shared in the envisioning process. *Showing the courage of the offer*
	4	Adopting	Overcoming resistance to change by doing what you said you would do with the new process/work and continually improving what you do to produce improved outcomes. *Showing resilience*
	5	Sustaining	Gaining commitment to keep doing the "new" work and securing the support of one or more first follower. *Showing determination*
Creating the environment for next practice	6	Executing	Making the "new" way of working routine and effective, such that it produces reliable and consistent improvement in outcomes. *Demonstrating professional effectiveness*
	7	Leading	Being proactive in mobilizing others within the organization (and elsewhere) to adopt the emerging practice and supporting them when their commitment falters or when they need additional support. *Showing professional leadership and building scale*
	8	Embedding	Establish the "new" practice as the norm for both each organization and educational systems and embodying the spirit of "we can change". *Showing that change can work, get to scale and stick*

The key with innovation in education is that it leads to change practices, improved educational outcomes and learner engagement and is both replicable and scalable. When we apply these requirements, little in higher education has changed, at least for the majority of learners and faculty. While we can all point to examples of truly innovative developments in a great many institutions, none of these have fully transformed these institutions "beyond recognition". We are still building physical classrooms largely as we did in the 1950s (though now they are "wired"), and we still use very similar admission and assessment systems as we did in the 1980s. If we were to estimate the scale of transformation using the Rogers adoption curve, higher education would be strongly classified as at the "early adopter" stage in most countries, with some institutions showing significant structural and operational innovations (Rogers, 1983).

In higher education, innovations based on technology are challenging activities. There are few people or financial resources to encourage and enable experimentation, and when these are available, they are usually channelled and directed. While this does lead to pockets of innovation, a collection of pockets does not make for an effective integrated system.

Often, innovations at one level of the system are constrained by continuation of old methods or working at another. For example, shifting to 365 points of admission for student registrations in courses (as has occurred in the Kentucky Community Technical College System) is inhibited by the insistence that all institutions use the same student information system; the way in which colleges and universities are funded by some variation of the Carnegie unit inhibits flexibility, especially with course length and credit weights; quality assurance regimes, based largely on an outdated notion of quality, inhibit genuine curriculum innovation; traditions of student assessment and the way in which these assessments are linked to credit inhibit innovation around micro-credential (sometimes called nano-certification) and badges.

The most significant inhibitor to innovation is the lack of investment in the professional development of those who teach in higher education. There is still no requirement for these individuals to have qualifications in pedagogy, instructional design or effective use of technology for learning. Nor has there been significant investment in supporting professional development aimed at overhauling antiquated methods of learner assessment, both in terms of assessment for learning and the assessment of learning.

Despite these challenges, remarkable things are happening. For example, the Commonwealth of Learning's (COL) use of text messaging, local radio, community networks and other supports for farmer education and cooperatives in India, Africa, Asia and other parts of the Commonwealth has produced remarkable transformations of farming practice, farm profitability and farmer livelihoods. This work is also replicable and scalable and has used all of the processes outlined by Denning and Dunham (2010). COL's work in support of the Virtual University of the Small States of the Commonwealth (VUSSC) and the Transnational Qualifications Framework (TQF) which enables learner mobility across 31 countries are significant achievements (Kanwar, 2015).

We can also point to interesting developments in a great many institutions, not least those which change the use of time and place, permit learners greater flexibility in terms of both what and how they learn (Contact North, 2013; Downes, 2015) and to creative developments related to assessment (Hill & Barber, 2014) and the uses of big data (Daniel, 2015). While these are important and hold the potential to be transformative, the contextual forces described above act as inhibitors to the potential leveraging of these related developments for significant change. Not only is innovation inhibited, it is frustrated by the inflated expectations sold by vendors, the plateau of productivity forced by a variety of forces which often results in a trough of disillusionment experienced by faculty and administrators (Fenn & Raskino, 2008). In terms of the innovation model introduced above, the final two stages—the work of adoption and readying for next practice—falter against the organizational "rules" developed to prevent higher education from transforming itself (Mills & Murgatroyd, 1991). Technology is a necessary but insufficient driver of innovation.

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Chapter 14
Learning Assessment Must Change in a World of Digital "Cheats"

Terry Beckman, Helen Lam, and Anshuman Khare

Abstract Digital disruption has touched almost every industry and sector imaginable including the education sector. One disruption in the education sector comes from the rise and acceptance of distance and online education, including massively open online courses (MOOCs), and the technological changes associated with course delivery and student interaction. Moreover, the rapid changes in digital technology have also led to the new breed of "cheats" who use the same digital technology causing disruption to cheat the system for better results. This paper looks at the evolution of cheating and suggests that the solutions may require a fundamental shift in how institutions conduct learning assessment in business education. Specifically, we posit that cheating is a function of two main factors: motivation and opportunities. While the motivation factor has not changed much by the digital advances, the opportunities for cheating have skyrocketed in this digital era, and it is this latter factor that warrants heightened attention. The paper, therefore, examines how digital technology has impacted the traditional assessment tools and how assessment can be modified in a digital world to ensure that students are achieving programme-learning goals.

Keywords E-cheating • Motivations to cheat • Opportunities to cheat • Learning assessment • Online education

14.1 Introduction

Digital technology has continuously changed our lives in both good and some not-so-good ways. In higher education, advances in technology, especially in the area of media and sharing tools, have been claimed to lead to better student engagement, collaboration, knowledge creation and dissemination as well as learning (Bain,

T. Beckman • H. Lam (✉) • A. Khare
Athabasca University, 201 - 13220 St. Albert Trail, Edmonton, AB, Canada T5L 4W1
e-mail: terry.beckman@fb.athabascau.ca; helen.lam@fb.athabascau.ca; anshuman.khare@fb.athabascau.ca

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2014; Tarantino, McDonough, & Hua, 2013). On the other hand, the easy access to online publications, the vast volume of information available through simple searches over the world wide web and the popularity of "tutoring" or course-helping sites that give rise to unprecedented opportunities and temptations for digital cheating (hereafter simply called e-cheating) have created a nightmare for educators in assessing academic merits, with the change threatening "to undo the entire educational enterprise" (Auer & Krupar, 2001; Khan & Balasubramanian, 2012; Howard, 2007, p. 3).

Academic honesty has always been a core value in education with fair assessment of student learning being the foundational basis for determining the achievement of programme and course goals in order to properly grant educational credentials, such as degrees, diplomas or certificates (Rowe, 2004). E-cheating, which King and Case (2014, p. 21) refer to as the "student violation of academic integrity through the use of any technology oriented device", compromises the institutional core value and credibility (Farisi, 2013). While cheating is not a new phenomenon, e-cheating has brought the issue of academic dishonesty to a new height. Cheating graduates may not have the knowledge and skills to appropriately prepare for their work life, and worse still, academic dishonesty is an unethical behaviour that tends to carry through into one's career, with the potential to poison the business environment (Karon, 2012; Mason, 2006; Swift & Nonis, 1998).

This paper examines the critical issue of e-cheating in higher education. It starts with a discussion of the digital trend and disruptions in the educational field. It then presents prior research and statistics, describes different e-cheating methods and analyzes students motivation for e-cheating. We devote a good portion of the paper to measures that can be taken to address the concerns. As different disciplinary areas may require different measures to counter the dishonest behaviour, we choose to focus on the area of business education, as high-profile corporate scandals over the past decade or two have made business ethics a very worthy topic of study and research. As research has generally shown that attempts to catch dishonest acts are insufficient to stem the tide (Alam, 2004), our emphasis is on preventive, opportunity reduction rather than remedial actions, with assignment design and assessment being key areas for analyses and recommendations. These areas have usually been mentioned as important ones to consider in combating e-cheating, but yet, systematic investigation and comprehensive suggestions have been meagre. By offering some concrete proposals such as having field projects and interactive simulations as assignment tools, this paper is intended to fill this gap. These approaches are also consistent with the principle of openness rather than of restriction, as the former is much more conducive to creativity, critical thinking and learning. The proposals will also leverage on technology itself whenever appropriate to combat this technology-induced cheating problems.

14.2 Digital Trends and Disruptions for Education

Pavela (1997) identifies four main types of academic dishonesty, namely, cheating (using unauthorized materials for academic work), plagiarism (presenting others' ideas and writings without proper attribution), fabrication (falsifying information or citations) and facilitating academic dishonesty (helping others commit the violation). Others have suggested that cheating in the academic context is basically the same as academic dishonesty, a broad term encompassing the other categories (Bain, 2014; Park, 2003; Trenholm, 2006–2007). For the purpose of this paper, we will adopt the broader definition of cheating and specifically look at how the digital environment has accentuated the different types of cheating (e-cheating) and how this problem can be addressed.

Before the proliferation of online resources such as electronic journal databases and efficient web search engines, students who wanted to copy others' materials would have to at least find the source physically and then type in the copied content. Now, materials can be found right at one's fingertips without the need to leave the house while copying and pasting involve just a few simple computer mouse clicks. Course-helping or "tutoring" sites are easily accessible and the online environment allows people to remain anonymous or use pseudo-names for access. While some of these sites are meant to provide legitimate help to students who need some assistance in understanding difficult concepts, many are actually "cheat sites" that offer direct answers to assignment or exam questions that are supposed to be attempted by students on their own. Even way back years ago, Atkins and Nelson (2001) claimed that there were as many as 200 such "cheat sites". Such services for cheating are becoming a profitable business, with sites charging up to hundreds of dollars per essay, and according to a UK executive of one such site, the industry was worth as much as £200 million annually, and his company alone distributed over 11,000 essays in 2012 (Matthews, 2013).

With the popularity of flexible online courses, students taking the same course can be continents away and in different time zones. Hence, exams and assignments may not be able to be provided at the same time and same place, and even arranging for proctoring can be a challenge. Many assignment or exams, especially in the business area, are meant to require reflective thinking and not simple regurgitation of materials. As such, it may be more appropriate to allow more time than just a few hours to write an assignment or exam. However, such arrangements may increase the opportunity for e-cheating, including unauthorized collaboration or collusion through emails, text messages, or social media; digital plagiarism of submitted materials; submission of answers purchased online; or even online impersonation of the exam taker (Bain, 2014). Even when exams are taken in one room, if many students are in attendance, monitoring can still be difficult as small electronic devices available nowadays can make cheating a lot easier. Instead of bringing in a big thick set of notes, electronic notes or even e-books can be stored in cell phones to be accessed when not watched. Instant text messages can also provide the tool for getting unauthorized help during exams. In a 2009 US survey, 35 % of teenagers admitted to using a cell phone to cheat in school, while over 50 % had cheated using the Internet (Common Sense Media, 2009).

Cheating is a very serious academic matter, and its incidences are apparently on the rise especially with the ease of access to online academic journals and Internet sources including "cheat sites" (or paper mills) (Baron & Crooks, 2005; Bennett, 2005; Phillips & Horton, 2000). According to Park (2003, p. 478), reported levels of cheating incidences in the literature tend to be 50 % or higher. More specifically with digital plagiarism, an Australian study involving over 1900 assignments in six universities over 20 subject areas found 14 % of essays had an "unacceptable level of unattributed materials" sourced from "the Internet or from peer essays" (O'Connor, 2003). Szabo and Underwood (2004, p. 195) also found in their UK study that over 30 % of higher education students had plagiarized from Internet sources, and the students involved did so regularly without feeling "wrong", nor did they feel they would be caught.

Even though online courses might offer more opportunities to cheat than in traditional settings, some studies did not find cheating in the online environment to be any higher (e.g. Hart & Morgan, 2010; Ison, 2014; Spaulding, 2009; Yates & Beaudrie, 2009). However, many others did suggest otherwise. For example, Lanier (2006, p. 249) found 41.1 % of students cheating in online courses as compared to only 4.4 % for courses held in classrooms. Varble (2014) attributed the higher online student test scores as compared with the onsite ones to cheating, as the difference was largely due to the "remembering" type of questions. More recently, Khan and Balasubramanian (2012, p. 12) specifically studied the difference between traditional cheating and e-cheating and found the e-cheating rate at 78 % was much higher than the 37.5 % for traditional cheating (without using IT sources or devices). They found technological advancement and availability of online resources significantly contributed to e-cheating (to the magnitude of 56 and 44 %, respectively) (p. 12). Further and more specifically, 35 % of students admitted to using Internet sources without attribution, and 9 % actually purchased answers online for their assignments (p. 15).

Research has also been conducted to investigate the difference in cheating rates across disciplines. Brown (1996) did not find any difference for business students, while Iyer and Eastman (2006) found business students cheated less than nonbusiness ones, attributable likely to ethics being an important subject matter in business curricula, and is also an area emphasized by business accreditation bodies such as the Association to Advance Collegiate Schools of Business (AACSB) (Chapman, Davis, Toy, & Wright, 2004). On the other hand, other studies found and/or suggested business students cheated more than nonbusiness ones (Park, 2003; Pullen, Ortloff, Casey, & Payne, 2000), probably due to the more instrumental attitudes of business students (Phillips & Horton, 2000).

In sum, while research results on online or business student cheating versus their counterparts in a different environment or discipline are not necessarily conclusive, e-cheating is nonetheless worth serious attention, particularly in situations where both the online and business dimensions are combined.

14.3 Motivation to Cheat

Before developing measures to counter e-cheating, especially proactive ones, it is critical to first understand students' motivations for engaging in academic dishonesty. Other than the overall change in the technological environment, a number of individual and institutional factors have been identified as reasons for cheating or e-cheating. At the personal level, some common ones are lack of clear understanding on plagiarism, relaxed attitude on ethics, time pressure, poor writing skills, pressure to succeed and the excitement of breaking rules (Comas-Forgas & Sureda-Negre, 2010; Harris, 2015). A student's national culture and gender have also been found to affect cheating behaviour. For example, students from Asian countries and Greece were accustomed to or even expected to recite the course materials verbatim by their home country institutions, and many may be uncomfortable using their own words (Barrett & Malcolm, 2006; Hayes & Introna, 2005). Language skills and other issues of adjusting to the new country environment, norms and expectations can also be contributing factors. Male students were generally found to cheat more than females (Iyer & Eastman, 2006; Khan & Balasubramanian, 2012). At the institutional level, Ashworth, Bannister, Thorne and students on the Qualitative Research Methods Course Unit (1997) attribute the larger class size, decrease in class interaction time, new emphasis on collaboration, heavy workload in course design and ineffectiveness of the monitoring system as factors for cheating increase. Overall, when students are disengaged and unhappy about a course or the institution, or when the institutional culture on upholding academic honesty is not strong, chances of their cheating increase (Calabrese & Cochran, 1990; Hayes & Introna, 2005; Turner & Uludag, 2013).

14.4 Opportunity: The Key Mediating Variable

The motivations listed above are not specifically related to digital disruptions. That is, they are not technologically driven. Although some of these motivations, in particular at the institutional level, are more current manifestations of our educational and societal situation, most of these have existed for many years, if not centuries. For example, one can readily imagine that the pressure to succeed, time pressures or the excitement of breaking rules all existed long before computers were even dreamt of in science fiction. However, what *is* new, and we propose is a significant change, is the *opportunity* that technology provides. That is, while a few hundred years ago, a student writing an exam may have wanted to cheat, there was no opportunity to do so. Today, a student writing exam who wants (or feels that she/he has no choice) to cheat only has to sneak a small, easily concealed smart phone into the exam, and a whole world of resources are available. The availability of the smart phone technology provides the opportunity to cheat, which was not nearly as readily available prior to the advent of modern technology.

Another example of the increased opportunity with today's Internet access is in the writing of essays and papers. One way to cheat is for a student to have someone else (usually someone who is smarter or more highly educated) write the student's paper, and the student then simply hands in the other's work as his/her own. The difficulty of doing so in the past was finding an appropriate person: someone who was smart enough, knew the material better than the student, had the time and was willing to be part to the fraud. Additionally, if a student approached someone for this purpose, she/he was risking his or her own integrity in the eyes of someone who might be a friend, or at least was in relatively close proximity to the student. Thus reputational risk made this opportunity even less available. Now, with access to the Internet and the many course-helping sites, students can quickly, easily and anonymously get an assignment or paper completely written for them. We see here the same type of cheating, with significantly less risk and radically less difficulty in getting it done, that is, significantly increased opportunity.

What is clear is that the digital disruption of the twenty-first century is increasing the opportunity for students to cheat.

14.5 Measures to Address E-Cheating

There has been no lack of suggestions in the literature for combating e-cheating, and yet the problem of e-cheating continues to be a prominent one (see, e.g., Alam, 2004; Bain, 2014; Gao, 2012; Harris, 2015; Karon, 2012, Szabo & Underwood, 2004). Table 14.1 provides a summary of some of these measures used and the corresponding cheating motivations or reasons addressed. Within the table there are several suggestions that relate to cheating detection, enforcement of penalties and educating students about why cheating is wrong. These measures should continue to be used, as they have a role to play. However, it seems effective to also target the opportunity part of the equation. If one can limit or eliminate the opportunity to cheat, then despite the motivation, student cheating will decrease.

What should be clear is that learning assessment methods themselves play a role in issues of cheating. For example, the use of published and readily available case studies—which are very common in business school programmes—creates a huge opportunity for cheating. Using such case studies simplifies course preparation for professors, so the practice is very attractive and very common. Also, the case method is believed to be a very effective teaching tool in business schools, so its use is widespread. However, enterprising individuals or organizations have taken these case studies and created solutions, which they then sell online. Given that there may be thousands of students a year for several years using the same case, this can be a profitable venture if even a small percentage of the students are willing to cheat.

Additionally, there is often a lead time of several days for students to prepare a case study for submission; this time allows them to pay someone online to write the solution for them. So even though case studies may be useful learning tools and

Table 14.1 Measures to counter cheating motivation

Measures proposed	Cheating motivations/reasons addressed
Clear policy on cheating and especially plagiarism	• Emphasize the value of academic integrity to drive out unethical behaviour • Define and explain the terms to remove unclear expectations • Make students aware of the potentially disastrous consequences • Ensure faculty are consistent in applying penalties as inconsistent practices can drive cheating
Class exercise on cheating and plagiarism	• Introduce active exercises or dialogues to reduce misconceptions on acceptable and unacceptable practices, e.g. when does collaboration crosses the line to cheating, what is acceptable paraphrasing • Bring awareness to the inferior quality of cheat sites • Help students from a foreign culture, who are used to copying verbatim, become familiar with and understand plagiarism
Level of penalties to fit the offence	• Assign heavy penalties to deter cheating • Enforce policy and punishments to signal to students they would not get away with cheating • Differentiate "accidental" plagiarism from blatant dishonesty to alleviate unnecessary student fear
Plagiarism detection using software or Internet search for assignments	• Have all assignments or suspicious ones going through the software detection process such as through turnitin.com can proactively deter plagiarism and reactively catch offenders • Adopt proactive submission by students to the software detection sites as part of education
More engaging classes	• Increased engagement and satisfaction can lower the temptation to cheat as the course is worth the effort
Better preparation of students for assignment	• Provide training and resources to enhance students' writing and analytical and research skills to give them confidence to tackle the assignment without illegitimate help • Provide training and resources for referencing tools such as endnotes and Refwork to reduce chances of improper citations • Discuss course assignment expectations with students to ensure a clear understanding
Reasonable course load	• Reduce cheating due to time pressure

help with course design, the way they are often used creates opportunities for cheating. In order to maintain the use of case studies, one must look at ways to remove or limit opportunities for cheating.

In terms of opportunity reduction for cheating, much has been written about using proctored exams and electronic monitoring devices and technologies (e.g. webcam, fingerprint and/or other biometric identifications) to reduce chances of online impersonation and illegitimate help/material access (e.g. Gao, 2012; Turner & Uludag, 2013). However, these measures are more for exam settings and do not address other forms of course assessments such as assignments. Therefore, the focus of this section is to specifically suggest assessment-based types of opportunity reduction measures.

14.5.1 Unique Course-Specific Assignment Assessments

One way is for professors to write their own case studies. This deals with the availability of stock solutions, but still leaves open the opportunity for students to pay someone to custom write the solution. Also, it is not feasible for most professors to write multiple brand new case studies each time their course runs. However, creating additional questions or material to supplement existing case studies *is* feasible. By changing the case questions, the professor limits the opportunity for students to simply buy stock solutions online. Furthermore, if the changed question brings in material that is course specific, such as relating it to a previous assignment or readings, then it limits even further the ability of students to cheat. There would be no stock solutions available online, and because of the unique course material, it would be difficult for a third party to actually write a solution; or it would require more effort for the student to provide this unique information to a third party than it would be to write the assignment for himself or herself.

14.5.2 Reducing Time Frame for Assessments

Another change that can limit opportunities for cheating is to reduce the time frames allowed for assessment. To some degree this is already practised with open book exams: students are allowed to have their course materials with them while writing the exam, but they do not have enough time during the exam to look up material, read through it in depth and write it out in the exam book. Rather, if they do not know the material extremely well already, they will not have enough time to complete the exam by referring to their course material. The same thing can be applied to closed-book exams. That is, a professor can calculate the available exam time to match what a knowledgeable student would be able to write, without looking up material or without asking for and getting answers through a digital device (e.g. a smart phone). This may not eliminate the opportunity for digital cheating, but it limits it. Time limits can also be used for case studies. Instead of allowing 5 days to complete a case study assignment, provide only 2 days. Again, this does not eliminate the opportunities for cheating, but it puts limits on those opportunities. Of course, in establishing the appropriate time frame, instructors do need to consider the time required for proper learning, understanding, absorption and application of the case materials.

14.5.3 Interactive Assessments

An assessment method that has been around for decades but is actually becoming more available as a result of advances in digital technology is the use of simulations. In a simulation, the students need to input data in response to a specific situation.

The situation then changes as it responds to the students’ input; the students then need to respond again to the changed situation and so on. Some simulations have a general market situation where the students are actually competing against each other. The choices made by one student (or student group) change the market situation for all the other students, who also make choices in the situation. This interaction amongst and between students and the simulation severely limits the opportunities for cheating. It also provides learning mechanisms that allow the students to apply their knowledge to see how effective their learning has been.

Interactive assessment is integral to simulations, but it can be used in other contexts as well. Class participation is one way this has been used for many years. Especially in an online discussion setting, students’ participation is dependent on regular interaction with others, and their contributions can be tracked, monitored and graded. With such an interactive learning environment, the opportunity for students to cheat is severely limited—regardless of the technology available.

14.5.4 Collaborative Assessments

One other method to reduce opportunities for cheating is to include collaboration amongst students in assessment methods, that is, have group work elements as part of some assignments. It is likely more difficult to convince an entire group to cheat than for an individual to decide on his or her own. Also, within a group, if one person cheats, the others are incented to catch and prevent this, as the penalties that could go to the entire group can be severe. Group work does require proper planning and design in terms of the level of assignment complexity, grading weight attached, appropriate group size and membership, duration and scheduling, as well as fair assessment that can prevent freeriding (e.g. peer evaluations).

14.5.5 Real-Life Assessments

Another assessment method that reduces opportunities for cheating is to use real-life situations for assignments. For example, for writing a marketing plan, have the students work directly with real companies. This can be done where every student or student group finds their own company to work with or where a small group of companies (or even one) works with the whole class. The unique context of the direct work with the company reduces the opportunities for students to cheat on such an assignment.

Field projects can be used to incorporate all of the above measures for reducing opportunities for cheating. Going to a business on a consultancy project (i.e. out in the field) provides a real-world context, which can be organized in a way so that a somewhat limited (although reasonable) time frame is allowed, and it can be very interactive, with the students, professor and business people all responding to each other throughout the project. Even when a face-to-face visit is not possible, the use of technology such as Skype can allow for almost the same level of interaction. Sharing of site videos can provide a virtual but realistic tour of the field facility.

Another type of field project could be having students do actual market research. One example (where ethics board approval would likely not be required) is to have students sit in one location in a shopping centre and observe the flow of people and characteristics of those people in the context of the stores and other people during a 1 or 2 h time frame. This is a real-world situation that can then be applied to further class projects. It is also a somewhat unique and interesting project that students may be more inclined to *want* to take part in.

These examples also provide for active or experiential learning. So not only are opportunities for cheating reduced, but they are effective learning methods as well.

14.6 Conclusion

This paper has looked at the issue of student cheating, in particular as it has been exacerbated in the current digital world in which we live. It was suggested that the amount of cheating is related to both the motivation of the student and the opportunity available to the student to cheat. With the advanced digital tools available so readily, the opportunity for cheating has increased significantly. Thus it seems reasonable that even students without a strong motive to cheat may actually engage in cheating behaviour, because it is so easy. While it is important to continue to address the motivation part of the situation, addressing the opportunity piece of the equation may be the most effective way to curb cheating in this digital era. As such, we offer five key opportunity-reducing suggestions, including using real-life assessments, incorporating course-specific content into the assessments, reducing time frames for assessments, incorporating interaction into the assessments and using collaborative assessments. Using any or all of these will not necessarily eliminate all opportunities for cheating, but they will limit such opportunities. Combining these opportunity-limiting measures with the measures that address motivation provides proactive ways to reduce the cheating that seems to have blossomed at the same time that digital technology has grown. Professors and course designers need not be limited by what is presented in this paper. Rather, having identified that focussing on reducing *opportunities* for cheating is a high-leverage point sets a path for new and creative assessment methods to be developed and used. Such methods can be both effective learning tools and help reduce cheating. For these methods to be successful, it will require coordinated efforts of professors and course designers, with good support from simulation vendors, case study providers, field organizations and, most importantly, proper recognition and sufficient resource commitment from the education institutions.

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Chapter 15
Digital Disruption: A Transformation in Graduate Management Online Education

Dwight R. Thomas

Abstract Digital disruption in the online education environment requires fundamental changes from the traditional classroom delivery model. Digital disruptions reflect innovations in program, course development, and delivery. Examples include the use of embedded or hot-linked video and audio presentations, group and team interactive assignments (conducted through either synchronous or asynchronous means), problem-solving and critical thinking exercises, and activities conducted through designated social media or via Skype, Adobe Connect, or similar real-time media. The use of expanding web-related (Web 2.0 and Web 3.0) major digital disruptions is explored.

This chapter includes observations on the learning and delivery models that two well-established universities have developed for the dedicated online delivery of graduate MBA degrees, which offer some insights into the use of evolving digital disruptions to enhance the quality of their respective online degrees. The programs described include the British Open University (OU) MBA that was launched in 1983 and the executive MBA that Athabasca University (AU) in Canada initiated in 1994.

This chapter includes an overview and offers some suggestions as to the future benefits and areas where digital disruptions will be derived from the Internet of Things (IoT) and the Internet of Everything (IoE) paradigms.

Keywords Online management education • Web 2.0 and Web 3.0 • Internet of Things • Internet of Everything

15.1 Introduction

In a paper published in the International Review of Research in Open and Distance Learning entitled "Three Generations of Distance Education Pedagogy," authors Anderson and Dron (2011) reflected on the generational development of distance education technology in which digital disruption is seen to play an integral role.

D.R. Thomas (✉)
Athabasca University, 36-13 Hawthorne Crescent, St. Albert, AB, Canada AB T8N 6X1
e-mail: Dwight_Thomas@fb.athabascau.ca

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Commenting on the evolution of learning at a distance, Anderson and Dron observed, “The first generation of distance education technology was by postal correspondence. This was followed by a second-generation, defined by the mass media of television, radio, and film production. Third-generation distance education (DE) introduced interactive technologies: first audio, then text, video, and then web and immersive conferencing” (Anderson & Dron, 2011, p. 81).

15.2 The Early Experiences

This chapter focuses on a discussion of the impact that digital disruption has had (and continues to impact) on online distance-based graduate management programs evolving from the second and subsequent generations of digital disruption-based technologies that have been integrated through a mix of synchronous, asynchronous, and hybrid learning modalities.

Although some limited examples of digital disruptions have flowed from earlier transformations (including, e.g., the use of fax machines, video disks, video cassette recorders, mainframe computer technology, and audio teleconferencing), the evolutionary impact of digital disruption for higher online graduate management education applications likely owes its formal beginnings to the visionary development and launch of dedicated open universities.

Applying variations of the second-generation distance education (DE) model, as described by Anderson and Dron (2011), as examples, both the British Open University (OU) and Athabasca University (AU) in Canada launched their first dedicated online degree programs in the early 1970s.

The initial OU learning model was based upon student access to print materials and to televised lectures produced and developed by the BBC in conjunction with OU faculty and staff. The undergraduate OU degree programs originated in the early 1970s. The undergraduate degrees were complemented by the addition of a distance-based (executive) graduate MBA program in 1983 which was offered utilizing a combination of print and audio–visual enhancements (including some short residential components) although the latter could also be taken online without the physical presence of the student.

Athabasca University (AU), in Alberta, Canada, commenced operations in 1970 and was mandated with a specific dedication to focus on open distance-based adult learning from 1972. The degree programs initially provided print materials, complemented with set texts and telephone access to tutors for its undergraduate classes. Several study centers were also created although attendance was not required. Subsequently, AU launched its online executive MBA graduate degree commencing in 1994.

Executive MBA degree programs are those targeted toward candidates who possess practical experience in management and supervisory positions or as entrepreneurs in addition to their educational qualifications. Both the OU and AU programs have such an experience requirement.

It should be noted that both the OU and AU's MBAs serve as exemplars of the dedication to open online graduate management degree programs. Both programs have evolved since their inception through the adoption of an increasing range of digital disruptive elements in order to provide their participants with enriched and adaptive learning models for the encouragement of critical thinking and group synergies within a collaborative learning environment.

From the outset, the OU and AU online graduate programs relied upon the creation of quality subject materials prepared by course teams comprised of members of their academic communities including course developers and academic SMEs and implemented with professional editorial support. Course content was also vetted by critical readers and/or peer reviewers to ensure that the content and quality of each course or class module was consistent with, and at least equal to, those being offered through conventional-quality "in situ" bricks and mortar programs.

Initially these online programs were viewed with some degree of skepticism by some traditional bricks and mortar-based universities that argued that a quality graduate management degree could not be offered entirely online. The skeptics were proven wrong as both the aforementioned programs (along with many others which have since been initiated, many by prominent bricks and mortar universities) continued to grow taking advantage of evolving technologies and innovations as they became available. Recognition of the quality of these online graduate degrees was also confirmed as traditional institutions and the marketplace recognized and accepted the qualifications of graduates of these online degrees. An informative discussion of the advantages of online learning when compared to traditional models was evidenced in a meta-analysis conducted by Means, Toyama, Murphy, Bakia, and Jones (2009).

15.3 Expanding Digital Disruptions

Throughout the 1990s, second-generation disruptive technologies were expanding allowing participants, academic faculty, coaches, and tutors to interact in synchronous, asynchronous, and hybrid modalities. This included the provision of audio and video materials to complement the set texts (and other print materials) complemented by access to online and face-to-face coaching and/or tutorial support both individually and through group interaction by telephone and teleconferencing and through face-to-face residential or group sessions which were usually optional respecting the lack of accessibility of some participants to any face-to-face presence.

The growth of personal desktop and portable and laptop computers which had been generated through the 1980s and had matured by the early 1990s provided added opportunities for a digitally transformed delivery system for information and data to be distributed through a range of digital disruptions to complement the extant courseware and text materials.

By the mid 1990s, students and course coaches and tutors began to gain a wider range of learning options for online learning. The first practical online accessible library resources and databases also became available beginning in mid-1990s. JSTOR (2016) allowed students, educators, and researchers (and later the general public) to undertake library searches online without the necessity of doing a physical search within library premises. Initially such access was available primarily through intranet and terminal access to central servers and was limited in content to abstracts of many serials and some archived works which could be read or downloaded depending upon author and publisher intellectual property rights. As Internet access accelerated through the 1990s and into the twenty-first century, full online access to library and serials became more available as libraries negotiated the rights for their students and researchers to read and download copies of many complete works through licensed digital databases.

By the early 2000s, we also saw the extensive development of learning management systems (LMS) to support the online delivery of an increasing number of management degree programs. Blackboard, FirstClass, Embanet, and Moodle were among the key major commercially available systems. At the same time, some institutions (including Athabasca University) pioneered their own unique delivery platforms which were not based upon a "cookie cutter" model but rather shaped to the needs of their respective learning environments and targeted student populations. The Athabasca LMS was developed as a proprietary variation of the original Lotus Notes (now IBM Notes) collaborative client–server software platform. These learning management systems (LMS) can be regarded as having made a significant contribution to the adoption of digital disruptions although collectively they would best be characterized as evolutionary rather than revolutionary in their impact.

15.4 Web 2.0 and Social Media

Web 2.0 is described "as a loosely defined term for web applications that go beyond displaying individual pages of static content and allow a community of users to interact with the site and each other by adding or updating the content the term was coined by Darcy DiNucci in 1999, though she was discussing on designing websites for new hardware platforms" (Dictionary.com, 2009).

Central to the composition of Web 2.0 developments has been the development of a wide range of social media vehicles which have provided a rich disruptive impact on learning both in conventional and online environments. Twitter, YouTube, LinkedIn, Pinterest, Skype, webinars, blogs, and wikis come to mind as exemplars of this evolutionary movement.

In an unpublished paper prepared for an online graduate management program faculty conference, Thomas and Khare (2014) suggested the new role of the online instructor needed to better reflect the realities of the new learning modalities that have evolved through the emergence of digital disruption and changing patterns of engagement. The presentation underlined that learning in online graduate teaching has to become more focused on nurturing student creativity, co-creation, and production and that learning rests on the ability to access and use distributed information on a just-in-time basis.

In this context, the role of the online facilitator or instructor has also evolved. Today, his or her role is to amplify, curate, aggregate, filter model, and commit to a persistent presence either synchronously or asynchronously on a 24/7 basis over the duration of each class (Siemens, 2009 cited in Conole & Alevizou, 2010). However, there are some pitfalls and challenges as well. First, innovation for innovation's sake should not be the goal, and instructors need to balance the integration of innovations with the teaching expectations. Second, not all academics have the vision or personal experience of what technology-enhanced or technology-driven teaching should look like. Finally, traditional teaching models can lead to pedantic teaching styles which ignore the research (and inclusion) of the best of teaching practices as these evolve.

Friedman and Friedman (2010) in an article entitled "Using Social Media Technologies to Enhance Online Learning" confirmed the view that introducing social media into courses can lead to improved participant skill sets including communication, collaboration, community, convergence, and creativity, thus underlining the positive impact of social media as generators of digital disruption which is particularly relevant in a graduate management program environment.

In addition, TED (which is a nonprofit organization) has provided a wide range of social media-linked video and audio presentations to complement the learning materials for graduate management classes, and these became readily accessible through Twitter, Facebook, Google+ and YouTube.

The key to the Web 2.0 components is that, collectively, they have had the ability to encourage students to actively engage in a variety of social interactive relationships with their classmates, instructors, and other resource persons and social communities both within and outside the boundaries of the prescribed LMS learning space. This has enabled the opportunity for students to explore, learn, exhibit critical thinking, and create in a community setting whether engaged in a classroom, online, or in a hybrid-oriented program setting.

15.5 Web 3.0 and the Internet of Everything

To this point, we have addressed the evolution of the first- and second-generation distance education stages as defined by Anderson and Dron (2011) and have discussed some of the key digital disruptions that have served to influence the design, development, and delivery of online graduate management programs. But what changes are likely to define the next or third generation of digital disruptions (characterized as Web 3.0) and their potential impact on online graduate management education?

To forecast some of these potential changes, we need to view this as a major or revolutionary stage where the Internet of Things and the Internet of Everything paradigms have become the focus of attention. The Internet of Things (IoT) relates to a convergence within a network that is comprised of physical objects, sensory devices, vehicles, buildings, and additional constructs which are embedded with communication-linked capabilities that can permit individuals and organizations to interface and update, modify, or add to their foundation of product or service or knowledge-base offerings on machine-to-machine and machine-to-human communication links that the Internet of Things (IoT) supports.

To date there has been a wide range of the sector applications of the Internet of Things (IoT) developed particularly as they relate to commercial innovations. According to a web-accessible article published by the Harvard Business Review entitled "The Sectors Where the Internet of Things Really Matters," Jankowski (2014) described that the Internet of Things (IoT) has initiated priority areas for adoption spanning a broad landscape focusing on wearables, connected cars, connected homes, connected cities, healthcare, oil and gas, transportation, and the industrial Internet sectors. Notably absent here, however, have been implications for further and higher education. However, as one moves into the next (and current state) of an expanded Internet of Everything (IoE) paradigm, there is a sharper focus on education as one area where stakeholders have begun to initiate new significant digital disruptions, which will accelerate massively over the coming decade.

The Internet of Everything (IoE) encompasses both the benefits of the digital disruptions emanating from the Internet of Things being connected with people, processes, and data. In a Cisco-sponsored White Paper entitled "Education and the Internet of Everything: How Ubiquitous Connectedness Can Help Transform Pedagogy," Selinger, Sepulveda, and Buchan (2013) outlined how the bringing together of people, processes, and data networking with things (which they characterize as the four pillars of IoE in education) leads to new capabilities, richer experiences, and unrivalled opportunities.

The Cisco White Paper proceeded to provide examples of the implications of the four-pillar paradigm:

> The four pillars of IoE create a need for an education system that empowers a new generation of digital citizens who understand the technologies that underpin IoE, the societal impact of widespread adoption, and the right application of the information that is captured (Selinger et al., 2013, p. 6).

In one pioneering initiative directed toward this end, the OU in the United Kingdom, starting with its computing science degree program, has developed a course module entitled, My Digital Life, which all computing students are enrolled in as a precursor to their degree courses.

This provides an orientation to the IoT and other digital technologies that they will encounter in their subsequent courses. A similar introductory course or tutorial would be a logical and valuable addition edition to all online graduate management degree programs and would be especially helpful to students studying at a distance. The importance of developing an understanding and literacy of the nature and application of digital disruptions as those generated by Web 3.0 clearly is viewed as an imperative moving forward.

The Internet of Everything is comprised of a variety of exponential technologies as explained in a web posting entitled "When the World is Wired: The Magic of the Internet of Everything" (Diamandis, 2016a). These exponential technologies include the Internet of Things, computation, robotics/drones, artificial intelligence, 3D printing, materials science, virtual and augmented reality and synthetic biology. Several of these technologies will most likely be of particular value both in the short and over time to further embed new forms of digital disruptions to further transform of online programs including the graduate management offerings which are featured in this chapter. Comments on the potential impact of some of these technologies follow.

15.5.1 Computation

The development of cloud computing provides massive and readily accessible storage capabilities which each subscriber can access through their desktops, laptops, or other mobile devices without limited onboard storage capacity as both big data and software can be stored and accessed in real time through the cloud. In addition, expanded global access to online broadband Internet services will be available at reasonable cost over the next several years as several competing projects are to be launched which will virtually cover the globe so that online participation to programs will no longer be restricted to areas which have terrestrial Internet access particularly in rural regions or developing countries where communication access has been even more challenging apart, perhaps, from smartphone and tablet access.

15.5.2 Artificial Intelligence (AI)

IBM's Watson is a prime example of the impact that artificial intelligence can play in both personalizing student's learning experiences and providing a trainable resource that that can be used to enrich the program content and delivery modalities of online learning. This innovative intelligence vehicle learns as it interfaces with its clients whether they be students, faculty, or administrators. For further insights and an example of Watson's capabilities, the reader is directed to an IBM Insights on Business article entitled "IBM Watson for Education" in which the author, Eassom (2015), discussed a pilot project at Deakin University in Australia exploring Watson's substantial capabilities to enrich learning and to facilitate the screening of unstructured big data sources. In the Deakin University project, the institution was able to take advantage of four IBM Watson-mediated initiatives comprised of the Watson Engagement Advisor that encouraged the creation of student-friendly advisory service where questions posed concerning the institution and its programs could be addressed in a personalized mode. Other Watson protocols that were made available in the Deakin IBM initiative included the Watson Discovery Advisor, "an engine that can search thousands of unstructured data sources in seconds with a level of intelligence that can make sense of semantics, idiom, and grammar and be trained to understand technical expressions, disciplinary jargon, abbreviations, acronyms, and labels with the purpose of making connections between these and delivering new insights for researchers" (Eassom, 2015). The Watson Explorer, a third feature, which comprises "the core ability of Watson to mine unstructured data and leave that data in place is invaluable for institutions where huge volumes of unstructured and structured data sit in silos across the enterprise and are not easily accessible at the "point of impact" (Eassom, 2015)".

The potential for the future of Watson and other artificial intelligence vehicles seems boundless. For example, Watson provides the student or researcher with a natural language-oriented capability of sifting through massive collections of data far beyond what a typical search of conventional databases could provide on a real-time basis. Watson is also an intelligent "creature" and can pattern its searches and collate data sources which are of interest to the user and has a memory so that iterative searches do not duplicate previous efforts and any guidelines or search profiles that are posted by the researcher will be "remembered" and taken into account as data search results are further refined and collated.

In a recent paper entitled "Intelligence Unleashed: An Argument for AI in Education" authored by Luckin, Holmes, Griffiths, and Forcier (2016), Pearson in collaboration with the University College London (UCL) Knowledge Lab published a paper that underlines the critical need for educators to recognize the importance of utilizing our artificial intelligence (AI) capabilities to address some of the more challenging issues in education today.

Although the authors present many suggestions, one recommendation would involve the utilization of AI in online management courses would be to include some form of intelligent tutoring systems where AI techniques are able to complement one-to-one human tutoring based upon a dynamic assessment of the individual student's cognitive needs. This would be achieved by monitoring his or her engagement and contributions in the class (in a background nonintrusive mode) and then providing personal customized feedback and suggestions for enriching their learning experience (based upon the student's progress and observed cognitive needs) on a 24/7 basis without the need for a human course facilitator or an instructor intervention. This would be seen to complement the role of the course facilitator or instructor and would be personalized and ongoing through the duration of the class.

A second AI-facilitated application that could be beneficial would be to use an adaptive group formation (AI) technique to constitute groups within a class where group or team projects are being assigned. This technique could permit an objective approach to generating group memberships where either similar skill sets are desired or where complementary skill sets are seen as beneficial. In the latter case, a comprehensive case study assignment which draws upon a wide range of functions to be analyzed could benefit from group membership which included a mix of students with a disparate mix of strategic, operational, financial, and marketing competencies and simulating what one might experience in a professional consultancy setting.

15.5.3 Virtual Reality (VR) and Augmented Reality (AR)

These two technological innovations are expected to offer major digital disruption to the graduate management courses as they become more utilized over the next several years.

15.5.3.1 Virtual Reality (VR)

Virtual reality (VR) is a computer-mediated experience that allows participants through artificial simulations to experience sight, sound, and touch sensory stimulation simulated in real life-like settings. For example, in the case of an online graduate management program application, VR could allow the student to actually sit and participate in management meetings to monitor interviews or physically explore production line in the organization under study. These scenarios could also be linked to case study assignments. A VR-mediated case study could provide the student with the ability in real time to experience the scenario of the case being examined and be able to see, hear, observe, and intervene within the virtual scene and to physically and emotionally interact with the players who are present in the actual case being investigated.

This VR experience could also be most valuable especially where cross-cultural issues and co-creation challenges, for example, are being experienced in a workplace setting. The possibilities are extraordinary especially as the hardware and software for providing a VR presence are soon to be expanded over the coming months as Oculus, HTC, Sony, and Apple and others are likely entering into this sector by 2017–2018.

15.5.3.2 Augmented Reality (AR)

Augmented reality (AR) does not allow the participant to become physically immersed as part of the learning experience directly, but it does allow for the merging of computer-generated graphics or video on top of the real world as we observe it. Rather, it allows for computer-generated graphics or video to overlay or blend with what we experience in a real-world setting (Diamandis, 2016b). The student can therefore enhance what he or she sees with digital overlays of information provided on the topic under study when learning a new skill.

Presenting a case study assignment could be complemented with a visual presentation of the setting of the case study with the actual voices of the key subject players presenting their views, concerns, and background perspectives orally to serve as an audio enrichment to the written documented case materials. Data could also be superimposed relevant to the core case materials overlaid on a video display.

15.6 Concluding Remarks

The growth and ongoing introduction of digital disruptions based upon the exponential technologies addressed especially under the umbrella of Web 3.0 will have a profound impact on the future evolution of online graduate management programs. This will provide for even more synergistic engagements of the student with the program and will facilitate greater networking and interaction with his or her colleagues through extended social community engagement, which may lead to a more profound relationship within both their personal and working lives. For educators engaged in the development and facilitation of these programs, there will be greater challenges and responsibilities to enrich the learning experience and to ensure a reality-based approach to the program commensurate with the concurrent changes that are also being experienced within the workplace environment. The Internet of Everything (IoE) will continue to suggest future directions for online learning both in established degree programs and for life-long learning opportunities.

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Part VI
Managing Virtual Networks & Services

Chapter 16
The Influence of Socially Orientated Growth of Virtual Teams: A Conceptual Model

Iain Reid, Marina Papalexi, and Neil Slater

Abstract The rapid advancement of new technologies has resulted in greater opportunities in innovation, new product development partnerships/collaborations and international trade. Today's social networking and 'open innovation' information communications technology has enabled work distribution to become more efficient and has presented organisations with a new way of working across different geographical locations. The chapter aims to explore social software and presents a conceptual model for virtual teams (including social networks) for socially orientated growth in complex management projects in where third parties play a critical part to the supply chain.

Keywords Social software • Virtual teams • Social media • Social communications

16.1 Introduction

Over the last few years, academics and practitioners alike have increasingly focused on the performance of their projects and the potential disruptions within their global supply chain. Any risk regarding the performance of a project or supply chain draws on many decisions. Today's project-driven organisations now operate closer within a global suppwly chain structure and are often exposed to higher levels of diverse information and are therefore vulnerable to higher levels of uncertainty. This uncertainty and disruption may harm the outcome of the project, in terms of value and performance, as well as disrupt the communication flow within the supply chain. For example, Thun and Hoenig (2011) stated that supply chains are vulnerable from

I. Reid (✉) • M. Papalexi
The Business School, University of Huddersfield, Queensgate, Huddersfield HD1 3DH, UK
e-mail: i.r.reid@hud.ac.uk; m.papalexi@hud.ac.uk

N. Slater
The Business School, University of Huddersfield, Queensgate, Huddersfield HD1 3DH, UK

EUMETSAT, Queensgate, Huddersfield HD1 3DH, UK
e-mail: neil@slateronline.net

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a project management perspective. Furthermore, Tse and Tan (2011) suggested that product quality risk practices, supplier chain quality management, participation and supplier selection have also been affected through globalisation, whilst Cheri, Whipple, Closs and Voss (2011) explained that supply chain disruptions pose an increased risk and that supply chain design strategies can be implemented to mitigate this risk. In a similar vein, effective risk management requires decision makers to rank and prioritise a portfolio of risk factors involved in the supply chain (Enyinda, Mbah, & Ogbuehi, 2010). Furthermore, numerous authors have explained that global supply chains are growing in both length and complexity, and the business turbulence that they experience is increasing (Blackhurst, Craighead, Elkins, & Handfield, 2005; Pettit, Croxton, & Fiksel, 2013). This is more evident with the current global economic and financial crisis and underscores the importance of well-developed and well-managed risk procedures and structures in all industries of developing countries (Enyinda et al., 2010).

The aim of this research intends to examine whether the social network medium can foster a similar integrated team ethos (Khungar, 2012) for geographically dispersed virtual project teams and how such social network implementations can be optimised in order to support the external parties involved in complex project environments. The focus of the research also offers a conceptual model for communications support systems (including social networks) and discusses the impact on resources to enhance proactive and preventive strategies through the collective experiences of individuals and teams to develop the organisation's capabilities through the facilitation and crafting of the lessons learned during 'live' projects.

16.2 Managing the Project's Supplier Network

Today, companies are aiming to develop their effective inter-project learning practices in order to improve their competitiveness, since these learning practices are intangible knowledge-based assets, through based traditional information sharing. With the increasing adoption of new technologies to enhance the knowledge transfer and information flow, the goal of any project team members is to achieve the project outcome through the application of technical and management capabilities in environments necessitating an integration of their resources and efforts (Jugdev & Mathur, 2013). Through the collective experiences of individuals will develop the organisation's capabilities through the facilitation and knowledge sharing across all stakeholders involved in the project.

Within such project-driven environments, certain attributes are nonphysical such a software development; the challenge is therefore to help facilitate collaborations and knowledge sharing in support of the decision-making process. Project-based organisations have traditionally focused on improving their operations through performance monitoring and measurement, although more attention has been put on financial measures and on measuring. In today's global supply chains, developing products and services has become more of a social activity in where developers have to work together collaborating and sharing resources as well as their knowledge.

Modern communication tools and the Internet services have allowed for and fostered a less localised business environment to a situation where virtual teams (VT) can be formed without concern for geographical locations and time zones (Hastings, 2008).

Through the rapid growth of technology, organisations and individuals have been allowed to use social software in order to productively communicate and collaborate (Bradley, 2010). Social media refers to a constellation of shared technologies that derive their value from the participation of users through directly creating original content, modifying existing material, contributing to a community dialogue and integrating various media together to create something unique (Tapscott & Williams, 2007). Kim (2009) highlighted that there is a need to improve the communication between co-workers, suppliers, stakeholders and customers. The use of social networks could enhance employees' passion and creativity which has an impact upon organisational productivity (Chui et al., 2012). This mass phenomenon has been adopted almost in any processes carried out by companies, such as product development, marketing and customer service; more than 1.54 billion dollars were invested for the social software implementation and support (Bruhn, Schoenmueller, & Schäfer, 2012). However, further research is required on the investigation of risks related to the use of social software in a project management environment; this could include aspects of social knowledge environments and knowledge protection, privacy regulations and development of the technical tools to be able to address the risks (Pawlowski et al., 2014).

16.2.1 Communication Networks in Virtual Teams

Considering that the majority of firms, on the one hand, operate nationally and internationally and on the other hand adopts hierarchical structures (Weinberg, de Ruyter, Dellarocas, Buck, & Keeling, 2013), difficulties have been occurred in sharing information and creating collaborations (Tsai, 2001, 2002). In addition, Gartner (2013) identified that 90 % of collaborative-technology initiatives fail because they adopt an inappropriate practice approach. Therefore, consensus is yet to form on the best way of adapting the online communication platforms by organisations and the changes related to processes, structures and culture that these initiatives might occur. For example, Weinberg et al. (2013) suggested a set of principles that can guide firms to adopt social software to successfully be transformed into social businesses in support of project management initiatives. This fact might enable a more competitive environment to be developed within collaborative project management that often relies on the level of trust within the community. Daim et al. (2012) recommended that dispersed work groups have to deal with a number of issues:

- Cultural differences
- Communication issues
- Weak leadership
- Technical issues
- Building trust

Daim et al. (2012) also observed that electronic communication between remote team members is challengeable due to the differences on members' culture, language and attitude that can lead to misunderstandings and as a result have an impact upon organisational productivity. They also identified that face-to-face communications can therefore overcome some of those issues because members could use their additional communication skills such as the tone of their voice, facial expressions or body language. They continued by explaining that asynchronous collaboration contributes in completing certain tasks more quickly. However, in complex projects, weak leadership has been observed with individuals' roles and goals to be vague. Pawlowski et al. (2014) agreed with the Daim et al. (2012) five issues, regarding the development of collaborative communities, and they added to them the element of knowledge protection and legal dimensions. It is known that organisations are very cautious about sharing their core knowledge (Müller & Stocker, 2011); knowledge protection is difficult to be achieved through using social software (Väyrynen, Hekkala, & Liias, 2013). Finally, they discussed the numerous asynchronous and distributed tools that are available and the criteria on which firms base their decision highlighting the risk of adoption diverse and incompatible tools (Onyechi & Abeysinghe, 2009). In order to combat, this social media usage needs to become an accepted part of the firm's communication structure, and organisations need to create a way of working that balances between openness and closeness. With this balance in place, the organisation can exploit the capabilities created by social media whilst ensuring sufficient protection against information leakage (Ooms, Bell, & Kok, 2015).

16.2.2 Social Media

Literature indicates that social media will aid the innovation by fostering enhanced creativity, expertise and collective intelligence (Mount & Garcia Martinez, 2014). However, Braithwaite and Patterson (2011) stated that social media can be a difficult medium to understand, and it can be difficult to accurately interpret meanings, attitudes and motivations. It will also contribute to open and dynamic innovation by facilitating interaction and knowledge sharing across organisational boundaries (Jalonen, 2014). It is widely acknowledged that social media will help to build the in-house research knowledge base, organisational coordination and social climate that will increase the absorptive capacity of an organisation and aid its innovation efforts (Ooms et al., 2015); however, there is a general reluctance to participate in social media communities due to a fear of potentially losing important knowledge. Organisations that access these communities and exploit the information and consumer experiences discussed there should find it easier and more cost-effective to cocreate value through 'co-innovation' (Bugshan, 2015). However, organisations can also be challenged by the sheer volume of the content on the social media sites. However, there are additional challenges around how to find and manage the online contributors, how to compensate them for their ideas and input and how to involve online contributors in the development process. For example, members of online communities innovate through interaction with other like-minded people, and a small number of community members were found to be very knowledgeable, highly skilled and able to create their own virtual high-quality and innovative products (Fuller, Jawecki, & Muhlbacher, 2007). Bengtsson and Ryzhkova (2013) later identified that social media is particularly useful in the idea generation stage where it can greatly improve both the speed and quality of the ideas. Due to the very nature of the online communities, isolating contributions from particular demographic samples can be problematic generated (Mount & Garcia Martinez, 2014).

16.2.3 Social Networks and Virtual Teams

Although the benefits of social networks and virtual teams are well documented, numerous articles have been dedicated to discuss the new trend of social networks and their impact upon organisations' effectiveness and efficiency and especially upon the productivity of teamwork (Weinberg et al., 2013). The spread of virtual teams within existing organisational structures and project-driven environments has evolved over the last decade. Social media remains an area that has not been investigated to a satisfactory degree but can be a good source of innovation in the new product development process (Bugshan, 2015). The rationale behind this research focus is based on the fact that firms have been shifted from 'a production orientation to a networked structure' (DiMaggio, 2003), which means that collaboration and information/knowledge sharing create the value (Vargo & Lusch, 2004). Culnan, McHugh and Zubillaga (2010) stated that a survey conducted by McKinsey in 2009 showed that about 64 % of 1700 worldwide companies have used social networks for improving the internal communications. In a similar vein, Barnes and Mattson (2009) found that 52 % of the firms, participated to their survey, are considered those networks as effective tools in their business. The opportunity for prescriptive studies and the analysis of internal projects have gained some traction over the past few years. Törlind and Larsson (2002) discussed how a web portal (featuring email, webcams, instant messaging and SMS) promotes online discussion awareness of project progression between colleagues. In terms of a global snapshot of digital statistics (Chaffey, 2016), presented a global digital snapshot 2.3 billion people use social media with 3.4, billion internet of which 1.9 billion people are active mobile social users. With open access to expertise, knowledge and data enable employees from different disciplines within a firm to collaborate and as a result be more productive, satisfying the market demand (Labrecque et al., 2013). The challenge is to integrate this usage in a more commercial sense of communicating of business decisions.

Currently, social networks play a pivotal role in exchanging information between departments and business units (Goh, 2002). Organisational department used to apply their own systems and collect only their own data; being transparent by sharing information through collaborative communities improves organisational productivity and supports innovation (Gulati, 2007). Furthermore, Carmal and Agarwal (2001) anticipated to the growth of virtual teams to allow functionally diverse and/or geographically dispersed individuals to collaborate as teams in order to deliver a project or service, compared to the more traditional concept of having team members in one location. Furthermore, Straub and Welke (1998) indicate that the primary line of defence for security is policy, yet the lack of legal frameworks for much of social media and the empowerment required to yield the benefits create security risks. The rapid growth of virtual teams has resulted in cost savings, optimised participation and consolidation of diverse ideas and competencies across various geographical locations, allowing new ways of working both in executing new projects and conducting day-to-day business. Giuffrida and Dittrich (2015) identified that traditional forms of communication such as email and phone and videoconferencing systems are the foundation to modern-day communication; however, today's communication takes place mainly in distributed teams through the so-called social software (SoSo). SoSo is often referred to as 'social media', 'web 2.0' and 'user-generated content' by practitioners and researchers. The research will test the hypothesis suggestion that tight integration at an interpersonal level between individuals within a team is able to deliver an increased level of performance (Cogliser et al., 2013) and whether the VT can deliver such integration through SoSo. The use of SoSo facilitates the communication process between the members of collaborative communities, makes their contribution more transparent and perhaps increases the level of trust (Simula & Mervi, 2012). For instance, Giuffrida and Dittrich (2015) study identified instant messaging to be the most popular form of SoSo, allowing instantaneous effective and efficient communication, as seen in Fig. 16.1. They reported that various other types of SoSo are

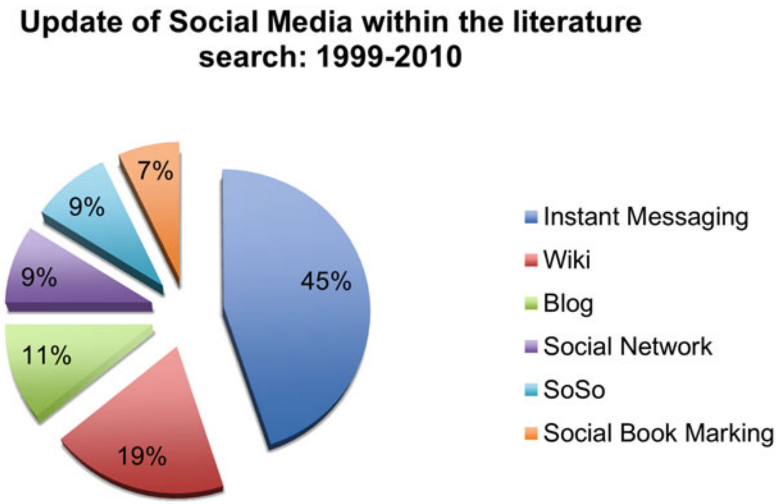

Fig. 16.1 The uptake of social software through the literature (adapted from Giuffrida & Dittrich, 2015)

more recent, owing to their late spread in mainstream usage. Furthermore, culture is not a significant moderator between trust and individual behaviour; it implies that when practitioners develop cross-culture, businesses do not need to consider cultural factors of individuals first. However, the importance of culture in influencing behaviours on such SoSo platforms can be ignored. In addition to this, the level of trust is gradually increasing within the communities through sharing beliefs and values (Dubé, Bourhis, & Real, 2006).

Although the use of SoSo improves the communication between the members of a collaborative community and, as a result, enhances organisations' effectiveness and efficiency, it also benefits individuals. Especially, individuals' characteristics and expertise are easily realised and highlighted which might create personal opportunities for those individuals (Weinberg et al., 2013). Besides, focusing on the workload, processes can easily be refined, redesigned and updated; for example, wikis supports and develops process documents, promoting transparency and connection between them (Weinberg et al., 2013). What is more, the members of a community or project can have a better understanding and visualise the progress by exchanging videos or images. Inherently, a social capital store can be gradually developed (Nambisan & Watt, 2011) which is more useful and powerful than offline word of mouth (Hennig-Thurau et al., 2004). Overall, the use of social networks by organisations creates an open organisational structure promoting transparency and overcoming hierarchies.

The authors believe that the literature on social media platforms provides rich theoretical perspectives to SoSo and contributes insights on how this shared learning can be made more effective within a dispersed project team environment. For example, Harrin (2011) carried out one such study with 181 respondents from 32 countries on how project managers use social media tools in a project environment. A summary of the key findings is presented in Table 16.1. The report concluded that project managers should be taking advantage of the available tools for stakeholder and team communication and collaboration.

The data highlighted that 60 % of Project/Program Support employees do not use blogs or wikis. Only half of change management professionals and 48 % of programme

Table 16.1 Uptake of social media tools (Adapted from Harrin, 2011)

Tool	Business use (%)	Personal use (%)	Don't use (%)	Don't know what this is (%)
Facebook	24	85	13	1
LinkedIn	72	46	6	2
Other social network	20	24	56	6
Twitter	42	47	38	1
Instant messaging	56	56	23	0
Blog	45	39	39	0
Wiki	41	25	46	1
Podcast	21	26	60	3
Video podcast	18	14	71	4

managers use blogs and wikis for business use. However, Project/Program Support employees may find that wikis are great tools for managing project knowledge artefacts, and there appears to be scope for wider use of wikis in this role. The objective of this research is to leverage these insights from the social media platform to make project management environments more effective through improved intra-project and inter-project shared learning as well as to initiate a foundation for empirical research.

16.3 Conceptual Framework for Socially Orientated Growth of Virtual Teams

Generally speaking, the communication activity is considered as one of the most important areas in project management as influencing so many decisions behind the management of resources, scope of supply, innovation, commercial and legal awareness. Project-driven organisations are designing SoSo services according to their customers' and suppliers' expectations and interventions. Therefore, a structured conceptual framework is presented in Fig. 16.2, which addresses both the strategic and operational level of social media and social communication.

The framework presents the practical implications of disruptive technologies, virtual teams, social media and social communications and subsequent key factors derived from a literature review. The findings demonstrate the use of modern communications support systems to facilitate communication channels within VT, and that these technologies also require a far deeper understanding of the positive and negative impacts when project teams move to environment where the traditional team platform is no longer the norm.

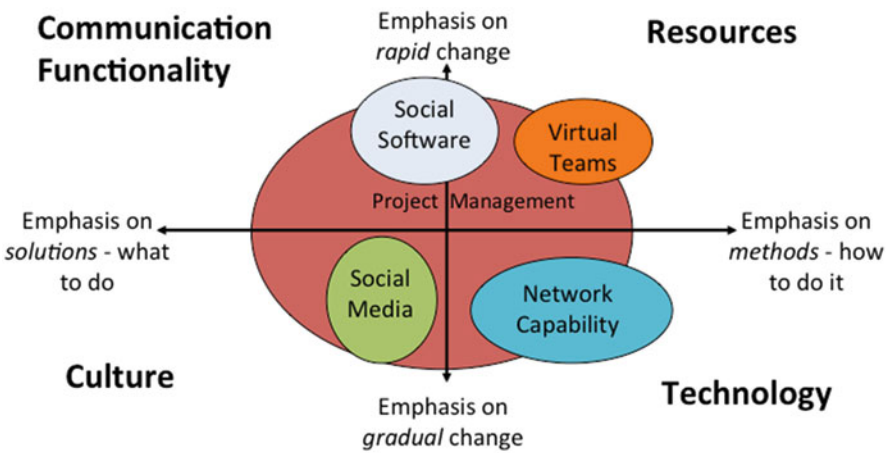

Fig. 16.2 Conceptual model for socially orientated growth of virtual teams

16.3.1 Communication Functionality

Successful collaborative communities are only created by achieving a balance between pure self-interest and altruism (Weinberg et al., 2013). This balance can be reached through an agreement on the communities' vision and the development of trust (Adler et al., 2011). Social software has been defined as web-based platforms that enable users to share information and contribute to collaborative community of participants (Pentina, Zhang, & Basmanova, 2013); a typical classification of these tools includes social networks, blogs and wikis. Deloitte stated that '*social tools that drive collaboration and information sharing across the enterprise and integrate social data into operational processes*' (see Kiron, Palmer, Nguyen Phillips and Berkman, 2013, p. 5). Although asynchronous collaboration applications were introduced as a weapon used by marketers to promote a brand, they are accepted also as a powerful management tool which aim is to facilitate and perhaps improve teamwork and workflow (Weinberg et al., 2013). However, making sense of the mass of relational data ('who knows who') produced by social media sites is becoming increasingly possible for nontechnical audiences.

16.3.2 Culture

Overall, the use of social networks by organisations creates an open organisational structure promoting transparency and overcoming hierarchies. Although the use of social software improves the communication between the members of a collaborative community and, as a result, enhances organisations' effectiveness and efficiency, it also benefits individuals. Especially, individuals' characteristics and expertise are easily realised and highlighted which might create personal opportunities for those individuals (Weinberg et al., 2013). Furthermore, culture is not a significant moderator between trust and individual behaviour; it implies that when practitioners develop cross-culture business, they do not need to consider cultural factors of individuals first. However, the importance of culture in influencing behaviours on such SoSo platforms can be ignored.

16.3.3 Technology

Although several studies indicate that social software can improve team communication and collaboration sharing important information and knowledge (Levy, 2009; Zheng, Li, & Zheng, 2010), the risks associated with the use of those tools need to be aware from the users as the ways of minimising them (von Krogh, 2012; Väyrynen et al., 2013). For example, Kietzmann, Hermkens, McCarthy and Silvestre (2011) presented seven functional building blocks: identity, conversations, sharing, presence, relationships, reputation and groups presented a number of recommendations regarding how firms should develop strategies for monitoring, understanding and responding to different social media activities. However, our knowledge of how to apply network analysis to gain practical insights from social media networks of individuals and organisations is still in its infancy.

16.3.4 Resources

The spread of VT within existing organisational structures and project-driven environments has evolved over the last decade. Carmal and Agarwal (2001) anticipated to the growth of VTs to allow functionally diverse and/or geographically dispersed individuals to collaborate as teams in order to deliver a project or service, compared to the more traditional concept of having team members in one location. In terms of the resource-based view of the firm, Jugdev and Mathur (2013) stated that an intangible knowledge base can serve as a source of competitive advantage because they tend to be unique to the company, but difficult to copy, and are culturally embedded. It is therefore important to examine how project participants share what they learn and to address how this learning might be better enabled. Therefore, SoSo models could be also created for analysing what is happening on a project and influencing the decision-making processes (Giuffrida & Dittrich, 2015). To do so, data collection and data analysis are critical. Without the required information, it is difficult to capture the current situation and go beyond the project's supplier network. As described above, social networks can be used to facilitate key data into information and support the decision makers to enhance VT knowledge in order to optimise the design, planning and control and improvement decisions, which will lead to the increase robustness of the project.

16.4 Discussion

Making sense of the mass of relational data ('who knows who') produced by social media sites is becoming increasingly possible for nontechnical audiences. The literature identifies the adoption of social media and provides possible improvements in relationships through the ability of tools to increase the awareness, transparency and response rate of the individuals involved in VT environment such as a complex hi-tech project. However, trust and risk have been affecting individual behaviour towards the adoption and application of SoSo/social media platforms (Wang, Min, & Han, 2016) which requires further investigation.

According to Wang et al. (2016), virtual communities are easier to adopt rather than social networking sites; therefore, as a bridge connecting vendors and individuals, platform providers need to develop their business strategies on virtual communities or build virtual communities beforehand. The ideal proposition is that a balanced approach to the two aspects of 'disruptive technologies' and 'social communications' provides the required ground for managing disbursed VT in order to develop their capacity to identify valuable knowledge in the environment, its assimilation with existing knowledge and the exploitation phase for successful project management. Designing a VT around the disruptive technologies and social communications results in both product improvements and enhancing team working more effectively. The authors believe that the literature on social media provides rich theoretical perspectives to contribute insights on how this shared learning can be made more effective within a project-based environment.

The result of the initial analysis highlights the relevant issues that such a framework needs to address the design of SoSo in diverse project teams in order to manage the operations and finally improvement communication functionality, allocation of resources, technology and culture. A number of themes were conceptualised through a holistic approach to a future-proofing SoSo awareness model, with a view to developing a structured framework. In particular an approach is proposed for strategy assessment in which the growth strategy is assessed by evaluating possible VT strategies.

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Chapter 17
How Digital Democratized Consulting

Rob Llewellyn

Abstract There are no greater evangelists of the need for companies to transform than management consulting firms. Executives with no experience of leading digital business transformation are anxious to pay for expert advice about how to survive and thrive in the face of digital disruption. The irony is that the business models used by many traditional management consulting firms have not changed in decades, leaving them, just like many of their clients, exposed to becoming victims of digital disruption.

As Clayton M. Christensen, Dina Wang, and Derek van Bever wrote in the Harvard Business Review, "Though the full effects of disruption have yet to hit consulting, our observations suggest that it's just a matter of time." While the consultants that Christensen and his colleagues spoke with warn their clients about the risks of disruption, back then they rejected the notion of disruption in their own management consulting industry. A lot has happened since 2013, but have management consulting firms faced up to the reality of the increasing risk they face, as digital amplifies traditional disruption?

Digital platforms based on a variety of innovative models now provide companies with expertise that has traditionally been found within traditional management consulting firms. Mobile, social, platforms, and other digital solutions have enabled peer-to-peer consulting, where independent consultants engage directly with prospective clients. All this provides executives with more opportunity to choose between spending high on brand-name consultancies and cost-effectively on equivalent independent expertise.

Keywords Management consulting • Digital business disruption

17.1 Introduction

Management consulting is an advisory service contracted for and provided to organizations by specially trained and qualified persons who assist, in an objective and independent manner, the client organization to identify management problems,

R. Llewellyn (✉)
CXO Transform, Apartado de Correos 77, Moraira 03724, Spain
e-mail: rob.llewellyn@cxotransform.com

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analyze such problems, and help, when requested, in the implementation of solutions (Greiner & Metzger, 1983).

Since 1886 when the consulting firm Arthur D. Little was founded in Massachusetts, and later incorporated in 1909, the management consulting industry has seen many others follow in the founder's footsteps, including James O. McKinsey, who in 1926 founded what is now considered by many to be the world's most prestigious management consulting firm (MCF)—McKinsey & Company.

Until not so long ago, management consulting was a solid, predictable industry, dominated by a relatively small group of firms. In 1980, there were only around 18,000 practicing management consultants worldwide (Canback, 1998, p. 4). But the world has changed, and while global players still dominate the industry, some of their leaders pine for a return to "the good old days" when competitors and customers were less sophisticated. Exactly a century after Arthur D. Little was incorporated, the global recession hit the industry. As The Economist (2013) reported, McKinsey & Company, Boston Consulting Group, and Bain & Company grew by 12.4 %, 14.5 %, and 17.3 %, with revenues of US$5.3b, US$3.1b, and US$2.1b, earned from 17,000 employees in 50 countries, 6200 employees in 43 countries, and 5500 employees in 31 countries, respectively, in the year 2011, which was marked by severe economic downturn. But an even greater threat now sits upon the doorsteps of MCFs. That threat is the consequence of digital disruption.

There are no greater evangelists of the need for companies to transform than MCFs themselves. Executives with no experience of leading digital business enterprises are anxious to pay for expert advice about how to survive and thrive in the face of digital disruption. The irony is that the business models used by many traditional MCFs have not been changed in decades, leaving them, just like many of their clients, exposed to becoming victims of digital disruption.

So if incumbent MCFs are to survive and thrive in the digital age, in the way in which they suggest their clients should, they too have no choice but to accept that the nature of their industry is being disrupted. This means that they too need to respond strategically and transform their business models. MCFs should take a good look in the mirror and question the longevity of their own traditional business models, and begin taking their own medicine.

Digitization of products, services, and business processes allows disruptive players to deliver the same value a traditional competitor provides, and even augment it, without having to reproduce the conventional value chain (Wade, Bradley, Loucks, Macaulay, & Noronha, 2015). Recent years have seen digital platforms help change the face of many industries. Combined with better customer value and experience, innovative new business models have disrupted the lucrative world of management consulting. Social media platforms have made it possible for companies to engage directly with independent consultants and cut out the middleman. MCFs are essentially the brokers between the client and the actual consultants, but broker style models are waning as intermediaries are often no longer required for clients and consultants to connect and work together. Increasing use of social media channels and content marketing by independent consultants and small consulting firms is giving companies visibility of a growing pool of consultancy options. The days when glossy brochures and sales representatives were vital to win new business have long gone.

Life is certainly tougher for traditional MCFs, and we have seen a number of mid-sized consultancies become casualties of change. For example, the Monitor Group went out of business after its customers were no longer willing to buy enough of what Monitor was selling. The company was crushed by the most dominant force in today's marketplace—the sophisticated customer and their increasing expectations.

In the October 2013 issue of the Harvard Business Review, Clayton M. Christensen, Dina Wang, and Derek van Bever wrote: "Though the full effects of disruption have yet to hit consulting, our observations suggest that it's just a matter of time" (Christensen, Wang, & van Bever, 2013, p. 4). While the management consultants that Christensen and his colleagues spoke with were warning clients about the risks of disruption back then, they rejected the notion of disruption in their own industry. Since that article, we have seen companies such as McKinsey respond to these risks with offerings such as data engineering and platform architecture that supplement their more traditional MCF model. But are these new offerings enough to fend off the threat of digital disruption in the management consulting industry? Or will the market call for a more radical transformation of their business model?

17.2 A New Environment

The convergence of technological advances, paired with political, environmental, societal, economic, and legislative shifts, has formed the basis of the digital business revolution we find ourselves in today (Wang, 2015). Digital solutions involving technology, data, processes, and people is giving rise to new and innovative value-driven business models, which in turn are refreshing the environments that many industries have become accustomed to operating in. In the way that Amazon has transformed the publishing environment and Uber has transformed the taxi environment, innovative small consulting firms and independent consultants are leveraging the power of digital to transform the management consulting environment. When environments transform, customers become accustomed to better experiences, which then become the expected norm. What might have been a first-class experience 10 years ago can easily become an unacceptable experience in the digital age.

These fresh environments are unsettling to traditional MCFs that have relied on the same models for decades. To survive and thrive in the digital age, they have no choice but to become acclimatized to the new environment evolving around them. Digital has given rise to unprecedented transparency, connectivity, and commoditization, resulting in an increase in client sophistication, borderless competition, and governance. None of this was previously a consideration for MCFs. But the world of management consulting is changing in many ways, and incumbents need to respond appropriately.

17.2.1 Democratized Knowledge

In recent years the democratization of expert knowledge has advanced considerably (Innerarity, 2013). The early Internet set the ball in motion for knowledge to flow from the tightly guarded briefcases of management consultants onto the Internet. While intellectual property (IP) remains valuable to business, it has, to varying degrees, become demonetized and democratized. Now MCFs are more likely to share much of their IP in content marketing campaigns, because the market expects it of them. Small consulting firms and independent consultants now also create their own content and help inform executive audiences who seek out knowledge online. All of this has, to an extent, democratized and demonetized knowledge, with MCFs, independent consultants, and academics all contributing to the vast pool of free information.

17.2.2 Self-Sufficiency

In recent years, the message that every company needs to become a technology company has been popularized. Whether in services, manufacturing, or healthcare, it is becoming increasingly apparent that more companies are joining this trend. With digital technologies finding their way to the hearts of more business models, more organizations are evolving into technology and data companies, and acquiring the talent required to drive this transformation. No industry is more self-sufficient in this way than the tech-sector itself. It has led the revolution of digital self-sufficiency and many others are following suit. While incumbent consulting firms have helped steer the direction of old industries such as oil and gas, they have played little if any role in shaping the giants of the new digital economy, such as Apple, Facebook, and Google. The new stars of business are unconventional thinkers in jeans and T-shirts, not MBAs in pinstriped suits. As more companies become better equipped with their own digital business thinkers, they too will likely become more self-sufficient like the front runners have done. This might well leave the services of management consulting firms far less attractive than they once were.

17.2.3 Digital Entrepreneurialism

For years, the top consulting firms have relied heavily on talent as a key differentiator. Global brands such as McKinsey, Bain, and Deloitte typically swallow up more MBA graduates in a year than companies in any other industry. But the mindsets and aspirations of young talent are changing, as digital has made entrepreneurship far more accessible to almost anyone. It was not so long back when start-ups required offices, machines, and other costly physical assets. Today's start-ups require nothing more than access to the Internet and a laptop. Enterprises and individuals who can seize the opportunities offered by digital advances stand to gain significantly, while those who cannot may lose everything (EY, 2015, p. 4). Across the world, entrepreneurs are increasingly young and/or female. Many of these new enterprises are digital from birth (EY, 2015, p. 16). The thought of becoming the next Mark Zuckerberg is now far more appealing to many young graduates, than that of becoming the next employed consultant in a suit. Large numbers of top MBA graduates also now aspire to join start-ups instead of consulting firms. This change in culture among tomorrow's bright young people is likely to reduce the talent prepared to jump onto the corporate treadmill, work long hours away from home, and endure a below average work-life balance. Highest prevalence rates of entrepreneurship are in the 25–34 and 35–44 age groups. Younger early-stage entrepreneurs (18–24 year olds) were often observed in EU and North America (Amorós & Bosma, 2014, p. 36). Those that do opt for a consulting career are increasingly looking for the exit, and in a survey of 31 influential consulting firms by Top-Consultant.com, over 60 % of consulting firms indicated that retention was becoming increasingly difficult (Top Consultant, 2005).

17.2.4 Modular Offerings

As Christensen, Wang, and van Bever explained in their 2013 Harvard Business School article, "we are seeing the beginnings of a shift in consulting's competitive dynamic from the primacy of integrated solution shops, which are designed to conduct all aspects of the client engagement, to modular providers, which specialize in supplying one specific link in the value chain. The shift is generally triggered when customers realize that they are paying too much for features they don't value and that they want greater speed, responsiveness, and control" (Christensen et al., 2013, p. 6). MCFs traditionally deliver their services through well-established and repeatable patterns and frameworks. While these frameworks help facilitate a consistent delivery approach, and new revenue opportunities, some of these standardized approaches fly in the face of an increasing desire for speed and agility. Companies now need to see outcomes in months as opposed to years. The need for innovative digital business model design, web and mobile solutions, data integration, and digital business transformation management calls for a set of services that no one, including the largest consulting firms, has many years of experience of. This makes it difficult for traditional firms to claim decades of experience over their nearest rivals or even some clients. Small boutique-style consulting firms are increasingly providing modular offerings through the use of data analytics, artificial intelligence, machine learning, etc. This enables them to solve specific business problems for clients. Some consulting incumbents have responded with similar offerings, such as McKinsey, which launched McKinsey Advanced Data and Analytics, McKinsey Digital, and McKinsey Solutions, to complement their more traditional offerings. But there are many consultancies that are still stuck with an analogue mindset, in denial of the disruption they face. Their business models are becoming increasingly antiquated and will eventually hit their bottom lines as customers opt for new and more attractive offerings, or to do it themselves.

17.2.5 Productization

Digital has enabled small consulting firms and even independent consultants to productize their expertise into online courses for customers to buy. Using highly affordable digital tools, any small business can now find a market globally, build a brand among a discreet niche, launch a platform, and be open for business, selling its digital products every hour of the day and every day of the year. As part of an ascending transaction model, these digital products are designed to ignite an initial low-cost commercial relationship between consultants and their ideal customer. After the customer has spent several hours learning from a consultant through Internet video, their relationship with that consultant grows. Psychologically, the consultant becomes familiar and trusted, and while the consultant might not know the customer, by this stage, the customer feels that they know and trust the consultant. The next logical step for the customer is to call the consultant and discuss consultancy services. Every day, similar intimate events are discreetly taking place between thousands of independent consultants and companies. It is a process that is highly cost-effective, personal, and void of traditional consulting firms, which cannot compete on price or customer attention. As an increasing number of independent consultants learn to adopt digital business models themselves, thousands of small pieces of business will be awarded to these consultants, instead of larger consulting firms. While this might not be death by a thousand cuts for larger consulting firms, they will certainly lose market share.

17.2.6 Transparency

Transparency is one of the most powerful trends across all of business and society, not just the management consulting industry. Knowledge has been democratized and the profiles of individual consultants and MCFs are under far greater scrutiny than ever before. Until recently, clients relied on the brand of the MCF to validate that the consultant standing in front of them was qualified. Now clients conduct their own validation of these consultants by turning to LinkedIn, Twitter, Blogs, and Facebook. As Furusten (2013) argued, “the source of professionalism in the management consulting industry may vary. The mechanism for authorization of professionalism and expertise is through trust gained by the consultant and the consulting firm through versatility, availability, relevance, and differentiation in their field.” The image of an MBA consultant with years of experience can be ruined by an irresponsible Facebook post or blog comment that reveals a less-appealing side to the individual. On the other hand, lack of a consultant's social proof can also raise questions about their depth of experience as a consultant. Transparency has also created issues for MCFs when internal communications have been shared with the world by disgruntled employees. This has resulted in the need for increased levels of governance. Since the scandalous days of Enron, WorldCom, and other controversies, governance has played a key role in cleaning up the consulting industry. While governance plays its role, clients are more cautious these days, about how they deal with MCFs. The challenge for MCFs has been to acknowledge this trend and respond in ways that build value and trust, which form the basis for future commercial relationships.

17.2.7 Commoditization

Loyalty is being increasingly replaced by pragmatism and price as management consulting has become more commoditized in recent years. Certain MCF offerings are now seen by some clients as simple commodities. Consulting firms from countries such as India have aggressively led this shift, pursuing markets that have previously been dominated by traditional MCFs. Their low margins and payrolls enable them to wave the tantalizing carrot of cost savings in front of clients that are under pressure to perform with limited budgets. While quality can be an issue and ultimately impact a firm's reputation, this commoditization continues to eat into market share, placing pressure on more established MCFs to reconsider their fees. With digital high on the client agenda, there is an increasing likelihood of traditional strategy consulting firms and IT consulting firms competing for the same business. Digital is becoming an integral part of strategy, so the historic separation of technology and business is diminishing. While larger established MCFs might frown upon low-cost entry points, only time will tell whether their fees will buckle under pressure from this new competitive landscape.

17.2.8 Client Sophistication

Clients are no longer unsophisticated and unaware of their options when it comes to selecting an MCF. While printed brochures were once the only source of information available to executives about consulting firms, social media and content marketing has changed that. Coupled with the drive to reduce costs, this has led to clients assessing the offerings of less well-known firms, and so business is shared across a consulting industry with far more suppliers than there were at the turn of the century. For consulting firms, the downside of increasing client sophistication is that the antiquated practice of "fleecing the client" is becoming more difficult to do. The upside of client sophistication for MCFs is that when inexperienced MBA graduates make their way onto client sites for the first time, they now enjoy a better standard of education during their apprenticeship and become an increasingly valuable asset for their MCF employer to sell to the next client.

17.2.9 Borderless Competition and Connectivity

International borders have become almost irrelevant as markets have become global. A consultant in London can provide professional services to a client in New York, just as effectively as their competitor in Boston can. MCFs face competition from around the world, and not just in their home region. There are also no longer any valid excuses for not being able to deliver to the client. The ease with which communication can now take place is very different to what it used to be. Informal, highly interactive communication channels enable clients to feel they are part of what consulting firms are doing for them, as opposed to simply being on the receiving end.

17.2.10 Democratized Technology

Some MCFs have profited well from software tools that many clients have previously not had access to, either due to their cost or complexity to use. But as Gartner (2012) suggests, "through the democratization of technology, users of all types and status within organizations can now have similar technology available to them." While MCFs would previously bill clients for the lengthy creation of Microsoft Excel models, now tools such as Tableau make it easy for clients to transform data into insight themselves. Even if a client opts to have their MCF perform such a task, tools like Tableau result in the job being done for fewer billable hours.

17.3 Disruptive Models

While digital is a catalyst for the disruption of the management consulting industry and incumbents need to respond, it takes bold leadership to move into unchartered territory, territory that involves digital business models that have not been part of incumbent MCF success stories to date. This bold mindset calls for leaders to step outside their comfort zones and lead their companies on an unconventional journey. A journey MCFs frequently suggest their clients should embark upon.

For decades, the traditional management consulting model involved employing consultants, grooming them suitably, paying them a salary, and selling them at a profit. The aim has been to charge out as many consultants as possible, for as much time as possible, at the best possible fee. While clients get to select and buy a brand, rarely do they get to select the consultants that serve them, so customer experiences and results often depend on the capabilities and personal characteristics of the consultants provided.

Below are some of the models that have been bold enough to taking advantage of the new environments described in the previous section.

17.3.1 Associate-Based Consulting

While associate-based consulting evolved before the digital era, it is worth noting that it leveraged the power of networks before the social media boom and was one of the early disruptors of the management consulting industry. Dozens or even hundreds of associate (not employed) consultants, with equal experience and capabilities as consultants from the largest MCFs, are made available to clients through this model. Consultants are typically under far less pressure, and often better financially rewarded than their employed peers. Clients also get to screen a selection of profiles, interview their shortlist, and select their consultants of choice. This way, clients get to work with individuals they believe are a suitable fit for their environment, as opposed to taking what they are given. This model strips away the overheads and inefficiencies associated with traditional MCFs and allows all three parties to benefit from a more efficient way of working.

17.3.2 Digital Associate-Based Consulting

The previous model is being updated and complemented by digital, making it even more competitive. The firms that have done this are able to offer better value and experience to both clients and associate consultants, while empowering themselves to scale rapidly. They are doing for the management consulting industry what Uber did for the taxi industry. Thanks to their platforms, they are able to scale and provide thousands of consultants to clients all over the world. The next section of this chapter is a case study which explores how two former employed management consultants have used this model and allowed companies to handpick consultants from a pool of thousands and engage them far more flexibly and cost-effectively than ever before.

17.3.3 Productized Expertise

Most companies now want to do as much work as possible without the use of management consulting firms. Although the likes of Gartner, Forester, and IDC have profited from selling information to companies for many years, as digital becomes more accessible, entrepreneurial independent consultants are taking advantage of this. They are creating video courses and other online education and selling it to a global audience via their own platforms. This follows the trend described by Stanford professor Sebastian Thrun the “Godfather of MOOCs” who announced a remarkable change at Udacity, an online portal offering Stanford-level classes. The portal will be providing fewer purely academic offerings and more courses tailored to the specific needs of companies (Roland Berger Strategy Consultants, 2014, pp. 8–9).

This enables consultants to sell their knowledge without their time, and for companies to purchase knowledge without the high costs of a consultant's time in the equation. It also encourages clients to educate their own workforce and give employees more accountability, as opposed to giving it to a consultant. When companies do not have the right capabilities available to put their new-found knowledge into practice, they might still need support from external consultants, and the logical choice is the consultant they have already purchased online education from, who they already feel they know and trust.

17.3.4 Peer-to-Peer Consulting

Travel agents took a big hit when customers could go direct to the airlines and hotels via their own platforms. As more independent consultants take advantage of digital solutions and innovative business models, more companies are engaging with consultants directly and bypassing the overheads of their brokers, employers, and other intermediaries. These enterprising consultants are equipped with impressive backgrounds and capabilities and come without any third-party costs. Using digital to build their personal brands and audiences, they are not only distinguishing themselves from consultants that have failed to embrace digital as a means to building their business, but they are also allowing clients to enjoy more options, flexibility, and affordability of working directly with a consultant. This is peer-to-peer consulting, which provides executives with the opportunity to choose between spending high on brands and cost-effectively on equivalent independent expertise.

17.4 Disruptor Case Study[1]

Expert360 is an online platform connecting client companies with consultants which can provide external capability, capacity, or expertise for project work. Founded in July 2013 by former Bain & Company management consultants Bridget Loudon and Emily Yue, with a team of high-profile investors behind them, Expert360 offers its clients a portfolio of over 7000 carefully selected independent consultants from around the world to choose from. They range from interim CFOs through to junior analysts. The start-up has enjoyed an injection of over AUD 5 million in investment capital, allowing it to work on expanding support for consultants through access to research, data, and other intellectual properties and leverage digital even further to connect clients and independent consultants more efficiently and effectively.

During an interview for this book, Loudon explained that while her time working for a traditional management consulting firm (MCF) enabled her to see some of the

[1] Based on interview with Bridget Loudon (2016)

great work that can be done for clients, she also realized that there were hundreds, if not thousands, of other projects within the client company that did not require a full-professional services team. She acknowledged that there could be a way in which technology could facilitate a connection between great consultants who wanted to work more flexibly and with more choice and clients who only wanted one consultant, a niche expert resource, or simply had a project that was under 200K. This set the wheels in motion to start up Expert360 with Emily Yue.

Loudon referred to Elon Musk's discovery during his SpaceX venture that the raw materials which go into a rocket only account for about 3 % of the costs. Musk believed he should be able to make a much cheaper rocket given those material costs; and Loudon and Yue have taken the same view. The raw materials in the management consulting industry are extremely smart business professionals. Expert360 has rearranged the parts and created a model that increases the reach, access, and choice in the management consulting industry.

While serving as an intermediary between independent consultants and client companies is not a new model, enhancing it using digital to the extent to which Expert360 does is. The company has harnessed digital technologies, to offer both consultants and client companies experience value that the more traditional MCF does not. Loudon said that in March 2016, 40 % of the company's employees were "technical" and focused on how digital can be used more extensively to provide increasing levels of value to both consultants and clients. This includes benefits such as transparency, flexibility, convenience, affordability, and many other advantages that are usually not found in traditional models.

What crowdsourcing platforms like Freelancer, Upwork, and DesignCrowd do for industries such as coding, design, data, and logistics, Expert360 does for management consulting. Expert360's online marketplace allows companies to access independent consultants on a flexible basis without hiring a full-time consulting team. This flexibility is experience value that many traditional MCFs cannot offer, without exploiting digital to reengineer their business models.

The companies mentioned in the previous paragraph all thrive as a result of their platforms, which is a business model enabler that did not exist before the digital era. These platforms are key to engaging consultants and clients and delivering new types of value to customers and raising customer expectations within the management consulting industry.

17.5 Conclusion

Expert360 is just one example of how start-ups are entering the management consulting industry with expertise that can leverage digital to provide customers with value that many incumbents are not yet doing. Until incumbents seize the opportunity to disrupt themselves, the likes of Expert360 and entrepreneurial consultants will not only eat into their market share, but they will disrupt the market by transforming the way in which consultants and companies expect to do business together. This could eventually leave traditional MCFs with business models that, while previously successful, are no longer of interest to the market.

As with disruption in any industry, it is not so much about one company taking another company's business, but more about the expectations of customers being raised, as disruptors help them become accustomed to better ways of working and new types of value.

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Chapter 18
Digital Disruption: Lessons Learned from Virtual Team Management

Shonelle Ramserran and Abubaker Haddud

Abstract The purpose of this paper was to discover how management skills influence online teams in direct comparison to offline teams. A survey was conducted of 120 managers working in varying degrees of online and offline teams. As virtual teams are affected differently by leadership and communication skills together with team dynamics and culture, these attributes were examined at length to understand how best to manage online teams. The paper gives light to the new phenomenon of online teams and their benefits but also the extra attention needed when communicating, as the element of human interaction is missing. The study revealed that leadership and communication are important in online teams. Also, interaction and engagement with online teams require more sensitivity. Finally, team dynamics are more difficult to develop with online teams, and culture plays a major role in managing online teams.

Keywords Virtual teams • Leadership • Communications • Team dynamics • Cultural influences

18.1 Introduction

Communications in the business world have dramatically changed over the past 20 years, merging modes with mediums and moving from a socially intimate to a more socially distant environment. Diving into a digital environment has disrupted the traditional lines of communication between co-workers and business partners, regardless of the goal to build long-lasting relationships or one-time-only transactional relationships. Nonetheless, effective communication remains essential in business with variables such as time constraints, scope changes, budget fluctuations

S. Ramserran
ToysRUs Canada Ltd., 2777 Langstaff Road, Concord, ON, L4K 4M5, Canada
e-mail: sramserran@gmail.com

A. Haddud (✉)
Management School, University of Liverpool, Chatham Street, Liverpool, L69 7ZH, United Kingdom
e-mail: abubaker.haddud@online.liverpool.ac.uk

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and other pressures which test a company's ability to thrive. The Internet has advanced the ways in which stakeholders interact, as they utilize items such as email, cell phones, social media, video conferencing, FaceTime (iPhone application) and virtual webinars (e.g. joinme.com or WebEx) to communicate. "With barriers such as location, distance, and travel removed, online work environments have come across new issues in terms of team dynamics" (Berry, 2011, p. 187). Virtual teams have become the new norm, and managers should aim to bridge the gap in communication to help reconnect the disruption caused by the new digital era. Although there is access to an incredible amount of information when team members are dispersed, there can be difficulties with creating a unified team culture if one team member resides in India, another in Canada and yet another in Australia. Culture, time zones, language, experience, personality and other factors affect the fluidity in communication between stakeholders on a team. "Making sense of another's beliefs or actions is a constant struggle in any team environment and this difficulty can be exacerbated in the virtual environment because of the potential for greater diversity within the team" (Boughzala, de Vreede, & Limayem, 2012, p. 720). Managers are tasked with creating cohesion and becoming the glue that holds all the pieces in place for each and every participant.

As a brief history on the differences between an offline team and an online team, it can be seen how management skills are challenged due to the differences in the modes, the mediums and the characteristics of communication. When speaking about teams, generically, they can be described as a "group of individuals who interact interdependently and are brought together or come together voluntarily to achieve certain goals or tasks" (Berry, 2011, p. 188). This ability to come together and work as a unit is challenged when lines of communication are strained through the digital disruption caused by virtual communication. "In online teams, communication is extremely important because it is almost always constant; several people can simultaneously or asynchronously interact in online spaces because these environments continue to function even if no one is using them" (Boughzala et al., 2012, p. 721). According to Berry (2011), "virtual teams can use computer-mediated communication technologies to work interdependently across space, time, and organizational boundaries" and are only restricted by how/what information is transferred (Berry, 2011, p. 190). Managers must be capable of understanding the skills needed to handle individuals in a team environment, so that they can be productive and accomplish the goals of the organization. They must also understand the differences that will occur once a digital mode or medium is introduced. It is imperative that managers take into consideration "the human/social factors and team climate, as these directly influence the course of the collaboration process and the quality of outcomes" (Boughzala et al., 2012, 722).

The prominent objective of this paper is to clearly identify what specific management skills would greatly optimize the talents of different stakeholders participating in an online environment (Lepsigner & DeRosa, 2010, p. 54). This will include how leadership and communication skills, team dynamics and as well as cultural influences create issues in how information is processed on an individual level, team level and organizational level. In order to find satisfactory research for attaining this objective, some research questions have been established. The questions fall into three major sections mentioned, which are leadership and communication, team dynamics and culture.

Leadership and Communication How would an online manager select and optimize modes of communication? What kind of characteristics would focus managers to ensure correct leadership skills are used? What specific technologies are used to effectively manage and articulate guideline/expectations of team members?

Team Dynamics How is trust built amongst team members in online environments? What management skills can be developed or sustained to build trust so that stakeholders are willing to depend on each other for support?

Culture What are the major cultural differences that will impact the virtual team? What are the advantages and disadvantages of working with online teams? How can challenges with culture be overcome?

18.2 Background

18.2.1 Leadership and Communication

18.2.1.1 Leadership

Leadership can be defined by many qualities in regard to team management, ranging from social skills to technological skills and to information interpretation skills, but have essentially shifted in character due to the digital nuances that have been brought to light. The introduction of the Internet has vastly changed the dynamics, modes and mediums of how leaders interact with their team members. The methods and skills needed to ensure virtual lines of communication are properly maintained must be established from the top down in order to reduce the occurrence of errors. Effective project leadership, which includes the need for proper communication, "has been identified as one of the most important mechanisms for managing team dynamics as well as steering teams through" the Project Management Life Cycle (PMLC) (Sarin & O'Conner, 2009, p. 190). The characteristics or skills needed to become an effective team leader are examined to grasp how online communication (virtual) differs from offline (face-to-face) communication (Sarin & O'Conner, 2009).

There are three tiers or spaces within an organization that can be affected by decisions made by an organization's leaders and can directly affect all persons involved due to the lines of communication and the digital disruption. These tiers being examined are organization, teams and individuals, the focus here being organizational leadership. Communication skills and techniques are crucial for successful team leaders, who are essentially the social architects who must understand the interaction needed between organizational and individual behavioural variables (Sarin & O'Conner, 2009, p. 192). There are three common levels of leadership: individual level, team level and organizational level. At an individual level, there are many traits that can help to classify the needs and wants of individuals when working in a business environment. Past research has shown that due to regulatory orientation, individual's experiences will influence their judgements, decision making, feelings, attitudes, behaviours and task performance (Dimotakis, Davison, & Hollenbeck, 2012). Online versus offline communication—and which will be the most successful for whom—is key information that a manager should seek to understand why these differences will influence how the information is perceived and whether or not the modes or means of communication or lack thereof can be due to digital disruption. At a team level, leadership shifts its focus from a broad overall company view to a more specific project or program team level view. Bruce Tuckman's stages of team development show the level of work done as a team and how it improves over time before there is a dismissal of the team (Rickards & Moger, 2000). Objectives, goals and process are the main focus here. It is all geared towards creating an image for the organization, developing a culture as well as delivering the product or service with the best quality while receiving the most return on their dollar. As defined by Humphrey (2012, p. 274), "leadership is the ability to influence the motivation or competence of other individuals in a group". These skills specifically will relate to how leaders influence the organization's functionality on a top level.

There are two distinct types of leadership: transactional leadership and transformational leadership. Both have very different influences on managers in a team environment. Humphrey (2012) has clearly identified the difference between these in that transactional is a simple exchange (possibly a one-time event) that takes place between the leader and the follower, whereas transformational is an engagement between the two where changes occur on both ends so that purposes and results are developed through a joint relationship (Humphrey, 2012). In organizational leadership, both can be identified, but in terms of working together as a virtual team, transformational leadership role is more flexible, more interdependent and more interactive than the transactional leadership role. The main reason is due to the fact that "transformational leadership motivates and encourages others to perform above the minimum requirements, and often times to perform beyond their own expectations" (Humphrey, 2012, p. 249). To help understand why digital communication causes conflict in how information is transferred between parties, learning exactly what type of leadership is taking place is essential.

Being able to anticipate, challenge, interpret, decide, align or learn how to work in an offline environment are all extremely important management skills at any level within an organization (Schoemaker, Krupp, & Howland, 2013). According to Erne (2012), it is well advised to satisfy professionals' motives of personal growth, operational autonomy, task achievement as well as material and immaterial rewards by institutionalizing reward systems, career paths, challenging employment and adequate resources (Erne, 2012). What is important to note is that although all of these managerial skills are necessary when developing a business strategy, the approach to how these skills function in an offline environment can greatly differ to when utilized in an online environment where digital correspondence can cause a break in the flow of communication. The proper management of professional employees is amongst the most difficult problems facing the business enterprise, and ensuring that adequate information is passed from one professional to another is weighted variable (Erne, 2012). Communication is more than just words on a screen; it envelopes many techniques that are not always evident when working in a digital online environment or through indirect communication.

18.2.1.2 Communication

There are direct communication and indirect communication, which can affect how the user portrays information. Yin and Kuo (2013) have delved into the realm of polite speech use with communication, both indirect and direct. The language that is used plays a big role, and when properly selected, the right information gets to the right people with the right message leading to correct reactions to the initial issue (Yin & Kuo, 2013). Organizations need to understand that language is the basic communication medium for completion of work as well as maintenance of interpersonal relationships (Yin & Kuo, 2013). As the team develops, for example, in an office where social or group learning is promoted, different modes of direct and indirect communications are possible (Singh, Dong & Gero, 2013). This will also lead to the use of all forms of communication that essentially provide opportunities for learning about the skills and knowledge of others, which can positively affect teamwork and team performance (Singh et al., 2013).

In the current workforce alongside the Internet—which has created the ability to communicate across the globe—indirect communication has exploded in popularity. But along with the explosion of indirect communication, there have been an increase in digital disruption and an increase in miscommunication amongst stakeholders. The realization of the need to gather other intellectual property not found within an organization comes with the awareness of how much a company can achieve by outsourcing work. Distributed teams or teams not located in the same vicinity can be constrained through the use of indirect communication as body language, tone and gestures are removed (Singh et al., 2013). In turn, online/distributed teams can reinforce the social interaction and observation opportunities through technological and communication media where all team communications, updates and activities are available to all the team members, facilitating indirect communications (Singh et al., 2013). When speaking about indirect communication, we are immediately referring to any online or non-face-to-face form of communication. This includes email, telecommunications, videoconferencing (Skype, Meetings-to-Go, FaceTime, etc.) and any form of social media (Facebook, Instagram, Twitter, LinkedIn, Pinterest, Google+, etc.). According to Zhang and Venkatesh (2013), they have discovered that individuals who have a large number of network ties or connections would have more interactions with others on the team, thus allowing them more access to different resources (Zhang & Venkatesh, 2013). This is where indirect communication proves to be a useful mode/medium for organizations that plan to work internationally with other global companies to make use of the resources they have become experts in. When an organization can distinguish between online and offline workplace communication networks and the risks of digital disruption, they will begin to understand the independent and interdependent roles of online and offline workplace communication network ties in affecting job performance and ultimately their business performance (Zhang & Venkatesh, 2013). Technology is the way of the future. Statistics show that virtual environments and virtual teams provide multiple advantages for both organizations and individuals (e.g. reduced travel costs, increased autonomy and flexibility of employees) (Krumm, Terwiel & Hertel, 2013, p. 35).

18.2.2 Team Dynamics

Moving from introductions to a functioning group of people with a common goal can sometimes be difficult; therefore, a basic outline should be used to help follow along the process. The following is how a traditional team generally is created and moved through the life cycle of a project. This also holds true for virtual teams, only the modes of communications move to a digital forum. For the purpose of understanding how teams are made, Tuckman's (1965) four stages of team development, alongside Tuckman and Jensen (1977) addition of the last stage, offline team development moves through the following five stages: (1) forming, (2) storming, (3) norming, (4) performing and (5) adjourning (Rickards & Moger, 2000). Tuckman and Jensen (1977) illustrate how, in an ideal situation, each stage represents a higher level of communication and a need for cooperative interaction in order to complete projects/tasks at hand. *Forming* is the initial stage where group members meet and formulate relationships with each other. For the virtual teams, this may mean via Skype, WebEx, email or some other virtual means. *Storming* is where personalities will likely clash and represents how the group conflicts amongst themselves as they resist the formation of a group structure (Bonebright, 2010). This can be exceptionally confusing in a virtual environment since time and space can interfere with when communications such as emails may not be received in time before or after other correspondence. Conflicting personalities or even passive ones may cause a lag in performance within a virtual team. As these behaviours subside, then a norm for the team can be formed, moving the individuals into the next stage of the model, norming (Rickards & Moger, 2000). Norming is the unifying of the different opinions and creating a model for all individuals to follow in order to complete the work assigned. It is where group norms are defined as rules that the group must adopt to regulate and regularize the team members' behaviours (Krumm et al., 2013). When the team members are able to understand the expectations and roles of others on the team, even with the disruptions that may occur in a digital team, they are then able to find a "norm" for their actions. But once this has finally occurred throughout the team, then the work can be performed. Performing is where tasks are carried out as each individual works with other team members, efficiently and effectively, in a work environment to ensure the project/task is completed (Miller et al., 2013, p. 79). Understanding that engaging a team into a series of processes approved actions that are a well-developed reaction to an external situation can be crucial in online situations

(Williams, Parker, & Turner, 2010). The performing stage poses many challenges for online teams, especially in terms of measuring team performance, but upon successful completion of the assigned project/task, the team will then be able to disperse in the adjourning stage. Adjourning is where the members who have been working together for the time it took to complete a project/task part ways. They may or may not ever work with these same people again, but ensuring that amicable relationships have been developed, working together in the future may prove to be an easier process. In virtual teams, individuals may never have met their teammates, but it does not mean that amicable relationships cannot be formed.

Current literature gives many examples on the need for team development in an offline setting, but it has become increasingly popular for those who are managing online teams. "Since virtual teams predominantly use digital media to communicate and coordinate with at least one team member working remotely, managers must develop the skills necessary to properly address all parties" (Krumm et al., 2013, p. 34). It can be particularly difficult to manage an online team in comparison to an offline team due to the fact that there are many more variables preventing clear communication. "Whereas traditional teamwork is characterized by immediate and automatic personal (face-to-face) interactions between team members, communication on a 'virtual team' is often reduced and cue-deprived creating new challenges that hinder the creation of norms for the stakeholders to adapt to" (Krumm et al., 2013, p. 34). This portion of Tuckman's team development model is the beginning of where the struggle to maintain communication in virtual teams begins. According to Krumm et al. (2013, p. 34):

> Virtual-team members may act according to norms activated by other more salient social identities (e.g., family or colleagues from outside the work team), process information based on their own cultural background rather than on their collaborators' cultural backgrounds, and even perceive their colleagues working remotely as outgroup members, thus potentially facilitating distrust and hampering cooperation in virtual teams.

With this understanding of online teams, one of the first steps to administering appropriate management skills is to identify what the team needs in order to succeed. As a team develops, it will need the support and abilities of the manager to successfully make it through the Project Management Life Cycle (PMLC) for any task or assignment. Team development for an online team is similar to that of an offline team, with the biggest difficulties being "effectively using technology, ensuring efficient work flows, monitoring and motivating employees who work remotely, as well as ensuring trust and commitment among team members" (Krumm et al., 2013, p. 34). Tuckman and Jensen (1977) illustrate the process through which understanding the team dynamics, communication methods (whether direct or indirect) and cultural backgrounds will enable managers to hone their leadership skills for each situation. Lastly, cultural influences directly affect all parties and must be taken into consideration when working with an online or virtual team. There needs to be a level of respect between team members, and in an online environment, this is always a challenge. Moving through the different stages of team development, gaining trust in the other team members' ability is imperative. Establishing this as a manager can be difficult, but it is important for this to be established. Trust opens the door for communication and builds the confidence for team members to believe in the integrity of their counterparts, regardless of whether it is in an online or offline environment.

18.2.3 Cultural Influences on Team

Teams today have become extremely diverse in terms of sex, race, age, ability, experience, etc. Virtual environments make this even more difficult to recognize as the initial human interaction has been removed as there is not necessarily an in-person meeting. This eliminates the nonverbal aspect of communication, which inconsequentially eliminates approximately 93 % of communication (Fields, 2015). One of the most pressuring issues when dealing with teams, offline and online alike, is the culture differences. Firstly, to define culture is to say that it is a patterned way of thinking, feeling, or reacting that is acquired and transmitted through symbols within a group of individuals" (Krumm et al., 2013, p. 35). Culture has everything to do with how people relate to others, as well as how they interact with those who do not share the same culture. It can create how individuals perceive people, work and teams on a whole. Now as the popularity of virtual teams grows, this cultural definition must be catered to on a much larger scale. This is due to the "globalization of business processes, where both traditional and virtual work teams have become increasingly more culturally diverse" (Krumm et al., 2013, p. 35). Globalization has become a key element in the interaction of teams who have people who exist across the world, integrating their goods and services with other international companies. According to Nurmi (2011), the most apparent potential context-specific stressors in geographically distributed teams are the feelings of "isolation and role ambiguity, loneliness, power and task coordination problems across distance and culture, amount of electronically-mediated cooperation, and language challenges and misunderstandings" (p. 125). In learning how culture influences a team, a manager is better prepared for the different variables when communicating with individuals. Some of the major cultural variables that have been found in literature that greatly affect lines of virtual communication are language, location/time zones and etiquette and tradition.

It is important that "language problems must be viewed within the context of communication problems, and these within the context of interaction problems, so that management is able to control any areas of risk before they are out of control" (Thomas, 2008, p. 309). Language can be one of the major communication barriers but is something that has been increasingly shrinking through the use of technology to connect people, businesses, countries and continents.

Another struggle found when working with online or virtual teams occurs when there are team members who are not collocated or do not live in the same time zones. Although members of a virtual team can work anywhere, virtual does not end the role of geography and the time zones in which team members can be found (Cummings, 2011, p. 26). The lack of proximity, face-to-face communication and spontaneous interaction drives the team culture into an environment where it complicates communication and collaboration (Nurmi, 2011). It can be easier for "team members within the same or a few time zones to coordinate communication, but the reality of physical separation still reduces awareness of what other members are doing", thus creating communication gaps (Cummings, 2011, p. 26). Managers are better equipped in managing virtual teams if location and time zone issues are identified, analysed and solved, and the productivity of the team in theory will increase.

Etiquette and cultural traditions can create differences amongst team members, whether online or offline. In face-to-face meetings, there is the ability to read gestures or body language, but it is still difficult when etiquette and traditions are dissimilar. When dealing with different individuals with different cultural backgrounds, "knowing cultural practices is as critical as being able to speak the local language" (Yang, 2009, p. 32). Especially with online teams, it is irresponsible to "implement policies and practices that increase the diversity of the workforce, such as outsourcing work to different people in different countries, without understanding how diverse individuals can come together to form effective teams" (Mannix & Neale, 2005, p. 37). Research shows that diversity "can have negative effects on social integration, communication, and create more conflict in groups" than there already is found in the storming stage of the group development stage (Mannix & Neale, 2005, p. 35). This makes managing a culturally diverse team more difficult and also a more sensitive situation where the issue is not to offend others directly or indirectly. There is more difficulty when a virtual medium is used, as in the Chinese culture, for example, for "greeting (business partners vs. family or friends), introducing oneself (with or without a business card), eating (formal vs. informal), gift giving (proper objects to give), and politeness (addressing someone with an appropriate title to show respect)" (Yang, 2009, p. 35). One cannot assume that a formal greeting versus a casual greeting can be the same, especially in cultures where respect is one of the most important characteristics.

18.3 Survey Design and Data Collection

A survey was conducted of 120 managers working in varying degrees of online and offline teams. For this research, the sampling method that was used in order to study the opinions of managers working with virtual teams was nonrandom sampling method as only managers working with virtual teams were eligible to participate in the study and complete the survey (Dale, 2013). The questionnaire has been designed as a multiple choice survey for the participants to easily select an option from a given list. There were 26 multiple choice questions to be answered, of which involve the three influential aspects for the research (leadership and communication, team dynamics and culture) as well as basic demographic questions to help get an idea of who is currently involved in online teams and what their opinions are. The online platform www.surveymonkey.com was used to developed the survey and collect the responses.

18.4 Results and Discussions

18.4.1 Results Introduction

This section aims to present the results of all of the surveys conducted, in order to determine which management skills managers deem most important, when managing online versus offline teams. The focus is on the three major topics that have been trending throughout this dissertation which are leadership and communications, team dynamics and also culture. The questionnaire consisted of a sample size of 120 project managers working with online teams. The demographics of the surveyed participants consisted of 62 % male participants, and 91 % of the total participants were between the ages of 25 and 44. Cultural backgrounds of the participants exposed 73 % were born in North America, 9 % in South America, 8 % in Europe, 6 % in Asia and the remainder in Africa, Australia and Antarctica. The educational levels of the participants surveyed revealed 49 % had completed bachelor degrees, 19 % graduate degrees and 14 % college diplomas, and the remainder held a high school diploma or less. To ensure experience was a factor in the results, the number of years in the industry was examined. Thirty percent of participants had been working in their industry for 10 or more years, 27 % working 7–9 years and 25 % working 4–6 years, and the remaining 18 % had 1–3 years of industry experience. This gives us a vague idea that the majority of the persons surveyed were male between the ages of 25 and 44, born in North America, with bachelor degrees working in their industry for 10 years or more. All results are taken directly from the surveys conveyed using Surveymonkey.com.

18.4.2 Leadership and Communications

The results from the survey concluded that 60 % of project managers surveyed believe both types of leadership styles; transformational and transactional leadership will help to build relationships in an online environment. It can also be derived that 30 % of participants also believe that transactional leadership or human-oriented leadership, where communication is at its highest level, is a better or more efficient way of conducting their teams. The research conducted confirms that communication is one of the most powerful management skills that a manager can possess when working with online teams. Developing honed transactional and transformational skills and understanding in which circumstance each is to be used and with what style of communication will greatly improve the ability to develop a cohesive team culture.

The participants were asked about six management skills needed when working with teams (online and offline) and these include: anticipation of industry, challenging employees, interpretation of communication, decision making, aligning objectives and goals and continuous learning. The survey revealed that 41 % of participants agreed that all of these management skills will somehow need to be altered to be effective in an online environment. However, it is clear that 40 % of the participants are aware that the interpretation of communication must be altered and is a major issue with working with online teams. Thirty-one percent feel that challenging employees is also a management skill that should be carefully handled. Twenty-nine percent recognize aligning objectives and goals to be the next management skill to top the list, followed by decision making at 25 % and continuous learning at 18 %. The last on the list of management skills that need to be adjusted when working with online teams is anticipation of industry at 15 %. When looking at the results once again, it needs to be taken into consideration that 41 % of individuals surveyed are using the Internet 5–10 h a day, with 68 % claiming that this time is spent at work. This means that the majority of project managers surveyed spend most of their time at work using the Internet. Also of those, 23 % surveyed worked in business and financial operations occupations, whereas 18 % in business management occupations and a close 15 % in arts, design, entertainment, sports and media. Working with online teams has become one of the fasted growing segments in the business world today as many people are seeking the benefits of the talents of those in places around the world.

When participants were asked about how often they work with online teams, although the statistics of the people surveyed claimed to work with online teams, 31 % of them stated that they rarely work with others online. 30 % claim to work with online teams sometimes, 25 % the work with online team often and 12 % always work with others online. This is atypical as it was found that 100 % of the people surveyed used email every day for communication, and this is still considered a form of online communication. This is likely an indication of the thought process of the survey participants, and it is important to understand—despite the survey findings—that even the small amount of communication via email is still considered working with others virtually. It is often overlooked by many that email communication is essentially online communication with virtual team members. This tends to be dangerous as they do not adapt their communication skills to fit the needs of individuals in online teams. Email is often used to as an initial form of communication before speaking to participants about projects. It is frequently overlooked that email is still considered virtual form of communication and needs to be used appropriately when working with online teams.

Another major portion of effective leadership is to understand which level the communication is on. Whether it is on an individual level, a team level or an organizational level, the manager should be able to differentiate each and develop their communication skills to suit the audience. Especially as leadership may play a "central role in inspiring and supporting knowledge sharing behaviours, this is consequently a result of human-oriented or transformational leadership which can have a positive effect on both knowledge collecting and donating behaviours" (deVries, Bakker-Pieper, & Oostenveld, 2010, p. 79). When the participants were asked about which organizational space they feel is the most important for leadership when working with online teams, the results showed that 64 % agreed that all three of the organizational levels should be equally important for leadership skills to be displayed. As a secondary tier, it can be seen that 24 % agreed that leadership must be found at a team level. These survey results both indicate that managers understand the need for communication (whether direct or indirect) for groups of people and how it can ultimately affect the team culture.

18.4.3 Team Dynamics

Participants were asked about which stage of developing team dynamics is the most difficult to create when working in a virtual environment, and the results showed that 43 % agreed that the storming stage where the personalities of individuals clash is the most difficult stage for virtual teams. As the second ranked stage, 26 % have stated that the forming stage is as well a complicated stage. The participants have only a 16 % norming vote and a 13 % performing vote, and the remainder 2 % feel like difficulties lie in the adjourning stage. It is apparent that these individuals are most concerned with the storming stage when creating teams in an online environment. Binsiddiq and Alzahmi (2013) explain that understanding group level constructs and dynamic is critical in understanding team level phenomenon (Binsiddiq & Alzahmi, 2013). In addition, when participants were asked if trust was difficult to establish when considering team dynamics in virtual environments, the results revealed that 47 % of participants think that it is occasionally true that trust building in online environments can be difficult and 28 % say that this is always true. Alternatively 20 % of the participants surveyed felt that it is not usually true. It is very apparent that dealing with virtual teams, "the attitude and ability to trust one another in a team is considered one of the most critical elements that help team members bond with each other and work together seamlessly towards their common goals" (Turaga, 2013, p. 17). A survey participant indulges us with their comment stating, "As with any team environment, you just need to be aware. Trust is key and most micro-managers simply don't have that. I feel that if my employee are getting things done on schedule and they are pushing to challenge themselves, then it's obvious that they do well being remote with little supervision. Once that trust level is breached, then I revisit the team dynamics". Trust building in teams is necessary to be able to reach the objectives and the goals of the task or project on hand.

18.4.4 Culture

As we continue to present the results, culture becomes a very important influential factor when working with multicultural online teams. The comparison of virtual and traditional cross-cultural teams might be extended to virtual and traditional monocultural teams, which would enable us to clearly separate requirements due to cultural diversity and/or virtuality, building on facts that arise when working in either environment (Krumm et al., 2013). The virtual communication areas that are most affected can be found within language, location/time zones and etiquette and tradition. When the participants were asked if they feel that language can be seen as a barrier when communicating with online teams, 76 % of participants felt positive that language was generally a barrier in a virtual environment, whereas 24 % feel that it is usually not true. To a degree everyone agrees that there is some language barrier, no one feels that there is never an instance where langue is not an issue. "A virtual team is a network group where team members from different cultures are temporarily gathered together for the period of a mission, and with the guidance of a manager", making the necessary adjustments for language barriers can improve interactions for all team members (Chang, Chuang & Chao, 2011, p. 308). Ensuring language barriers are recognized, the situation assessed and a solution provided, it is something that can be easily dealt with.

When participants were asked about their feelings on how location (spatial) and time zone (temporal) dispersions delay communication in online teams, the results showed that 48 % agree that location and time zone affect communication, 23 % are neutral, 16 % disagree, 11 % strongly agree, and the 2 % remaining strongly disagree. This gives a clear indication that the general populous surveyed feel that location and time zones create new issues with communication in online teams. This is something that is unique to virtual environments, as real-time face-to-face communication requires no waiting for a response due to the immediate nature of the communication style. Society's "fast-paced globalization of commercial activity" has expanded the need for online teams, and "it is not uncommon for organizations, especially those that span across nations, to group people from different locations as virtual teams" (Chang et al., 2011, p. 310). Location and time zones tend to hinder the ability to receive immediate feedback. When a question is asked, there is not always a response readily available; thus, this lag becomes something that can create a bottleneck for tasks or projects.

Furthermore, when participants were asked if etiquette and tradition create ambiguous communication as these cultural identifiers are not always readily identifiable, the answers were 53 % agreed that etiquette and tradition can sometimes cause ambiguous communication, 23 % were neutral, but 13 % strongly agreed with the question. "Leaders and members of virtual teams may be well advised to support common group identities, so that despite a lack of physical contact, the team becomes real", which in turn facilitates the norm formation (Krumm et al., 2013, p. 34). This meaning that although there are different cultural aspects that can be found within a team, embracing and accepting that etiquette and tradition will influence different members differently.

The suggested process is an active way to be aware of the participants in an online team. Managers must be proactive in order to be able to capture the trust and participation of team members. With a lack of constant interaction, language barriers, spatial and temporal factors as well as cultural differences in tradition and etiquette, it is important that managers are more sensitive to the differences in individuals' personalities and how they would react under different circumstances.

18.5 Conclusions and Recommendations

Three major conclusions can be made from the research and findings of this research: Firstly, leadership and communication are important in both online and offline teams, but the interaction and engagement with online teams require more sensitivity due to the loss of physical communication through human interaction. Secondly, team dynamics are more difficult to develop with online teams, requiring managers to play a more active role in ensuring that all team members are equally involved and engaged. The stages of team development are relatively similar but essentially require different leadership and communication skills to develop trust that is needed for team members to become interdependent. Lastly, culture plays a major role in team synergy and raising awareness of individuality, thus understanding that language, time zones, etiquette and tradition are influential elements for the decisions, interpretations and reactions of each team member. Key findings are summarized in Table 18.1.

The differences between offline teams and online teams have been examined through the characteristics of effective communication, leadership within organizations,

Table 18.1 Key findings

Leadership and communications	• Both types of leadership styles: transformational and transactional leadership will help to build relationships in an online environment • Communication is one of the most powerful management skills that a manager can possess when working with online teams • Developing honed transactional and transformational skills and understanding in which circumstance each is to be used and with what style of communication will greatly improve the ability to develop a cohesive team culture • All of the six management skills (anticipation of industry, challenging employees, interpretation of communication, decision making, aligning objectives and goals and continuous learning) will somehow need to be altered to be effective in an online environment • Effective leadership is to understand which level the communication is on, and whether it is on an individual level, a team level or an organizational level, the manager should be able to differentiate each and develop their communication skills to suit the audience
Team dynamics	• The storming stage where the personalities of individuals clash is the most difficult stage for virtual teams • Trust building in online environments can be difficult but is considered one of the most critical elements that help team members bond with each other and work together seamlessly
Culture	• The virtual communication areas that are most affected can be found within language, location/time zones and etiquette and tradition • The language is generally a barrier in a virtual environment • Location and time zones create new issues with communication in online teams, e.g. this tends to hinder the ability to receive immediate feedback • Etiquette and tradition can sometimes cause ambiguous communication, and managers need to be aware of such things

influential management skills, team dynamics and cultural issues. Similarly, the identification of specific management skills and the optimization of talents in a virtual environment have also been acknowledged through this research and review of literature. Ultimately, the various facets related to the effects of management skills with both online and offline teams have been studied in searching for a remedy to find what management skills work for online or offline teams.

There are a handful of recommendations that can be made for managers working with the huge influx of online teams that have been developed over the last 10 years. When working with online teams, a different managerial approach should be taken as traditional management skills can harm the delicate relationships with virtual team members. Managers should first internalize their leadership skills and test different elements of transactional and transformational leadership as different levels of each will be utilized in different situations. By defining and redefining the virtual team, the understanding is, "groups of geographically and/or organizationally dispersed co-workers are being assembled using a combination of telecommunications and information technologies to accomplish an organizational task" or project (Mysirlaki & Paraskeva, 2012, p. 977). Improving leadership skills by directly interacting with members on an individual, team and organizational level will ultimately bring the group of random persons to a comprised functional team. In fine-tuning the interaction with online team members, communication must be adapted for the medium or mode of communication, because "business becomes increasingly distributed and virtual in nature" (Mysirlaki & Paraskeva, 2012, p. 980). Understanding that the human element has been removed, adapting and creating an amicable working environment become extremely important, where communication is encouraged to ensure all members' participation. By maintaining a high level of interaction, open lines of communication as well as positive and timely feedback, team culture can be built to encourage the involvement and development of all participants. If there is an absence of the interdependent relationships amongst team members, tasks, projects and organizational goals will not be made. Focus should be on the proper development of team dynamics, and consciousness of any feeble relationships should be brought to the forefront.

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Chapter 19
Digital Disruptions and the Emergence of Virtual Think Tanks

R. Andreas Kraemer

Abstract This chapter focuses on policy-relevant research organizations or think tanks as important institutions in open, democratic, innovative, and adaptable political systems. Think tanks deal with data, facts, ideas, and narratives as most fleeting commodities and should be highly vulnerable to digital disruption. The evidence shows, however, that think tanks manage to incorporate digital innovations into their operations, both internally and how they related to their various audiences. Digital innovations provide as many opportunities to think tanks as they present threats. This is true for old, pre-digital think tanks that adapted by developing additional layers of management and communication as well as for digitally native think tanks that were created with digital opportunities in mind. Recently, an evidence base documenting good and best practice of using digital opportunities in think tanks has begun to build up, and there are first good case studies on the development of digital strategies. Although there are warnings but no signs yet of widespread digital disruption of think tanks, there are examples of emerging virtual think tanks that might only cost 10 % to establish and operate compared to traditional think tank organizations with similar access to expertise and producing output at similar levels of quality, quantity, breadth, and depth. Although a ratio of 1:10 would indicate disruptive potential, there is no evidence of disruption yet. It appears that the early examples are not sufficiently matured and understood to be replicated, which would involve think tank sponsors accepting the new format of virtual think tanks and provide them with long-term funding.

Keywords Think tanks • Innovation • Social media • Globalization • Governance

R.A. Kraemer (✉)
Institute for Advanced Sustainability Studies (IASS), Berliner Str. 130, 14467 Potsdam, Germany
e-mail: kraemer@ecologic.eu

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19.1 Introduction: Whispers, Tomes, Tweets, and Google

Truth, ideas, arguments, metaphors, narratives, and lies: Think tanks deal in the most intangible of commodities.

Sometimes called "policy institutes" and defying easy definition, think tanks bridge gaps between science, society, and policy, usually with a focus on public interest but some also on the basis of narrow ideologies or with partisan motives. "I know one when I see one," says McGann (1995, 9 ff), following US Supreme Court justice Potter Stewart's definition, with clerk Alan Novak, of pornography in Jacobellis v. Ohio, 1964 (Lattmann, 2007).

The best think tanks have a strong science base and provide excellent scholarship—documenting findings in articles in scientific journals and series of books that form lines of tomes on shelves—as well as an eye on the future and the will to help solve societal problems by working with practitioners (or "stakeholders") in public administration, business, and society organizations to develop good ideas for the improvement of public policy. Some are "clean factories" (Dickson, 1971, p. 3), "honest brokers of policy alternatives" (Pielke, 2007, pp. 17–18), or "laboratories for reform" (Smith, 1991, p. 24), many are "second-hand dealers in ideas" (Stone, 1996, p. 136), and some are modern-day court jesters (Perthes, 2007); the worst are institutionalized demagoguery. At the margins are shadowy areas of overlap with corporate communication and advertising agencies, political spin doctors, and government propaganda.

The variety of think tanks is a function of their proximity to academia, advocacy, business, and education; their political orientation or even affiliation with a political party; their size, disciplinary orientation, policy focus or breadth, or geographic focus or reach; the political and governance system they operate in; and their legal form and governance structure, their regulatory environment, and the origin and structure of their funding or revenue streams.

Their variety creates difficulties in defining think tanks and making general observations about them, especially the inflections or "forced adaptations" and disruptions to think tank "business models" caused by the digital revolution. Most think tanks are not "businesses" but part of government-funded research institutions and nonprofit organizations supported by foundations, donors and sponsors, government (research) grants, or contract research. A small part of think tanks overall is a "business," either as a commercial, as a for-profit enterprise or as a front organization for business interests. In the case of most think tanks, "funding model" is more appropriate than "business model."

Think tanks produce very special packets of information. Ideas may be whispers in the wind but are meant to be heard by those whispered to; they are the most private and directed means of delivery of "truth to power" or ideas seeking to influence an important decision. Ideas need to be shared, not owned, if they are to have consequences. And nothing is easier than sharing on social media platforms.

To be effective, relevant insights must be delivered on time and in context to those who need it in a form they can digest and act upon. At first sight, think tanks should take to the digital age like fish to water, now that there are many more ways to package and deliver information, as long as they master the language of the Internet and the new media (Manfredi, 2014). From tomes to tweets, think tanks are developing outreach and communication strategies to suit all needs from sound analysis building credibility to brevity for impact. The mobile screen in the palm of the user's hand is a direct-to-target dissemination channel; the challenge is to condense research into infographics and deliver visuals to the tablet. That is the perspective of the think tank; but what is the user's?

Every year, the University of Pennsylvania publishes a Global Ranking of Think Tanks by region, policy area, and special achievements. In 2015, Google attained rank 52 among the Top Science and Technology Think Tanks (McGann, 2016, p. 99). Think of it: from the perspective of many clients or information users, the Google search box in their browser window is now performing the function of a think tank. Google enables anyone with access to the web to get information when needed, pre-screened by Google with clever algorithms that are fine-tuned to the user's needs through the analysis of past searches and clicks. Today, Google may know the users better than think tank experts in the past ever knew their counterparts in power. Google obviates the need to commission reports and pay think tanks. It should be noted that Google has an affiliated think tank known as "Google Ideas" before being renamed "Jigsaw." Google Ideas is listed separately among "Best For-Profit Think Tanks" (McGann, 2016, p. 107).

Whispering in the ear of those with power or influence can change the course of policy, but for whispers to be effective, the whisperer must have credibility and access to the deciders, be sufficiently embedded simultaneously in science and policy communities, and understand the issue and economics interests at stake as well as the dynamics of political play. Whispered information may be intangible and fleeting, but it is the product of a long value chain that needs to be maintained and financed.

19.2 Logic Models and Functions of Think Tanks

The art of "speaking truth to power" has come a long way since Diogenes dispensed his wine-imbued wisdom to passersby in ancient Greece. In modern times, think tanks are—or try to be—venerable institutions with a reputation for competence, relevance, influence, and independence.

The core function of think tanks is evidence-based, systematic, one-off problem-solving in partnership with the intended beneficiaries and for the betterment of mankind. They tend to work, develop ideas, and argue on the basis of data and facts, using scientific methods and reason. Their work follows established patterns from problem analysis to the formulation of solutions that ensure success is not a product of chance but follows from a planned and purposeful application of a problem-solving strategy.

There are a number of "logic models" to plan for or explain the impact of a think tank on public discourse, policy debates or policy, and law. The most common form is for think tanks to seek direct access to the policy-making process, by engaging directly with policy-makers or legislators or indirectly with their staff or advisors, to whom the dissemination strategies are directed. This model is close to (public interest) advocacy or lobbying (for particular, usually economic interests), but it relies on the conviction that policy-makers listen to truthful voices of reason.

Another logic model is to seek to change the framing and the narratives in public discourse, for example, through the media, in the expectation that such "education of the public" will lead policy-makers to change. Communication of think tanks following this model will be directed at mass media and the general public or to like-minded supporters that can be reached by direct mailing, on paper or electronically. This model relies on the conviction that policy-makers listen to polls, votes, and opinion leaders as precursors of views in the electorate and don't much care about facts, truth, or reason (other than interests). All think tanks need to measure or otherwise evaluate their impact on public discourse, policy, and law, for operational reasons or for justifying the deployment of resources.

Sources of funding and (perceived) dependencies or conflicts of interest are very important to consider in the context of national political cultures and structures, and the assessment will depend on the logic model of impact pursued by a think tank. Some think tanks define their independence and integrity by having stable core funding or institutional support from government, while in the eyes of others, financial dependence on government breeds political dependence that is detrimental to the integrity of think tanks and their ability to contest policy ideas. In their view, independence is best served by relying on philanthropic foundations or "crowd-sourced" donations from the public, plus perhaps corporate sponsorship. Other regard corporate sponsorship as detrimental to the public interest orientation of a think tank and the independence of its advice.

Within these (very general) logic models, think tanks serve a number of discrete functions. Google and similar businesses may be reducing the space of think tanks at the information interface between science, society, and policy and perhaps even replacing them in some cases. But think tanks provide a number of functions other than just brokering ideas, and not all are affected in the same way. Assessing the digital disruption experienced by think tanks requires a systematic analysis of their functions and modes of interaction with the communities around them.

Experience shows that not all the functions must be fulfilled for a think tank to be effective, but there must be a critical mass in their number of strength. They can be described as:

- General functions that are independent of specific policy domains or governmental systems
- Functions in the (usually domestic) policy-making process
- Functions in international affairs, diplomacy, and international policy coordination

19.2.1 General Functions: Science, Society, and Practice

Sometimes considered a part of the science system, think tanks provide meaning from data (seeking the signals in the noise) and order information for various purposes, and they generate knowledge and understanding. For many individuals and institutions, they are information gatekeepers and provide curating and filtering of information in specialized areas in a way that is similar to that of media organizations. In this way, they educate the public, policy-makers, and practitioners, directly or through media, and help manage the complexity of addressing "wicked problems" and their elusive solutions.

They can provide a pathway from data and evidence via analysis to policy options and political strategies. This includes the identification, articulation, and evaluation of current and emerging issues, problems, and proposals, from the exploration of ideas and floating of "trial policy balloons" to transforming ideas into policy (McGann & Sabatini, 2011, p. 4).

An important function in that context is contestation, the validation and improvement of viable (good) ideas, helping them spread by repetition and replication (with adaptation to different circumstances), as well as the identification and weeding out of bad ideas, by helping to avoid the repetition of mistakes and providing warnings. Contestation is usually evidence-based and designed as a process of policy learning to provide alternative theories, policies, instruments, designs, management rules, etc. It also involves exploring possible futures and pathways toward their realization, often in the form scenarios and other methods of future studies, determining what may be desirable or to be avoided. In doing so, think tanks can provide long-term plans for the evolution or purposeful development of policies and societies.

Within and for the science system, think tanks play a pivotal role in providing connectivity among scientific disciplines (inter- and multidisciplinary methods) and between the sciences and practice (transdisciplinary methods), in ways that other parts of the science system, such as universities or (usually narrowly disciplinary) research institutes, cannot. In this respect, think tanks also serve in recruitment, in the identification, training, and development of talent for work at the interfaces between science, society, policy, and practice (McGann & Sabatini, 2011, p. 4).

19.2.2 Functions in Policy-Making: Policy, Politics, Polity, and Statecraft

The central functions of think tanks are related to improving the efficiency and effectiveness of policy; the making of public policy; the management of the polity as a community, often a nation or linguistic or ethnic community, that shares a past, an identity, and a destiny; and maintaining and improving the institutions, procedures, processes, and underlying norms that ensure good government or statecraft (Ferguson & Mansbach, 1996).

Central for the success or otherwise of policies are the instruments employed and their combinations. These need to be evaluated based on past and current experience and assessed with a view to future impacts, including of new ideas or proposed policies. Connecting the experience of the past with the potential for the future can be done by other types of policy-relevant institutions, but think tanks are comparatively good, because they are not constrained like academic research nor conditioned to think only in election cycles as many other political actors and institutions are.

Part of this think tank service to the policy-making process is the closing of the policy cycle, the linking of policy and law to implementation and practice, the evidence-based evaluation of practice, and the intended and unintended consequences of policies to feed into policy learning and revision (where appropriate). Apart from filtering and processing information and ideas, think tanks also facilitate the engagement of practitioners from local authorities, business, and civil society in the various stages around the policy cycle.

In parallel to, for instance, political parties, associations representing members' economic interests, and civil society organizations promoting public interests, but in different ways, think tanks help structure the polity. With their convening and bridge-building power, they create, shape, and enlarge (public) spaces and constructive forums to facilitate shared understanding of the past and present as well as future options, and they help to develop the metaphors and narratives that help form policies. Part of that process is the identification and isolation of sources and areas of controversy as a stem in building consensus or majority decisions that respect minority interests.

Think tanks help order an otherwise often chaotic political process and compensate for insufficiencies of political parties and bureaucracies. They build networks, with think tanks often serving as network nodes, and thus provide connectivity in various ways:

- Policy community connectivity across policy communities serving policy domains represented by government departments, ministries, and agencies, as well as parliamentary committees
- Connectivity across the ages, by providing a space for living memory and oral history telling and training "from master to apprentice" and maintaining a "reservoir" of ideas and (past and future) political leaders
- Geographic connectivity by linking multiple levels of government, facilitating interregional relations, and maintaining stable channels for cross-cultural and multilingual policy learning and policy coordination

By improving political institutions, rules and procedures for policy-making, implementation, and enforcement and therefore providing the foundations for good government, think tanks are a nongovernmental source of good statecraft.

19.2.3 Functions in Diplomacy and International Policy Coordination

In an economically and politically increasingly interconnected world, think tanks also serve important functions in providing trans-boundary connectivity between domestic and international levels, by bringing ideas from other countries into domestic debates and explaining the background to domestic policy choices to international audiences. Some think tanks engage in the facilitation of (formal) diplomacy, not only in science diplomacy and the establishment and management of international networks for science but also in (informal) diplomacy, including aspects of public diplomacy, track-two diplomacy, parallel negotiations, and back-channel communication (cf. Hocking & Melissen, 2015).

In a similar way, think tanks provide intellectual support and public spaces for international policy discourse around the workings of international or global institutions, from the United Nations to specialized, regional programs. Think tanks are often the only organizations that shadow such institutions and provide expertise, constructive criticism, and ideas for solving policy coordination or management problems. In such cases, they fulfill the role of an international civil society, often by connecting nation-based civil society organization, and thus provide not only contestation as a service to improve international policies but also legitimacy that would otherwise not exist.

19.2.4 Functions of Think Tanks and Their Vulnerability to Disruption

This overview of the functions of think tanks shows how they are different from consultancies, because they do not repeatedly apply standardized methods but rather focus on novel, complex, or wicked problems that defy such methods or for which suitable methods need to be developed. They do this not in an ivory tower but in the midst of those who “own” a problem, need to be part of the solutions, or are the (intended) beneficiaries. And they work in the public interest and often seek to influence public policy, which explains why most of the funding for think tanks does not come from “commercial” revenue, such as fees or service, but from public (research) grants, sponsors (corporate), support from philanthropic foundation, and private donors.

The “business model” or rather “logic model” of many think tanks is to engage simultaneously with communities of experts and policy communities, business, media, and the general public and act as brokers of ideas among them. As is true for intermediaries in many areas, new information and communication technologies are reducing the space and the margins for brokerage to the point that think tanks may need to reinvent themselves.

The substance of the thinking, from the raw material of data; the processing for analysis, discussion, and evaluation; and the development of options, with assessments of likely impact and side effects of choices, to the development of the narratives and explanations that are targeted, timely, relevant, digestible, and actionable: The total value chain of think tanks is fragile and costly to maintain. As brokers of information, their “business models” are uniquely vulnerable to digital disruption.

19.3 Digital Disruptions to and Around Think Tanks

Digital disruptions affect think tanks in their internal operations, where they provide more opportunities than they present threats, especially in the area of dissemination and communication.

Perhaps more important than the digital disruptions within think tanks are changes in the environment around think tanks (Bennett, 2015). The most relevant is economic and political globalization, both as driver and consequence of ICT innovation. Globalization has profound impacts on domestic or national policy-making: There is a trend toward centralization of a growing number of issues in policy-making, promoted by the need to improve coordination across government departments and between domestic and international policy. As a consequence, the role of the heads of state and government is undergoing changes, as more sectorial domestic policies need to be coordinated to address challenges that cut across departmental lines, or among nations in fora, such as the G7 or the G20, where heads of state and government are present, and sectorial ministers relegated to supporting roles.

In view of the scarce time leaders have in such meetings, this process of centralization serves to crowd out “micro-policies” and “low-politics issues,” if only because they are complex, difficult to communicate through media, or evolve too slowly to attract the political attention they would objectively deserve: Some issues are ignored because they are never urgent until it is too late. These trends reduce the number of access points think tanks can use for influence, and it reduces the public space for issues to be processed before global leaders’ meetings.

On the one hand, the increasing interconnectedness and complexity of policies and processes disrupt traditional channels of influence that think tanks use and reduce their operating space. On the other hand, the same trends often overwhelm the national bureaucratic systems that should coordinate across policy domains, nationally and internationally, and that create new opportunities for think tanks. The opportunities can, however, only be exploited by larger think tanks able to cover the range of policy domains involved, covering a much larger thematic and geographic range.

Digital disruption can also be observed in the erosion of polities and the emergence of “social media bubbles” (Nikolov, Oliveira, Flammini, & Menczer, 2015) or “echo chambers” which aggravate trends toward polarization in societies and political systems all the way to one-issue initiatives or political parties with very narrow agendas. A similar process, with less sinister implications, can also be observed in the growing importance of civil society and democratization driven by easier access to information and more channels to express opinions or “voice.” New technologies and the channels and platforms they provide also allow for smaller regional units to express themselves, reach others, build communities, and coordinate political activities. This can lead to the emergence of new, specialized think tanks, sometimes established to support a specific region, community, or agenda, but it can also lead to more information and “noise” in the political system.

This "noise" creates a need, in the minds of many policy practitioners, for effective "information gatekeeping," a role traditionally fulfilled by the dominant media of the time, from newspapers to radio and then television, and now trending toward the media organizations with the strongest brands on the worldwide web and social media. Think tanks now compete with media organizations, and only a few think tanks with global brands can keep up. Examples are Brookings or Carnegie as originally US based but now enjoying increasingly global recognition, followed by think tanks with strong national brands and international reputation, especially those established in important countries, such as the G20. The annual global think tank ranking established by the University of Pennsylvania (McGann, 2015, 2016) serves to keep the score in an international competition that favors the large and well-known think tanks, which may come to absorb more funding from donors seeking impact for their cause and visibility for themselves, denying support for small, geographically or thematically focused think tanks.

Digital disruptions affect the political or societal institutions, conventions, and social habits that provide the framework for think tanks and their communications with various audiences. Such communication can originate from think tanks as institutions in the form of analysis and recommendations formally adopted as institutional positions on an issue or branded as such by the prominence, for instance, of the institutional logo over authors' names. Alternatively, communication can come from think tankers—experts as individual—who may be affiliated with more than one think tank. The disruptions they face are similar to those in other organizations, such as the media, in that there are effectively no more gatekeepers, quality controllers, aggregators, etc., of information and opinion, and many parallel and competing channels.

By corollary, there are also similar opportunities and emerging good and best practice at think tanks in the use of digital media, some on the basis of coincidence and some as a result of new strategic approaches. The development of "digital strategy" for think tanks has been a standard part of discourse among think tank and nonprofit professionals and scholars (see, e.g., Scott, 2011, 2012, 2013; Mendizabal, 2012a, 2012b; Connell, 2015a, 2015b; Connery, 2015; Harris, 2015; McGann, 2015, pp. 33–34). A good up-to-date overall source is the topic page on *On Think Tanks* maintained by Garzón de la Roza and Boyco (n.d.). A selection is illustrated in the following section.

19.4 Responses: Adapting to the Digital Age

The mid-1990s were pivotal for think tanks, when they were forced to respond to the worldwide web taking off and providing new opportunities but also imposing a need to develop internal capacities for taking advantage of those opportunities, often before their financial viability was clear.

The International Crisis Group (ICG), for example, was founded in 1995 with offices in several locations and a mission to address international violent conflict by bringing together the best thinking wherever it was available; its staff and fellows are distributed over five continents, and yet it remains a small think tank by international standards. McGann and Sabatini (2011, p. 122) note that the ICG (and other global think tanks) "simply could not exist without the current communication infrastructure that allows for the real-time transfer of ideas and knowledge. This technology has allowed for increased ease in international collaboration and dissemination of information [...]; without it, they would not be able to fulfill their many agendas or influence the policy-making process as decisively." The digital revolution enabled small think tanks to have global reach instantly and far beyond what was possible before.

Also founded in 1995 was Ecologic Institute, a private initiative or "grass-roots" think tank in Germany, focusing on environmental and sustainable development challenges with a global vocation (Kraemer, 2014). Its global reach developed more slowly than was the case at the ICG but keeps growing through experimentation and innovation using the web and social media channels and platforms. Some examples are explained below. ICG and Ecologic Institute are examples of "digital natives" among think tanks, where the historical and technological context of their foundation inserted digital thinking into their institutional DNA. An example of recent digital native think tanks that used digital technologies and social media from the beginning and is now recognized as a leader in the field is the Center for American Progress (CAP), also known as "Obama's favorite think tank."

Older think tanks, many of which were "universities without students," focused on research resulting in scholarly articles and books, with paper-based dissemination of their ideas. One of the most remarkable strategy developments occurred at the International Institute for Sustainable Development (IISD) in Canada. Established in Winnipeg, Manitoba, with harsh winters and far away from policy-making hubs, it faced challenges in attracting staff and maintaining contact, especially direct personal contact, with policy-makers. It opened offices in Ottawa and Geneva, Switzerland, to ensure presence where it mattered, but more importantly, it developed new work flow routines and staff policies to accommodate dispersed staff not located in Winnipeg or one of the offices.

IISD also developed strategic approaches, including real-time sharing of information with its dispersed staff, and built an infrastructure of email list-serves, many of which were opened and are relied upon today by think tankers, researchers, policy-makers, and their staffers all over the world. IISD also established the Earth Negotiations Bulletin (ENB), a reporting and archival mechanism for international negotiators in the field of environment and development that makes the outcomes of negotiations available within hours. The highly fragmented international sustainable governance regime with a few 100 separate and specialized agreements and institutions could simply not function without the ENB as an enabling infrastructure. IISD is not a digital native think tank but clearly an early adopter that continues to demonstrate good and best practice.

Most other old or pre-digital think tanks have developed digital strategies by now, with the Urban Institute in the USA, the Overseas Development Institute (ODI) in the UK, or the Ethos Laboratorio in the Mexico providing good examples. While these strategies are ambitious and transformative for the think tanks and how they relate to their various audiences, these think tanks retain a significant pre-digital character in much of what they do; they are traditional organizations with digital outreach.

19.5 Experimental Creatures: Virtual Think Tanks

Rather than focusing on the "digital disruption" as a threat, Ecologic Institute experimented to find ways of using new technology to strengthen its impact. It focused on a cluster of think tank functions: the identification, recruitment, and development of young talents and emerging leaders to work at the interfaces among science, society, business, and policy-making. This can be illustrated by two examples:

- The virtual Arctic Summer College and the sustaining network of Arctic think tanks
- Emerging Leaders in Environmental and Energy Policy (ELEEP), a virtual think tank

These two examples build on the EcoScholars network as an earlier successful innovation. EcoScholars is an "in the flesh" but transient community, of about 30–50 visiting fellows and scholars working on environment, climate, energy, resources, or sustainable development that pass through Berlin, Germany, each year. Members are recruited via a "snowball" system, using the web and social medial for visibility and as magnets. The community has to be reestablished every fall, when new cohorts of fellows and scholars arrive, and is then encouraged, through electronic communication to self-organize "real" activities and provide mutual support for members in their scholarship and everyday matters. Started as an experiment, EcoScholars has gone through several iterations, achieved continuity, and is building a multi-cohort community that shares ideas and resources across the years. Increased retention of talent in Berlin and an increase in applications and in the attractiveness of the issue areas covered by EcoScholars have been additional benefits.

19.5.1 The Virtual Arctic Summer College

Every year for the last 5 years, from June to the end of August, about 20 select, mainly young researchers or early career professionals join the virtual Arctic Summer College. The fellows hail from all Arctic nations—they cover the circumpolar space—as well as other, non-Arctic countries with an interest in the area. As a rule, fellows are appointed for 1 year and are invited as observers or sometimes as speakers in later years.

Through the (academic) summer, they participate in eight to ten webinars on various topics relevant to the Arctic, each with presentations by two eminent experts in their Arctic field. The idea is to hold interactive sessions, ideally involving everyone in the group, in discussions that benefit from a variety of backgrounds in different policy fields, scientific disciplines, and national perspectives.

The approach and the technicalities of webinars with moderators, presenters, discussants, and participants from very different time zones required the development and fine-tuning of a range of skills, from giving instructions and assistance to (usually inexperienced) presenters to moderation techniques that create tolerance for time lapses.

In addition to participating in the webinars, at least once as appointed discussants, the fellows research and provide background material, write summaries of discussions and policy briefs, and sometimes agree to coauthor scientific papers. In such cases, the Arctic Summer College may have been an important stimulation and contribution, but that is rarely attributed to it.

In between webinars and throughout the year, the Arctic Summer College maintains presences on the Arctic Summer College web site and Twitter and encourages ongoing exchanges among fellows through (closed) groups on LinkedIn and Facebook.

Initially, the Arctic Summer College was an experiment designed to provide cohesion and continuity of Arctic-related work within Ecologic Institute, which involved staff, visiting scholars, and alumni from Alaska to Finland. Even in its first year, word got out and outsiders wanted to participate. In the second year, the Arctic Summer College was established as a joint initiative with partners and sponsors.

Each year from then on, additional features were added to the Arctic Summer College experience, and more sponsors were attracted. Since 2015, the Arctic Summer College concludes its course with a breakout session at the Arctic Circle Assembly, usually in October in Reykjavik, Iceland.

19.5.2 A Virtual Think Tank: The ELEEP Community

The (closed) Facebook group of the network of Emerging Leaders in Environmental and Energy Policy (ELEEP) is literally off the charts. It produces a much higher frequency and intensity of interaction than any other group of around 100 members. In fact, it has more comments and replies among its members than groups 20 times its size ("likes" do not count in this context).

The ELEEP network is a joint project of the Ecologic Institute US and the Atlantic Council of the USA, launched in fall 2011. It is a dynamic, membership-only forum for the exchange of ideas, policy solutions, best practices, and professional development for early and mid-career North American and European leaders working on environmental and energy issues. ELEEP currently has over 100 members, split about evenly between North America and Europe.

Members debate topics of the day online, meet regularly for study tours and other face-to-face activities, and collaborate on transatlantic impact projects. Although the main activity of ELEEP is invisible to outsiders—it takes place in the closed group on Facebook—the network has growing visibility and attracts sponsors. The ELEEP fellows, supporting one another, form regional and thematic groups; organize meetings, events, visits, and study tours in various places; and raise funds for such ancillary activities on their own initiative, thus leveraging the ELEEP framework and backing.

In 2014, ELEEP fellows succeeded in raising funds to replicate ELEEP with a focus on the Arctic. The result was the Arctic Climate Change Emerging Leaders Fellowship (ACCEL), incubated by ELEEP. This shows the dynamisms in a group that may also be at its maximum size for efficiency, seeking to divide itself like a growing cell, with some differentiation of focus. However, ACCEL fellows did not succeed in raising funds that would allow the network to continue, and the initiative ended in 2016.

With low visibility and an annual budget of less than $500K, ELEEP produces output in very respectable quantity and quality, over a range of issues and on par with think tanks employing staff in similar numbers to the ELEEP membership, and benefits its members through significant career enhancement. The work program is self-directed by members, and there is no central programming except for voluntary bottom-up coordination. That is very different from most established think tanks with central control over program development and fund-raising.

19.6 Conclusions: The Emergence of Virtual Think Tanks

These two cases show that the Internet, the web, social media, and other manifestations of the digital age do not just cause disruptions or threaten think tanks. They show how new media can be used to build and nourish geographically and professionally dispersed expert communities, so that they can share information, analysis, insights, and judgment and achieve new forms and higher levels of cooperation.

Depending on starting points, preexisting management and communication systems, resources, and global relevance and ambition, different strategies for coping with, adapting to, and specializing and thriving in the digital age are open to think tanks. There are no disruptive new logic models of think tanks yet that would endanger the existence of think tanks as such or force a process of “adapt or die” on them.

Theoretically, the ELEEP model of virtual think tanks has the potential to disrupt: It is cheaper to establish and maintain by a factor of between 10 and 20 compared to think tanks of similar size, breadth, and depth, a factor of 10 being more likely for a virtual think tank that is legally independent rather than being incubated by traditional think tanks. However, it is not proven yet that the model can grow beyond the current number of members or be replicated with similar success. Thus far, therefore, the disruptive potential is theoretical only.

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Part VII
Conclusion

Chapter 20
Disruptions: Truth and Consequences

Brian Stewart, Anshuman Khare, and Rod Schatz

Abstract The range of digital disruption is far broader and deeper than any one volume can cover. For example, some of the industries that need further discussions are robotics, artificial intelligence, digital platforms and the role that information management plays in the next wave of business models. The purpose of this book has been to view the impacts of digital technology on a selected group of industries and to provide some guiding frameworks to view potential impacts to allow business leaders to identify and start to deal with the effects of digital disruption.

This last chapter does not provide a single narrative summary of the topics covered in this book. It is more a thematic review of the ideas raised combined with an identification of other aspects of digital disruption not directly treated. These include the risks of digital technologies and the enabling capabilities of big data and advanced analytics and the Internet of things. Our intention is to provide brief vignettes of these areas to inform the reader of additional lines of enquiry.

Keywords Digital disruption • Digital risks • Cybersecurity • Leadership • Intellectual property • Industry 4.0

20.1 Introduction: What the Book Seeks to Unravel

This book has focused on a broad range of topics related to the disruptive forces of digital technology. By way of both a literal and metaphorical book end, this last chapter does not provide a narrative commentary, rather it is a more thematic

B. Stewart (✉)
University of Eastern Finland, 45 Beaverbrook Crescent, St. Albert, AB, Canada T8N 2L4
e-mail: brianstewart3@gmail.com

A. Khare
Athabasca University, 201 - 13220 St. Albert Trail, Edmonton, AB, Canada T5L 4W1
e-mail: anshuman.khare@fb.athabascau.ca

R. Schatz
Alidade Strategies Inc., 12 White Oak Place, St. Albert, AB, Canada T8N 3H4
e-mail: rod.schatz@shaw.ca

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review providing brief vignettes of these areas to inform the reader of additional lines of enquiry.

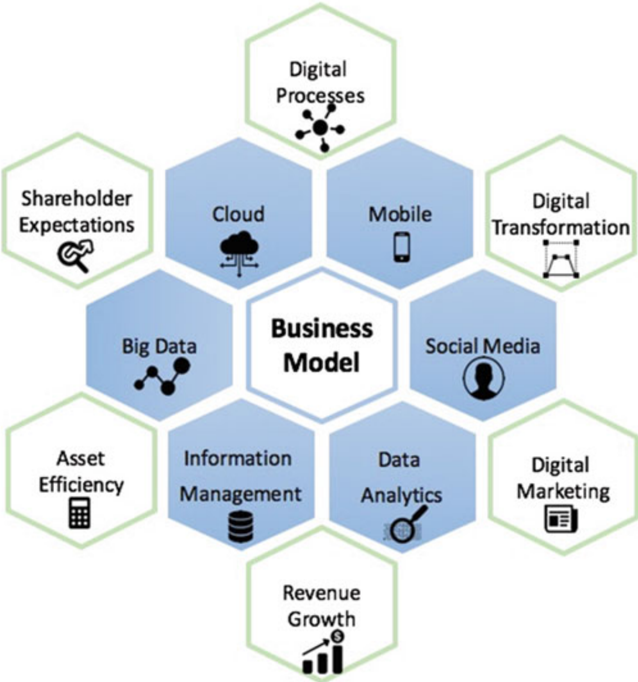
Strategically speaking there are many ways organisations have adopted and are adapting to disruptive change. The digital experience tends to begin with awareness developed on the frontier of an organisation, starting with the adoption of proven social media tools to deepen connection and engagement with the public and customers. This is more than awareness marketing but also a tool for creating and strengthening brand loyalty. Past this stage bigger changes start to surface as organisations begin to broaden their perception of the usefulness of digital technology to grow and reshape their businesses. Digital technology begins to be seen as the enabler and a key success factor in enterprise strategy. We see it interfacing with business processes and extending throughout the enterprise and its supply chain.

The change is as complicated as it is multifaceted, encompassing all operational units in addition to cultural and social norms and requiring a large degree of expertise to introduce, manage and sustain. Communication during such a change process can be seen as crucial for success. Customer relationship, supplier relations (Günther, Kannegiesser, & Autenrieb, 2015), pricing regimens and new business models, driven by digital technology, start taking shape. In short, strategically speaking, the continuum runs from simple to sophisticated and there is no one model to help with strategy formulation and adoption. The basic principle of business remains intact—know your customers, know your suppliers, know your strengths and weaknesses and use technology to serve your stakeholders better.

Then there is the emergence of new technologies that we have just started to see—wearables, 3D printing, robots and virtual assistant bots—all poised to make changes in our lives and in the business environment without precedent. Even the field of education has not remained untouched, as it needs to change to be able to train and educate the future workforce. This very traditional industry is struggling to adopt new technologies in meaningful ways. Yet, there is evidence that there is progress in the investment growth in EdTech and in the expansion of online learning, particularly in the commercial sector. Since the discussions would not be complete without mentioning the social impact and the impact on how we collaborate and partner, it would be worth mentioning that think tanks, consulting and how we collaborate virtually are all seeing changes and newer ways of bringing knowledge and knowledge workers together. Figure 20.1 shows a hierarchy of the key technologies that are disrupting existing business models.

20.2 Digital Issues and Risks

As with all innovations and new technologies, their capabilities also bring with them new risks that if unaddressed severely constrict or potentially limit the development and adoption of the technology. With respect to digital technologies, these range from societal attitudes, accessibility, data and personal identity security and privacy and the ability to effectively use the technologies.



Credit: Icons designed by Freepik from www.flaticon.com

Fig. 20.1 Foundational elements of the business of the future

20.2.1 Human Comprehension and the Ability to Act

The degree and pace of change can be incomprehensible for anyone not at the cusp of disruption. Indeed, it is certain that outside our own areas of interest and professional experience, we are very unaware of the degree of disruption already underway in many fields. Michael Lewis's *Flash Boys* demonstrates that the financial markets have become robotosised through the combination of algorithms, fibre optic networks and smart routers (Lewis, 2004). While a deep understanding of stock exchanges and the financial markets is still required, it is now more to design systems than to practise trading. The puts and calls are now undertaken at speeds beyond human capabilities. The abstraction from the purpose of stock markets to provide liquidity for investment in companies that enabled an entrepreneurial economy is almost complete. The programming wars to squeeze nanoseconds from the trading cycle are completely irrelevant to the capital requirement of companies and have moved to the realm of warp speed poker.

A larger issue on the near-term horizon for businesses is that of ethics as these new technologies start to proliferate through the business ecosystem. Ethical issues will be at the cornerstone of many business model discussions as the pace of technology continues and forces companies to keep pace in a globally competitive market place. Elon Musk, the founder of SpaceX and Tesla Motors, has publicly announced that he is concerned about the role artificial intelligence will play in the future of business and government. As a result, Musk has cofounded the OpenAI initiative to ensure that AI's impact on humanity is largely positive (Muoio, 2015).

20.2.2 *Disenfranchisement Through Accessibility and Competence*

Digitally disruptive forces create and are created by the ability to access and use the technologies. This presents a challenge to all levels and sectors of society. It is in the mutual interests of organisations and their clients and customers to develop new functional capabilities commensurate with the ability to use them. Punie and Brečko (2013) developed a framework to identify digital competencies (Fig. 20.2). These compromised five areas:

- Information: ability to search, locate and evaluate information

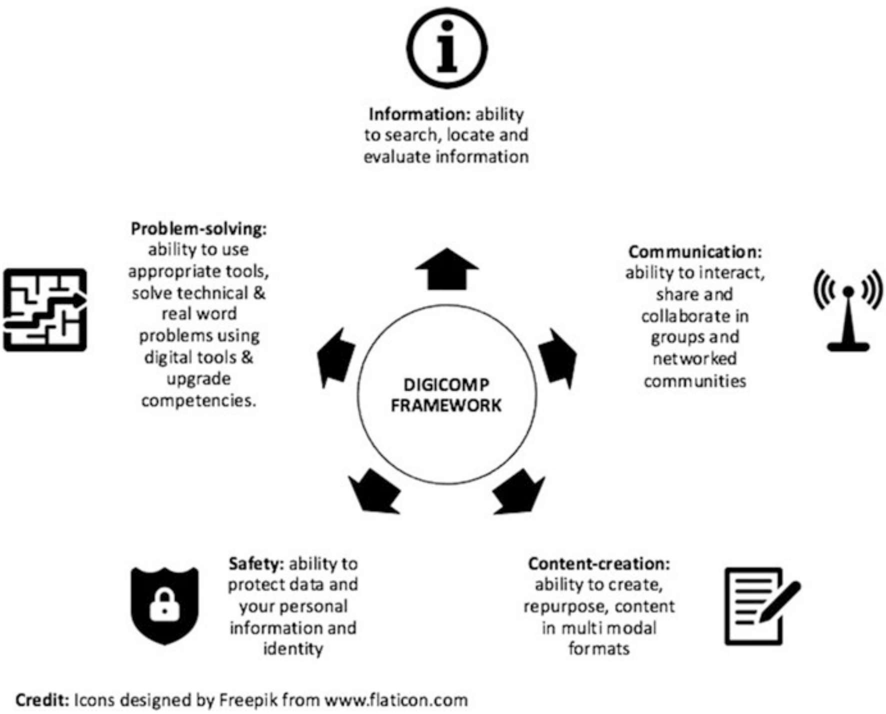


Fig. 20.2 DIGICOMP framework (based on Punie & Brečko, 2013)

- Communication: ability to interact, share and collaborate in groups and networked communities
- Content creation: ability to create, repurpose, content in multimodal formats
- Safety: ability to protect data and your personal information and identity
- Problem-solving: ability to use appropriate tools, solve technical and real world problems using digital tools and upgrade competencies

The competencies from Punie and Brečko (2013) can only be developed with access to both devices and networks, but this is not guaranteed for all sectors of the population (Internet World Stats, 2016). The digital future will need to ensure that the products and services, whether purely digital or enabled through digital, are consumable by their target market group. Segments of the population will need to be provided services in formats that they can consume, particularly by public sector organisations. As this will require a multimodal approach to ensure accessibility, it will increase the cost and put a drag on organisation's ability to fully adopt digital enablement. This will likely lead to additional funding for libraries and other remedial activities to uptrain the digitally disenfranchised to allow movement to singular modes of delivery to reduce cost and to improve service efficiency. In the interim, there will be an opportunity for intermediator services to be provided to assist individuals that have not mastered the requisite skills to partake in the connected economy. This digital as a second language (DSL) population will otherwise be faced with a continuing reduction in opportunities that they can avail of as more products/services move to online provision.

This stratification of the population by digital access and literacy will therefore become an increasingly important marketing classification. Offering DSL segments, products through a relatively complex website will be unsuccessful, and an intermediated service or digital simplification will be needed. The DSL segments are not based simply on either demographic or socioeconomic lines, as there will be pockets within these mass groupings that are digitally competent.

In addition, sector-specific offerings will increasingly target ever smaller segments as digital enables micromarketing to access the underserviced populations that inhabit the long tail (Anderson, 2013).

20.2.3 Socioeconomic Considerations

The digital disruption will progress and overcome the challenges we have outlined here and many more that have yet to surface. If we review previous technology-driven disruptions, we can get a better understanding of the forces that impelled them to success and the adaptions that were made to guide their paths.

The disruptive forces of the first industrial revolution eventually led to the demise of the landed aristocracy and ushered in the societal changes that have led to the growth of democracy in industrialised countries. The distribution of wealth that accompanied mass production created a more egalitarian society while also developing mass markets for ever-developing products and services. This latter point is very telling as the current trend to a more uneven distribution of wealth places a significant drag on the progress of digital disruption. As mentioned the ability of the population to demonstrate effective demand for digital goods will be severely constrained if they have neither the material nor cognitive ability to consume them. The wealth generated by the digital economy will need to be shared to buttress its expansion rather than to undermine it. The current wealth transfers from older technologically based sectors including manufacturing and intermediated services will reduce their earning capabilities and lower the incomes of those working in them. The reduction in their income will not initially be matched by the growth in the income of the digitally savvy sector potentially leading to a gap in the ability to purchase the new products and services. The life cycle of business models of new digital start-ups reflects this with the initial thrust aimed at getting users and then developing a model to monetise their use. Their elongated mean time to profitability further demonstrates the difficulty in moving from an ostensibly required service to a viable business. Twitter, Yelp, Lyft, Instagram, Square, Dropbox, Snapchat and even Amazon have yet to realise highly profitable and sustainable positions. And Google has yet to invent a secondary revenue stream to their Google Ads singularity (Davila, 2016).

We currently lack an economic model for many of the new goods and services and have yet to provide a monetary value for them, although the market has developed methods to attribute a capital valuation to the firms that make these virtual goods and services (Goedhart, Koller, & Wessels, 2016).

For example, the digitisation and sharing of content, most clearly demonstrated in the music industry, has significantly reduced the real and perceived value of content. Wikipedia is a free service for all but those that donate, as are Google, Facebook, YouTube and a host of free subscription content sites. We have yet to develop the model to make these sustainable as they are currently existing on the surplus of preexisting goods. But such a situation cannot continue, and a shakeout will be inevitable as investors' patience wears out and they seek other avenues of opportunity.

This also points to a new phenomenon that is indicitive that we are, and have been in the throes of a digital revolution, witnessed by the creation of entirely new products and services rather than the improvement of existing ones demonstrating invention not just innovation.

We can look for evidence of this digital impact on one of the most dominant and well-researched industries in the twenty-first-century economic system, the automotive industry. It is a good example to take as it can be seen as the apotheosis of the industrial revolution that started in the eighteenth century. The interconnection of enabling technological developments has spawned an interdependent ecosystem of industries that include oil exploration through refining to distribution, the gamut of engineering disciplines, marketing, banking, transportation and goods distribution and delivery, attesting to its pivotal position in western economies. The threats to this industry are neither trivial nor distant, and a PESTLE analysis of the industry would demonstrate significant issues on all dimensions.

The substitution of virtual for physical space, the improvements in public transit systems, the sharing of unused prosumer inventory mobilised by a virtual infrastructure, the development of self-drive vehicles and the growing green consciousness to reduce carbon footprint represent significant deflators of demand for the output of the automotive sector. Automotive companies also face the digitisation of their supply chains and manufacturing processes, albeit they have been using robots for several decades now. In total, automotive companies provide an excellent bellwether of the progress and impacts of digital disruption. Indeed they are already exhibiting that they have identified the necessity for change and have been investing in new technologies and business models to ensure that not only they do not fall behind but that they can be among the front runners to harvest the benefits of digital disruption.

20.2.4 Personal Information

The sharing of information that individuals with a little more mindfulness would likely not wish to reveal, are the more direct and most well-known instances of the compromising of digital personal privacy. Facebook, Twitter, Instagram and Snapchat all afford opportunities to overshare and to place into the public record information about ourselves that can and likely will be used in ways that we neither intend nor control. The use of digital information in making hiring decisions is increasing (Schwanbel, 2012) as human resource search firms create profiles of applicants to attempt to determine best fit candidates. We have a choice to reveal private opinions, events and anecdotes, albeit that we may choose to use this unwisely, but we have control over what we share.

This freedom to choose is not the case with information that we share, and this is not as clearly descriptive of who we are or that we perceive as not having any particular detrimental impact on us. Skatova et al. (2013) broke personal information sources down into high risk; bank statements, geospatial location, medium risk; browsing history and broadband usage, and low risk; loyalty card information and utility bills. But the perceived risk is as personal as the information. For example, a person with few transactions in a bank account may see this as low risk, while the browsing history may represent a high risk to anyone in a repressive regime. It is difficult to put a value on such information either personally or by the companies using it to create actionable knowledge. Perhaps one method would be to have a choice to either pay in cash or in information, by so doing it would be possible to establish the market value of personal information.

Nonetheless it is very unlikely that the value equation will come out in favour of the individual and far more likely that the economic value is and will greatly favour the harvesters. How our information will be used to benefit the harvesters will not always be clear; the transparency of Google Ads or Amazon preferences is not a default position. Companies and organisations will use information to learn things about us collectively and individually, in order to combine it with psychology, neuroscience and decision theory to attempt to influence us to act in a manner advantageous to them—whether this consists of purchasing a product, voting in an election, choosing a school, selecting a medical treatment or simply advocating a position, all resulting in a Kurzweilian singularity of algorithmic programming that both seek and succeed in surreptitiously influencing us without our consent and understanding. And we enable this through the provision of our personal information in a perceived beneficial exchange of gaining functionality for free.

20.2.5 Cybersecurity

Winnefeld, Kirchhoff and Upton (2015) suggest that the benefits of digital technology that have been outlined earlier unfortunately come with associated risks. Many of the attendant risks are becoming more visible through the passage of time. Privacy violations, server compromises, identity theft, phishing attacks and ransomware are fast becoming part of everyday language, indicating both the growth and awareness of threats. The term cybersecurity has become a portfolio label for the compendium of threats that we face when using digital technology.

The growth in cybercrime is a response to the lucrativeness of the form. The global reach of the Internet allows criminal behaviour to be undertaken in a borderless jurisdiction and free virtual space while law enforcement is constrained within jurisdictions. Even if caught, which is extremely difficult, the appropriate jurisdictional law presents an almost equally unfathomable problem.

This growth of cybercrime and cyber breaches represents the largest single threat to the expansion of digital technologies. The ever-growing volume of cybersecurity statistics is indicative of the lucrativeness of exploiting commercial networks and systems for gain. Once undertaken for bragging rights or mischief, the new cyber hacker[1] is a careerist who undertakes to profit from the vulnerabilities of poorly defended systems for maximum payback. Cybercrime has become a global industry worth a reported $113 billion in 2013 (Symantec, 2013). For struggling and impoverished computer programmers with few better options, a career in cybercrime where the probability of prosecution approaches zero offers a very rewarding choice.

In recent times, many major companies and government agencies have been compromised. Best known of these include Sony, Target, Home Depot, Neiman Marcus, JPMorgan Chase, Ashley Madison and Anthem. Over the past 3 years, intrusions into critical US infrastructure—systems that control operations in the chemical, electrical, water and transport sectors—have increased 17-fold (Winnefeld et al., 2015). Figure 20.3 (ISACA, 2013) provides a clearer breakdown of the sources of threat faced by digital systems.

While technological infrastructure is essential, the largest weakness will always be people. A Ponemon Institute (2014) study indicated that enterprise detection of

[1] The more correct term is 'cracker' as hacker is a term that includes all coders; it is used here as it is more used and understood.

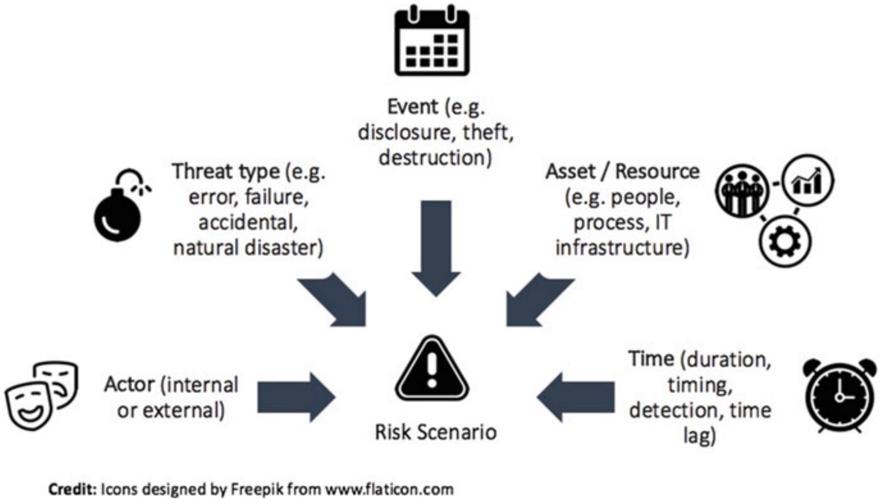


Fig. 20.3 Risk scenarios (adapted from ISACA, 2013)

attacks averaged 170 days when conducted by outsiders compared to 259 days when insiders were involved. As humans we find it very difficult to follow rules to the letter and to remain consistently vigilant when no imminent threat is apparent. In addition, our desire to be social and courteous actively undermines any organisation's security position. In essence our own humanity plays against us. There are numerous stories of simple errors leading to major system intrusions, phishing attacks based on social engineering, the use of infected thumb drives, easy-to-no password protection, identity credentials sharing, loose access management and un- or under-enforced patching regimens. Indeed, given the potential risk, the actions of many organisations appear almost cavalier.

Winnefeld et al. (2015) state that the term highly reliable organisation (HRO) originated to describe organisations that face catastrophic failure if breached. These include nuclear power plants, military bases and air traffic control where single failures are potentially disastrous. Given the reliance on the human element as the key to effective security, any organisation requiring maximum protection must inculcate a security culture in its staff and/or user community that counteracts human error.

The following provides an example of how the US Navy's nuclear propulsion developed an HRO culture using six interconnected principles:

- Integrity: Users follow the appropriate behaviour without exception and are alert to any potential breaches by others.
- Depth of knowledge: Providing users with an understanding of all aspects of the system on an ongoing basis requiring constant training and monitoring.
- Procedural compliance: Users are required to know—or know where to find—proper operational procedures and to follow them as written. This is supported by a system of inspection and observation.

- Forceful backup: Every process is closely monitored, and high-risk procedures are always undertaken by two operators. When a process is being obviated, all users are empowered to stop it.
- A questioning attitude: While difficult to cultivate particularly in a strict hierarchy, it is invaluable to have users follow their instincts, ala a Lean approach, to continuously ensure and improve performance.
- Formality in communication: All communications follow a prescribed manner with instructions repeated verbatim. This leads to an atmosphere of a high degree of formality.

The example is provided to demonstrate the rigour that is required to develop a security-minded culture; however, not all or even a sizeable minority of organisations will be required to undertake the level of thoroughness of an HRO. What is telling is the far higher degree of security mindedness, procedure, process, policy and culture in all digitally enabled organisations.

20.2.6 Role of Senior Leadership

Perhaps the biggest impediment to digital adoption is the ability of organisations to learn, adapt and instil a digital acumen. Senior leadership that have appeared to studiously avoid gaining a fundamental understanding of IT must now embrace it and seek opportunities to learn and gain experience regarding its capabilities. They must also include IT/digital experts in their executive cabinets to be at the top level of decision making. It will simply not be effective to seek clarification and validation for already decided business strategies from the IT boiler room, rather they must be formed with IT/digital central to them. It will prove impossible to develop digital products and services without digital expertise, and they can't be conceived in a vacuum of knowledge.

An issue here is the conflation of IT with digital as these are often seen as one and the same and are entrusted to the same group to provide services to the organisation. While this is not ostensibly a problem, there are major differences with the intentions and objectives of each that may compete for resources and focus. Digital technology encompasses IT, which provides the capabilities that enable it—networks, data centres, firewalls, servers, identity management, wireless, application development, hosting and operating and service desk. However, there is a larger dimension to digital than the common understanding of IT. Digital seeks to permeate business operations, products and services with IT in order to transform it. In essence IT 2.0, an IT capability that has transcended the operating paradigm of system stack management to one that has not only become a partner in the business, but an endemic part of the business itself.

Given the need to build on IT expertise to develop a digital capability, the externalising of IT functions to lower cost may prove a detrimental strategy as critical knowledge is lost to external providers. This is not to state that all IT has to remain on-premise but that any outsourcing needs to be selective and considered with the business model, product and/or service development strategies, market direction and technological innovation. In addition, incubation of potentially useful technologies will need to be encouraged to gain critical fundamental insights that can inform the planning and execution of digitally enabled strategies.

In order to meet the challenges of at a minimum of future proofing their businesses but more positively to advance their organisations, leaders will need to develop a digital savviness. This is no different than the awareness and competence leaders have developed in finance, marketing, manufacturing, administration and stakeholder relations. The popular and much frequented finance for nonfinancial managers' training will need to find a parallel in the digital realm, and it is incumbent on corporate leadership to ensure that their leadership teams avail of any and all opportunities to upgrade their digital acumen. The alternative will culminate in an abdication of authority over this aspect of their business with the accompanying gradual erosion of their firm's market position.

20.3 Opportunities and Enablers

Two of the fundamental enablers of digital technology are big data in combination with advanced analytics and the Internet of things (IoT). These functional categories contain a host of related technological developments that are used as subcomponents of ever increasingly complex systems. In attempting to understand digital disruption, it will be essential to have a sound understanding of these enablers and the directions they are moving in.

20.3.1 Big Data and Advanced Analytics

The use of massive data sets in combination with data science, data analytics, machine learning supported by high-performance computing and high-speed networks is producing predictive algorithms that are proving increasingly effective at yielding actionable insights in a wide range of fields.

In sports, Moneyball is perhaps the most widely known narrative, where data analysis was used to quantify player's skills to successfully build a low-budget baseball team, the Oakland A's (Lewis, 2004). This has led to a general acceptance of analytics in sports and to the development of analytics capabilities across all major sports teams (Steinberg, 2015). Most recently the Arizona Coyotes, a National Hockey League (NHL) team, hired a general manager who is in his 20s solely based on the face that he understands how to build and use data science applications to sports franchises (Dater, 2016).

In the US health-care sector, Kayyali, Knott, and Van Kuiken (2013) from McKinsey report on a number of initiatives:

- "Kaiser Permanente has implemented HealthConnect, to ensure the exchange and use of medical records across all medical facilities. The integrated system has improved outcomes in cardiovascular disease and achieved an estimated \$1 billion in savings from reduced office visits and lab tests.
- Blue Shield of California, in partnership with NantHealth, are seeking to improve performance in prevention and care provision by developing an integrated technology system that will allow doctors, hospitals, and health plans to deliver evidence-based care that is more coordinated and personalized.
- AstraZeneca is undertaking real-world studies to determine the most effective and economical treatments for some chronic illnesses and common diseases having established a four-year partnership with WellPoint's data and analytics subsidiary, HealthCore."

Analytics is also gaining acceptance in academia with the growth of learning analytics:

- In Northampton University the library impact data project (LIDP) successfully tested the hypothesis that "there is a statistically significant correlation across a number of universities between library activity data and student attainment" (Collins, 2012). The project used the student's final grade, course title and variables relating to library usage: books borrowed, library e-resources access and entry to the library and found that students not using e-resources are over seven times more likely to drop out of their degree.
- Roehampton University "developed an 'early warning system' approach to collate key activity data and flag up students who were at risk of failing to progress was trialed in the Department of Psychology. The indicators ranged from poor lecture attendance to receiving a fail grade or a warning for plagiarism. In its first year of operation, the system saw student progression rates improve by 14% amongst first year psychology undergraduates" (King, 2012).

The Netflix Prize represents an unsuccessful example where the winning team developed a large number of machine learning algorithms to improve the prediction of customer recommendation algorithm (Holiday, 2012). Although the team developed an effective design, Netflix chose not to implement citing the gains in accuracy were not sufficient to warrant the computational needs (Masnick, 2012).

Closely related to Netflix is the movie industry. The Economist (2016) delved into the data and discovered that there are apparently some keys to returns at the box office:

> create a child-friendly superhero film with plenty of action and scope for turning it into a franchise. Set your budget at an impressive but not reckless \$85m. Convince a major studio to distribute it on wide release in the summer (when releases earn an average of \$15m more than at other times). Lastly, cast two lead actors with a solid but unspectacular box-office history, who are thus not too expensive. With reasonable reviews from critics and the audience alike, your film would make about \$125m at the American box office. But do it for the money, not the plaudits: such a film would have just a one-in-500 chance of carrying off an Oscar for Best Picture.

Table 20.1 Business strategy and IT/digital strategy essentials (based on Laney, 2013)

Business strategy	IT/digital strategy
Develop dig data acumen across enterprise	Implement data governance
Build business leadership belief in big data	Develop analytic team expertise
Find opportunities to use big data	Create access to infrastructural environment
Start small—look for quick wins	Develop data architecture and standards
Identify information-rich data sources	Establish common analytical tool set
Look to copy where big data is being successful	Establish source of truth and reporting framework

Table 20.1 (Laney, 2013) builds on Gartner's big data strategy essentials for business and provides a list of key activities to implement a big data strategy. The list demonstrates the interconnectedness between the business and IT and the requirement for integrated development of a big data analytics strategy, which is representative of digital strategies in general.

A word of caution on the potential risks of algorithmic determinism. The use of massive data sets to derive algorithms without an initial hypothesis or theory, being only validated by their ability to predict lies at the heart of big data. The statistical approach of validating to a coherent theory is ceding to the effectiveness of prediction as the determinant of significance, which is fine as long as it works.

But what happens when the predictor begins to fail? How do you fix it? And what if it is used to shape career, health, education and other life choices? For example, Google's flu algorithm was widely praised for its ability to predict flu outbreaks better than the capabilities of health service organisations. This has since stalled with it misfiring for several consecutive years (Hodson, 2014). This suggests one possibility to assess the validity of an algorithm is to use a control condition to allow continual assessment of the predictive algorithm. Unfortunately, such may not be the case with an algorithm that is used to select staff or indicate career paths given personal characteristics and behaviour patterns. It may be too late when the flaw is discovered. Our trust in the predictions of big data analytics needs to be tempered with experience and validated by comparative observation, and this will require a solid understanding of the techniques, tools and data used to derive algorithms. Otherwise, we will fall prey to the mistaken beliefs that so enamoured soothsayers to earlier generations.

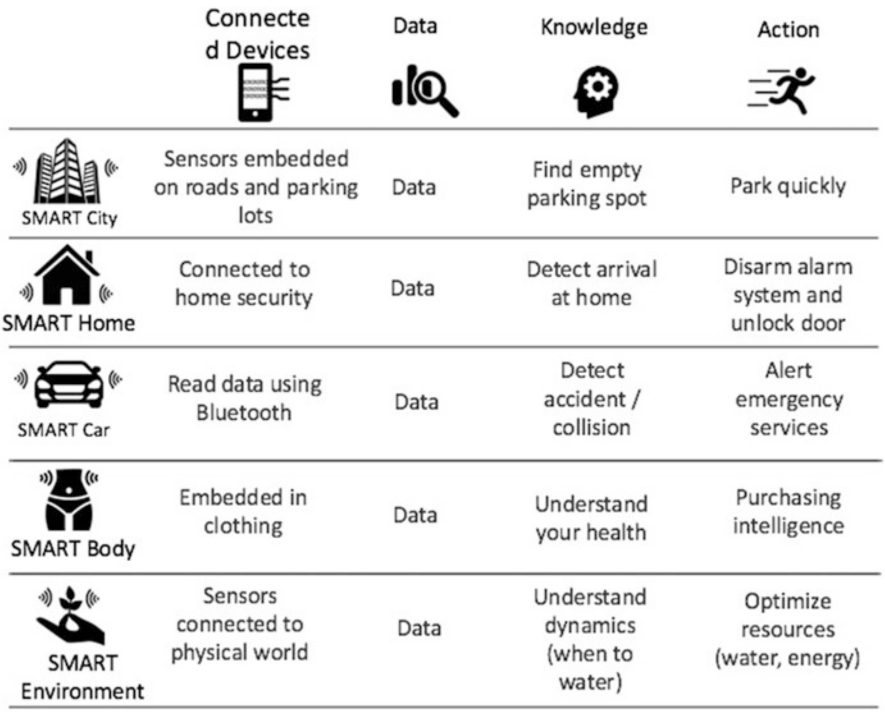
20.3.2 Internet of Things

The Internet of things (IoT) offers enormous opportunities to integrate the physical and the virtual worlds into a synergistic synthesis that uses the advantages of to create a hyper-informed reality that would improve quality of life. If information is power, the infusion of information into everyday objects and experiences will provide a power boost even to the most mundane appliances allowing them to provide richer supports and experiences that enhance and simplify our lives.

The ability to overlay and integrate information into physical experiences offers endless opportunities to reinvent services and products. The technology to support and enable IoT has been developing steadily driven by Moore's and Metcalfe's laws which are reducing cost and increasing capacities in processing power, data storage, device miniaturisation, wireless connectivity, process digitisation and economic accessibility to computing power.

This cheapening of interconnected computing technology allows devices to be connected and to share information, thereby making them smart. Automotive geo-positioning systems use satellite positioning to provide a car with direction-finding capabilities, which are further leveraged into self-drive cars. Building systems are being integrated with databases to develop big data warehouses that facilitate the development of efficiency algorithms. The popularity of Fitbit and similar smart wearable technology evidences the growth in IoT in the health, wellness and fitness sectors. Given the societal ageing demographic, it is reasonable to expect substantial and rapid developments in these areas.

A term cyber-physical systems (CPS) has been coined to reference systems within integrated computational and physical capabilities. These can interact through sensors with humans on a broad range of modalities affording opportunities



Credit: Icons designed by Freepik from www.flaticon.com

Fig. 20.4 The internet of things—from connected devices to action to create intelligent spaces and on an ever-broadening scale from wearables, smart appliances, smart rooms, smart houses and smart cities (Baheti & Gill, 2011). Asay (2014) quotes VisionMobile which projects that the number of IoT developers will grow from roughly 300,000 in 2014 to more than 4.5 million by 2020. Figure 20.4 shows a sample of interconnected scenarios and the potential experiential benefits.

The fourth industrial revolution has introduced us to a world of "sensor technology, interconnectivity and data analysis allow mass customization, integration of value chains and greater efficiency" (European Parliament, 2015, p. 3). Industry 4.0 is a "combination of many elements, including distributed intelligence, network security, massive data, cloud computing, and analytics, among other things" (Singh, Al-Mutawaly, & Wanyama, 2015).

While this development promises higher productivity and growth along with better service to industry and customers, it is not without its challenges. First and foremost, many of the technologies have yet to prove themselves. Industry is still trying to determine the benefits from adopting the Internet of things, dealing with big data and, most important of all, the changes in business model these technologies demand. We are also moving through a period of low economic growth with low financial risk appetites. Finding new investment and bringing major change are not the first priority of organisations, and they tend to stay with status quo or adopt incremental changes. The initial adoption may exist in process rather than product, and the digital disruption will grow more expansively in the area of improving how rather than what is made. This is evidenced by the desire to reduce and automate value chains, apply digital workflows and develop automated decision support systems. In addition, and most notably, process automation is applied to disintermediate through self-serve, whether for financial management, travel and event booking, online shopping, B2B procurement and even customised manufacturing and design. The improvement of process here not only reduces the waste in the system but also allows improved service by passing ownership of knowledge to users to make a more informed choice.

20.4 Conclusion

All through this book, the keyword has been "disruption". It means something that interferes and disturbs a preexisting condition, and by extension it also infers that it is unanticipated. To some extent, it is fair to say that the environment in which present day changes happen is best described by VUCA (volatility, uncertainty, complexity and ambiguity) (Mack & Khare, 2016). Unpredictably situations can change rapidly resulting in the obsolescence of existing models (Mack & Khare, 2016). Unfortunately, there are no new models either that can replace the existing models. As such the way to address the situation is also not anticipated or given, we are in a new era where the rules are being written while the game is in play. We therefore have little choice but to return to "first principles" to determine our approach and to not abandon our current business logic, but to use it mindfully, always aware that it may be imperfect and must undergo challenges to be reset, refreshed and reshaped to address an environment for which it was never designed and one where only expost review will allow success to be conferred. Disruptions emphasise the need for agility. Success will be defined by how fast one can recover from disruptions, indeed business sustainability will depend on it.

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