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Revolution of Innovation Management: The Digital Breakthrough

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1.1 Motivation

Why another book on innovation, and why use the big word "revolution"? The simple answer to this question is the fact that we believe the time is right to explore what could be the next phase of innovation management not only in corporate practice, but also in the academic field.

On the company level, we see that the management of innovation is changing drastically. This insight is not new, but it is getting even more important for companies. In Europe, there is a growing emphasis on nurturing the adoption of innovations in addition to developing creative products and services. In Asia, China is now facing the challenge of

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sustaining its economic growth with a model based not only on industrial knowledge and experience but also on innovation skills and expertise, to move quickly toward digital economy. Some Chinese companies like Huawei, Lenovo, Baidu, or Alibaba are already excelling in this field. In the USA, there is a renewed interest in how big companies can innovate while there are hot discussions regarding the impact of innovative technologies such as big data, cloud computing, and 3D printing. Meanwhile, new theoretical concepts are trying to grasp the reality of agile innovation, business model (dis)continuous innovation, and crowd engagement, among others. And finally the phenomenon of worldwide movements of people—voluntarily and involuntarily—brings new challenges and opportunities for industry.

On the academic research level, we note that beyond the fact that the academic landscape in innovation management is getting even more decomposed and fragmented, there are several areas where trends are still on the rise. In our earlier book, we also present key areas for innovation management trends in an international context, see Brem and Viardot (2013). Such trends are currently visible in books and specialized research journals, but will find their way into special issues and topic areas in high-ranked outlets. This can be observed, for instance, with the topic of open innovation. In recent years, additional topics like business model innovation and crowdsourcing have followed the open innovation movement. Also interesting is the fact that numerous subtopics followed once the main research area was established, such as innovation ecosystems in the business model or crowdfunding in the concept of crowdsourcing. However, many of these areas are (still) not interlinked, as researchers tend to publish only in certain journals and attend specific, conferences.

1.2 The Digital Innovation Breakthrough

The business world is currently engulfed in a massive digital tornado that is revolutionizing how companies are doing business. The so-called digital revolution is characterized by a restless digitization of businesses and the escalation of e-commerce, as the new generation of Internet users is getting even more mobile, interacting, and transacting. The digital whirlwind has already shaken industries such as travel, music, retail, banking,

and media. But other traditional industries are also threatened such as the overprotected business of taxi companies, as well as energy, health care, and even agriculture and insurances. In this context, Bradley et al. (2016) have investigated the potential impact of digital disruption for 12 industries and 13 countries and have concluded that digital disruption will displace approximately 40 % of incumbent companies before 2020. This said, there will no longer be any industry that can sit back and wait. Each company needs to analyze what the impact of digitalization on their way of doing business is and might be. For such considerations, we recommend as starting point the *digital maelstrom* concept, which will be explained in the following.

The digital maelstrom is dislocating the value propositions of many existing companies and as a result it is altering their market. The six driving forces of the digital revolution are digital technology, mobile communication, social networks, instant (real-time) data, virtual platform (cloud), and startups/venture capitals (VCs):

1. Digital technology is the engine of the digital maelstrom as there seems to be no limit to the size and speed of data that can be created, stored, and communicated. When it comes to creating data, the relentless increasing performance of integrated circuits has allowed them to double in performance every 18 months while the price has been halved every 2 years, more or less, since the 1960s. This performance—often dubbed as Moore's law as it was first observed by one of the founders of Intel, Gordon Moore—is mirrored with a similar evolution in data storage. Indeed, according to Kryder's law, the disk storage density has been growing faster than the chip density (Walter 2005) while costs have been declining steeply: The average cost of a gigabyte has gone from $10 million in 1956 to $0.09 million in 2010 (Frictionless Data 2016). The network capacity to communicate has also expanded dramatically as the amount of data transmitted by fiber-optic medium has been doubling every 9 months since the 1980s while the costs have been rapidly decreasing (Richardson 2016).
2. This network capacity has contributed to the explosion of mobile communications as in 2016 more than 4, 7 billion people are using a cellular phone GSMA, 2016 not only to make calls, but for a wide variety of applications including messaging, taking pictures, gaming, shopping,

making payments, and doing business. In 2011, smartphone shipments surpassed personal computers for the first time (Albanesius 2011). In many countries, smartphones are overtaking laptops as the most popular device for getting online, not only in emerging countries which lack a sophisticated telecommunication infrastructure, but also in more developed countries such as Brazil or the UK (Ofcom 2015).

3. Social media is a relatively new phenomenon in the digital world but it has grown exponentially with more than 1.59 billion monthly active users on Facebook, 1 billion users on WhatsApp and 853 million users on the Chinese QQ, some of the largest social media in the world in 2016 (Statistica 2016). Social media allows those billions of users to interchange ideas, experiences, pictures, information, and so on via their favorite Internet device instantly.
4. These instant, real-time data available on the Internet represent an incredible amount of information, sometimes referred to as "big data". At the end of 2015, the total data traffic over the Internet was close to one zettabyte, that is, one billion gigabytes (Cisco, 2016), while about 90 % of the world's data was generated in the last 2 years alone (IBM, 2016). Also, the Internet is moving toward what Cisco describes as the Internet of Everything (IoE) with the networked connection of people, processes, data, and things. These connections should surge from 15 billion in 2015 to 50 billion by 2020 and they will redefine the dynamics of entire industries as small firms can now compete more easily with large global companies.
5. Cloud computing also contributes to an acceleration of the digital maelstrom as it is accelerating the virtualization of the world thanks to the Internet. Cloud computing provides shared processing resources and data to computers and other devices on demand. It was originally developed for companies to minimize the amount of hardware they had to acquire to compute and store data. But in recent years, cloud computing has become also very important for individual users as they do not need physical data storage anymore. They just use cloud servers. While the technology has been available since the 1980s, cloud services have been expanding radically only quite recently with the launch of the Elastic Compute Cloud by Amazon in 2006, the release of Azure by Microsoft in 2010, and the introduction of Google Cloud by Google. Other vendors have

then joined the fray, including Oracle, IBM, and SAP for instance. In 2016, cloud adoption has been shown to be growing significantly with a market growth of 16.5 % in 2015 and a considerable increase of revenues for all cloud vendors (Colombus 2016).

6. Finally, the digital maelstrom is also nurtured by an army of innovative startups financed by numerous and wealthy VC funds. While it is impossible to identify all the digital startups in the world, it is worth noting that there has been a recent increase in the number of "unicorns", the private companies valued at $1 billion or more like Xiaomi, Palantir, and Flipkart (Fortune, 2016). In 2016, 14 unicorns are valuated over $10 billion (CB insight, 2016).

Originally "Unicorns" got their name (Lee 2013) because they were rare. But they are getting increasingly numerous. There are currently more than 100 unicorns in the world with a recent surge as 64 companies joined this exclusive club in 2015. They are nurtured by VC funds that hope to repeat the story of Alibaba, the Chinese e-commerce portal that raised around $25 billion in capital with the largest IPO in history so far. But the success rate of software companies is still the same over the years; according to Erdogan et al. (2016) from the consulting firm McKinsey, a software company has less than a 3 % chance of surviving and becoming a $1 billion company (and less than a 1 % chance of becoming a more than $4 billion company). Thus the increasing number of unicorns just reflects the increasing number of new digital companies which are now entering the field (Fig. 1.1).

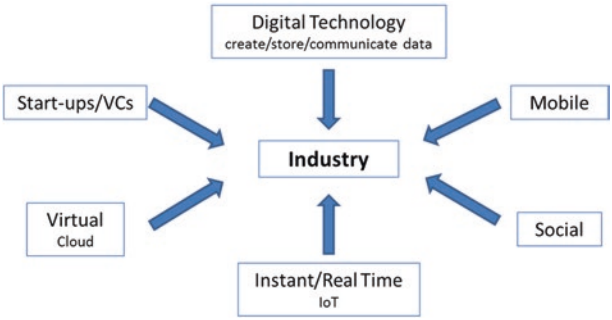

Fig. 1.1. The 6 forces of the digital revolution

Two features are making the digital revolution different from the usual dynamics of business innovation: the speed and the scope of change (Bradley et al. 2016). They make for unpredictability and excessive turbulence in business sectors.

Let us consider the speed of change first. Business has been going digital for years. It all started with the introduction and the development of the computer in business-to-business applications in the 1960s and 1970s. The power of the computer changed the way companies were manufacturing, controlling operations, selling, and communicating with their large customers, and even tracking their cost and financial information. The personal computer enlarged the scope of digitalization by including end users and customers. In the 1980s, digitalization moved to consumers with the development of new software and smaller hardware contributing to the increasing use of PCs and digital services.

At the end of the 1990s, the digital tornado started to grow in size with the Internet. In the middle and toward the end of the following decade emerged smartphones and social media, which have been instrumental in the digital revolution.

The digital tornado keeps growing rapidly: the number of Internet users—via computer or mobile devices—reached one billion in 2005, two billion in 2010, three billion in 2014, and more than 3.2 billion in November 2015 (internetlivestats, 2015).

Digitalization of the economy has seen the emergence of a new category of competitors: the "digital disruptors". We call them the "Digi-raptors". They leverage digital innovation to dislodge their challengers mostly in the physical world while reshaping markets. They are Amazon, Apple, Google, Facebook Salesforce and TransferWise, among others. In addition, many other lesser-known digital companies, including the "unicorns" as well as a score of other well-funded startups, have also disrupted traditional businesses.

These Digi-raptors compete at high speed as illustrated in Fig. 1.2, which shows how much time is needed to reach 100 million users worldwide by some of the most successful digital innovators. The time span is getting increasingly shorter as some companies need only 1 year to reach the 100 million user threshold. It took the World Wide Web 7 years to reach the same number of users, the mobile phone 16 years, and the telephone 75 years (Dreischmeier et al. 2016).

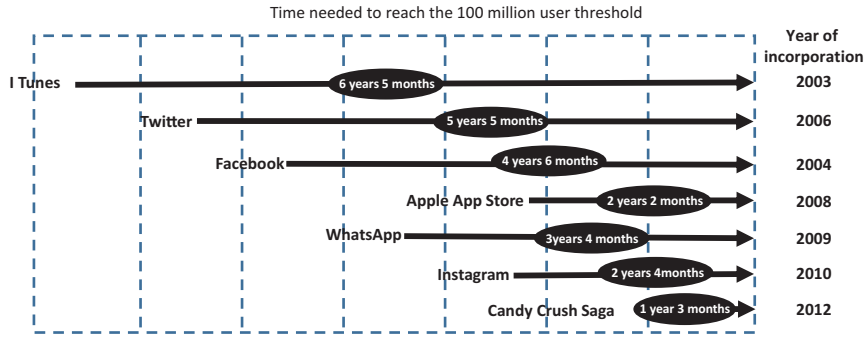

Fig. 1.2 The acceleration of the digital maelstrom. *Source*: Dreischmeier R., Close K., and Trichet P. The digital Imperative. *BCG perspectives* (2016), Twitter.com, Instagram.com and Eric Viardot analysis

But Digi-raptors also have an enormous impact in terms of scope as they can scale much faster than their challengers. Take the case of WhatsApp since it has been acquired by Facebook in 2014. It moved from 200 million users in 2013 to reach 1 billion in February 2016 (Gibbs 2016). With more than 30 billion messages per day, WhatsApp has managed to erode the SMS business of the traditional telecommunication operators that peaked to 22 billion messages per day in 2012 and has been decreasing since. And even WhatsApp and Facebook do not have a safe future—new applications like Snapchat, a mobile video messaging application, have grown considerably within a very short time frame.

Interestingly, Digi-raptors can beat the incumbents at their own game in any industry and play down their traditional strengths, which are the existing clients, a strong financial leverage, and a powerful brand image. Indeed, Digi-raptors are able to quickly capture a large customer base, as we have already mentioned; but they can also quickly increase access to large amounts of capital such as Snapchat, which raised $537 million in capital in May 2015; and they can also achieve a strong brand image like Facebook, which is already among the 12 most valued brands worldwide according to Millward Brown (BrandZ 2015).

Additionally, Digi-raptors pose a great danger to competitors because of their ability to turn their enormous user platform base very quickly toward new markets: Amazon successfully entered various categories of retail before becoming a champion of the cloud; Google moved successfully to the

smartphone market with Android; WhatsApp is now allowing free calls; Apple is competing with banks with ApplePay, just to name some examples.

The case of digital innovation in the car industry with the development of autonomous cars is another interesting example of how digital disruptors may change this industry. Almost all car manufacturers open their doors for software companies like Apple and Google. If they are not cautious, they might have invited a Trojan horse. This example is detailed later in Chapter 4 by Bartl and Rosenzweig (2016).

After introducing these opportunities associated with the digital innovation maelstrom, we hope that you as a reader are now as excited as we are to follow the chapter contents, which we will briefly outline in the following two paragraphs before providing a more detailed summary of each chapter.

The first part of the book includes four chapters exploring the main characteristics of the digital revolution and especially social media, the current cornerstone of the digital breakthrough. Chapter 1 explores the quest for innovative users in firm and community collaboration and its dynamics, while the focus of Chapter 3 is on the role that crowdsourcing and crowdfunding have in modern corporate innovation management. Chapter 4 discusses another innovative way to leverage social media called innovation mining, shown in the context of autonomous driving. Chapter 5 is about a key service in social media, Twitter, which the authors analyze in a Spanish context.

The second part of the book provides fresh thinking about how incumbent companies can adapt to the digital revolution. Chapter 6 advocates that firms should get a clear idea about how they can generate value with digital technologies and provide practical tools as a linkage between information technologies and corporate value creation. A truly international view comes in Chapter 7 where the authors reflect on the digital breakthrough from a Latin-American perspective, specifically on the role that governments can play to help companies embrace the digital revolution, especially in former or currently emerging countries. The impact of social media applications on the management of innovation is discussed in Chapter 8, pleading for more creativity in the content and the use of social media. Finally, the book closes with the challenge for legacy firms in keeping innovation alive and to deal with the digital innovation

that is going to strike them. This serves as a warning and a guideline for accepting the challenge of the digital revolution and adapting practices in innovation management in order to stay ahead of competitors through the use of digitalization. In the following paragraphs, we will summarize the key results and implications of each chapter in detail.

In Chapter 2, "Exploring the Dynamics of Firm and Innovation Community Collaboration: A Complex Love Story", Ghita Dragsdahl Lauritze and Søren Salomo show that firms face a general membership paradox as they collaborate with user communities. They try to incorporate community participants as part of the firm and encourage them to remain outsiders to the firm simultaneously. The authors apply systems theory to examine this phenomenon, which is an original use of the theory. They are also moving the focus away from explaining users as innovative assets to describing how organizations attribute meaning to innovation-related communities.

Regarding the managerial implications, the authors underline that it requires additional commitment and capabilities of key individuals in the innovation process to actively reflect the dynamics of paradoxes arising from firm and community collaborations. Thus, firms must recognize that executing user-driven innovation projects goes hand in hand with investing a large amount of internal resources. Certainly, community collaboration should not be justified as a way to cut cost. The chapter opens also for new understandings of contradictory managerial demands and ubiquitous tensions such as the simultaneous experience of extrinsic and intrinsic motivations as different types of motivation vary in their orientation and may arise from both autonomous (self-)interests and outside controls. Accepting that the paradox is painful and never disappears, firms should thus not seek to overcome or resolve the conflicts emerging from the innovation process. Instead, firms must endure the (at times fierce) pain related to innovation community collaboration. Only then can they actively use their opposing (inside and outside) characteristics to restructure resources, rethink products, encourage new opportunities, and exploit the innovation potential of community collaboration. Firm and community collaboration is enforced through the digital revolution and in order to retain a competitive innovation management, companies have to explore and exploit the potential of firm and innovation community collaboration.

In Chapter 3 "How Crowdsourcing and Crowdfunding Are Redefining Innovation Management", Ferran Giones and Pyayt Oo explain how the creative identification of solutions to innovation problems (crowdsourcing) and the funding for innovation projects (crowdfunding) have changed how organizations innovate. More specifically, they analyze how crowdsourcing and crowdfunding are changing consumer behavior and giving a taste of co-creation to a much larger collective.

In their chapter, specific emphasis is given to how the multiple roles of the participants, from provider of ideas to users, customers, investors, and brand ambassadors, create unintended impacts on the market structure and might introduce new opportunities and challenges for innovation management.

They conclude that crowdsourcing and crowdfunding imply an additional effort from innovation managers to be more flexible and open their innovation processes to benefit from but also provide to a participatory crowd. On the positive side, these new co-creation mechanisms open the door to identify and work with emerging lead users that otherwise might not have ever been identified. From a broader point of view, innovation managers should expect not only to engage lead users, but also to tap on the whole diversity of talented individuals that define the emerging creative class. More often than ever, this talent pool is mostly self-employed and ready to act as independent creative sources for all types of organizations and projects. Despite being a recent phenomenon, crowdsourcing and crowdfunding are quickly evolving into valuable innovation management mechanisms, but it will be as important to use them as to know how and when to use them, being aware of their potential value as well as of their long-term transformative impact on the relationships between organizations, consumers, and their stakeholders.

In Chapter 4, "The Voice of the Crowd—An Innovation Mining Study on Autonomous Driving", Michael Bartl and Juan Rosenzweig introduce innovation mining as a new powerful quantitative research technique and systematic procedure to identify, select, and analyze large volumes of user conversations on the Internet and make them usable for innovation challenges. The authors use the case of autonomous driving to show how user-generated content becomes useful through the process of defining a search strategy, collecting data, analyzing data, data visualization, and interpretation. Thus,

social media as a source of user-generated content becomes increasingly important for companies and successful innovation management depends among other things on picking the right approach to utilizing the right mix of social media. Bartl and Rosenzweig show that innovation mining can provide highly promising results for supporting foresight and applying a user-centric view in investigating technology acceptance. Nonetheless, if social media is to be fully utilized for innovation, there is a high demand for both qualitative and especially quantitative methods to generate sufficient relevant data, especially in the digital economy, which is absolutely dependent on the right amount and quality of data.

Chapter 5, "Innovation in the Spanish Twittersphere: An Ontology and Stakeholder's Salience Analysis", is another illustration of an innovative quantitative methodology which is used to analyze data from social media. The authors—Angel Crespo et al.—have developed a powerful framework for the extraction and the big data analysis of more than 200,000 tweets. Their method also includes the original concept of innovation ontology that allows them to make a comprehensive analysis of the needs and interests that are occurring on the Twitter social network about innovation. The authors then apply a stakeholder's analysis to identify and validate a stakeholder typology in the context of innovation in Twitter based on the two central attributes of power and legitimacy applied to five different categories of users, which are represented as the following: (a) the professional experts or consultant firms, (b) enterprise owners and their managers, the firms, CEOs, and entrepreneurs, (c) the "four power" or mass media, (d) formal organizations of the government and public services, including public institutions and political parties, and finally (5) the other individuals interested in innovation. This investigation and interpretation gained from one social media (Twitter) contains valuable insights into innovation knowledge diffusion and for identifying main actors. Both areas are of high importance for innovation management in practice.

In Chapter 6, "Urgent!…To Reward the Innovation on Information Technologies with a Real Focus on the Value Generation", the author Emigdio Alfaro argues that there exists a loss of value originating in the fact that chief technology officers and IT managers do not take the direct value generation of the information technologies that are developed and

implemented in their respective organizations into account. Alfaro goes on to present a logic sequence for evaluating the value generation of the innovations on information technologies, which answers the following questions: (1) How do organizations generate value? (2) How do innovations on information technologies generate value? (3) How can organizations calculate the value generation of innovations on information technologies? After answering these questions, Alfaro concludes that many managers simply don't understand how their organizations generate value and that IT needs to apply non-IT characteristics in order to generate benefits. There exists an urgent learning need for managers to evaluate the value generation of the used information technologies. Furthermore, it is important to consider management indicators and evaluating which selection will enhance the analysis of the IT-based value generation.

Gaining this insight can be an important aspect of managing innovation in firms in an increasingly digitalized environment.

In Chapter 7, "Future Revolution In Innovation: Digitalization Reflections in the Brazilian Perspective", Hugo Ferreira Braga Tadeu and Jersone Tasso Moreira Silva consider the role that governments may play to foster or mitigate the effects of the digital breakthrough, especially in emerging countries such as Brazil, Russia, and South Africa. These countries are currently facing decreases in gross domestic product (GDP), high interest rates, and mainly a drastic reduction on firms' productivity. Digital innovation could help them to improve productivity and reduce operational limitations as the overall benefits of digitalization in emerging economies, derived from products and services that invariably accompany technological transformation, could include as much as $6.3 trillion in additional GDP, 77 million new jobs, and more than half a billion people lifted out of poverty over the next 10 years. Actually emerging economies enjoy greater reductions in unemployment from digitalization than developed economies because in emerging economies, digitization supports the continued acquisition of tradable, often labor-intensive, jobs in sectors such as manufacturing, while in developed economies digitization enhances productivity in non-tradable jobs, such as service jobs, which yields fewer new positions but has a greater effect on GDP. In Brazil, private companies are now facing a growing fiscal pressure and it is important that they resist the pressures to cut back on the research

and development (R&D) spending on digitalization. But this requires an environment that is conducive to innovative activity, supported by the public sector. The chapter discusses the best governmental strategies and policies to help emerging countries to overcome the obstacles and benefit from the digital revolution. The authors conclude that the benefit of digitalization can be best applied if innovation is considered in firms in relation to organization, integration, and synergy. If digitalized IT is applied in transforming and upgrading the manufacturing industry, this can significantly improve productivity and other issues. The government should support this in order to enhance this development.

The impact of digitalization seems to be greater in emerging economies and both local and international firms need to take this into account for using innovation management as a tool to increase productivity in similar environments through consciously utilizing the potential benefits of the digital revolution.

In Chapter 8, "Social Media Innovations and Creativity", Vanessa Ratten asserts that the competitiveness of a firm can be enhanced dramatically when creativity is incorporated into business strategy in social media. Increasing creativity and innovation levels of a firm are important strategies for overall performance and help increase further social media applications. The main reason is that social media incorporates technological innovation into services in a different way compared to the traditional processes used in the past by organizations. Creativity is an interactive process and it is important for individuals to understand how it can be embodied in a group setting particularly in the social media context, which involves individuals interacting in an online context. The advantage for creativity in social media is that there is flexibility around time and geographical position. There are also a number of technological resources that individuals can use with social media including desktop computers, handheld devices, and multimedia technology that enable more creativity.

Against this background, Ratten attempts to contribute to innovation management research by focusing on the linkage between creativity and entrepreneurship in social media practices. She concludes three managerial implications from her study, namely increasing knowledge

sharing, considering personality traits of individuals in creating an online community, and ensuring a clear vision about group creativity. She argues that the way creativity is used through technological innovation has changed through social media. Thus, social media has revolutionized innovation management and continuous innovations in relation to social media depend on the customer's interaction with technology, which has to be taken into account in innovation management in a digital context.

Finally, in Chapter 9, "The Revolution of Innovation Management: the Challenge for Legacy Firms", Jerry Wind and Kelly Rhodes describe that our world is rapidly changing, primarily driven by five forces, namely advances in science and technology, skeptical and empowered people, an exploding media landscape, disruptive cultural, social, and geopolitical environments, and finally new business and revenue models. In all these forces digitalization plays a significant role and for firms this implies that they have no choice but to innovate if they want to be successful in the future. The authors claim that innovation management itself is rapidly changing and has to be used effectively in order to create breakthrough innovations, which is a shortcoming of legacy companies. This chapter uses the case of legacy firms to explore why they struggle to develop breakthrough innovations and to provide practitioners with a guideline for addressing the previously described challenges. Wind and Rhodes conclude that becoming more innovative as an organization requires a challenge of mental models through their guideline, assessing their current state and generating new ways of managing innovation. This will lead to accepting change as an opportunity and including it as a part of sustainable business models.

This revolution of innovation management is driven by the digital maelstrom that we have introduced earlier. If acknowledged as both a challenge and an opportunity, it will open up new ways to products and services that generate the revenue for tomorrow's success. But the digital breakthrough is only one facet of the revolution of innovation management—there is more to come.

Being curious about everything related to innovation management, we are very much looking forward to hearing your experiences and viewpoints.

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