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REVOLUTION OF INNOVATION MANAGEMENT

Volume 1

The Digital Breakthrough

Revolution of Innovation Management

Alexander Brem • Eric Viardot
Editors

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1

Revolution of Innovation Management: The Digital Breakthrough

Alexander Brem and Eric Viardot

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).

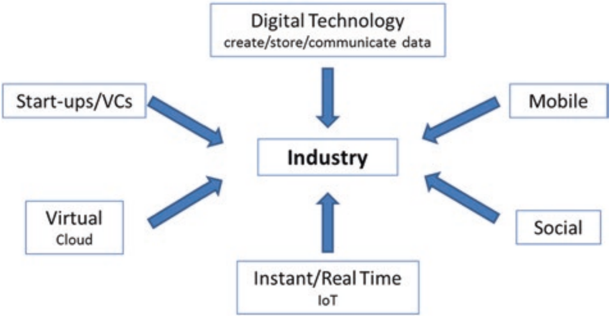

Fig. 1.1. The 6 forces of the digital revolution

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).

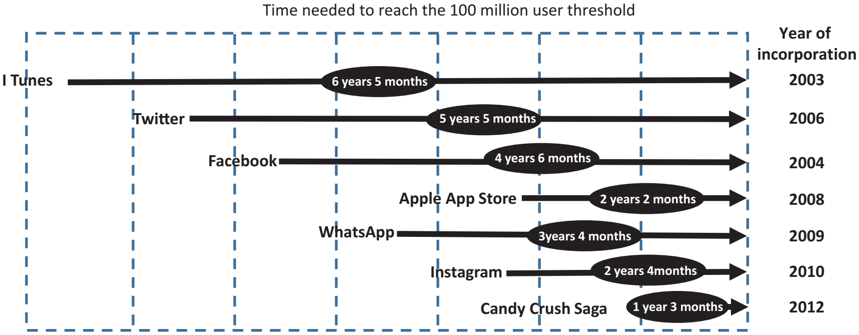

Fig. 1.2 The acceleration of the digital maelstrom. *Source*: Dreischmeier R., Close K., and Trichet P. The digital Imperative. *BCG perspectives* (2016), Twitter.com, Instagram.com and Eric Viardot analysis

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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2

Exploring the Dynamics of Firm and Innovation Community Collaboration: A Complex Love Story

Ghita Dragsdahl Lauritzen and Søren Salomo

The classic fairy tale of The Little Mermaid (Andersen 1836) tells the story of the little mermaid falling in love with a prince from the unknown and different world over the sea inhabited by humans. She tries to access this world by exchanging her voice for a pair of human legs. Although she accepts the fierce pain of walking, she can never fully transcend the boundaries of their separate worlds and when the prince does not return her love, she dissolves into foam. However, instead of ceasing to exist, the little mermaid transforms into a new spiritual form floating above the stars. She will never be able to be with her prince and satisfy her desire for the human world, but her transformation renders it possible to obtain an immortal soul and rise up into the kingdom of God.

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In many ways this fairy tale resembles the managerial implications that firms encounter when incorporating user communities into their innovation activities. First, the story shows the desire for the unknown of a separate world that can never be fully accessed even though new methods—like user communities (Jeppesen and Frederiksen 2006), crowdsourcing (Zogaj et al. 2014), and innovation contests (Terwiesch and Xu 2008)—are being used. Second, it shows the tensions that derive from the clash of separate worlds by emphasizing the fierce pain the little mermaid suffers from walking and her inability to clearly communicate with the prince due to her loss of voice. As firms try to gain access to the world of users, they suffer from conflicting demands, and communication with the user communities is often complicated (e.g., exemplified through Internet storms of indignation (so-called shit storms) and the Not-Invented-Here (NIH) syndrome). Finally, the story recounts how attempts to cross the boundaries of separate worlds may in fact create novel opportunities by producing critical transformations.

This chapter intends to promote understanding of the dynamics of firm and user community collaboration by showing how attempts to incorporate user communities external to the firm create a complex transformation of firm boundaries. Building on systems theory (Luhmann 1995), we suggest that firms face a general membership paradox as they collaborate with user communities. When exposed to this paradox, firms try to incorporate community participants as part of the firm and encourage them to remain outsiders to the firm simultaneously. We suggest that only by honoring the complementarity of firm (inside) and community (outside) characteristics can firms leverage the innovation potential of user communities.[1]

The remainder of this chapter is organized as follows: First, we introduce literature on firm and user community collaboration. Second, we describe the notion of boundary within innovation-related community studies, including the tensions arising from firm and community collaboration. Third, we introduce systems theory to explain a transformation of firm boundaries within community collaboration. Building on this perspective, we propose a dynamic framework of firm and community collaboration. Finally, we present a discussion pointing toward future research, including implications for theory and managerial practice.

2.1 The (Unsatisfied) Desire for Users as Innovators

The insights and findings of researchers like Chesbrough (2003), Cohen and Levinthal (1990), and Eric von Hippel (2005) point to external sources for innovation as an opportunity to enhance firms' innovation potential, and firms are adapting their innovation strategies accordingly (Mortara and Minshall 2011). In particular, evidence indicates that customers are not only users, but also co-creators capable of contributing knowledge that can increase the quality and value of products (Henkel and von Hippel 2005).

Using several approaches, including structured interactions with online communities, many firms thus attempt to incorporate users into their innovation efforts. However, little is known about the barriers and drivers for firm and community collaboration (Hienerth et al. 2014; Raasch et al. 2008) and many firms fail to exploit the contributions of innovation communities (Dahlander and Piezunka 2014; Mortara et al. 2013; Schaarschmidt and Kilian 2013). This has prompted researchers to better understand how to integrate user communities in the innovation process to leverage their innovation potential.

So far, user innovation research has provided valuable insights into what motivates user participation and how organizations gain access to external sources of innovation. Yet, they tend to focus on the individual actors in the innovation process, which limits the understanding of the interdependencies that can emerge through the *interaction* between different partners (Levina and Vaast 2006; Smith and Lewis 2011), including the tensions arising from the conflicting interests of the firm and those of the users (Jarvenpaa and Lang 2011; Raasch et al. 2008). Roughly, user innovation studies focus, primarily, on *users or individuals* and their characteristics (Lilien et al. 2002) or motivations (Hertel et al. 2003; Lerner and Tirole 2002; Krogh et al. 2012) and, secondly, on *communities* and their structure (Lee and Cole 2003) or governance (O'Mahony and Ferraro 2007); or *organizations* and their absorptive capacity (Cohen and Levinthal 1990; Huston and Sakkab 2006). In comparison, few papers (Dahlander and Magnusson 2005; Dahlander and Wallin 2006) discuss the relationship between users and organizations or provide evidence about how their interaction affects the innovation outcome. Thus, the *dynamics* of firm–community collaboration remain widely unexplored (also noted by Raasch et al. 2008).

For example, most community studies emphasize key trade-offs between openness (attracting external participation and stimulating creativity and innovation) and control (over platform activities, content production, and appropriation) (West and O'Mahony 2008; Dahlander and Magnusson 2005; Henkel et al. 2013). However, research has not yet resolved the managerial need to make appropriate trade-offs and both academics and practitioners struggle with the linkage between open participation and control of the innovation process (Dahlander and Gann 2010; Gilbert and Sutherland 2013; Jarvenpaa and Lang 2011).

An illustrative example of the challenges of firm and user interaction is the case of Henkel.[2] Henkel is a German consumer brand giant that ran an innovation contest asking consumers to design the layout for the relaunch of their premium dishwashing detergent. Different from colorful designs using flowers and butterflies, the contribution with the most votes depicted a brown grilled chicken with the words "Yummi, chicken flavor!" Instead of nominating this design according to its ranking, Henkel announced that an in-house jury would ultimately decide on the most appropriate design—hence, not the grilled chicken. The community participants felt patronized by the firm's enforcement of (new) rules and with their frustrations spreading over the Internet, Henkel faced a so-called shit storm and a PR disaster.

The Clash Between Separate Worlds: Openness Versus Control

Current literature on communities recognizes well the dual role of openness and control within firm and community collaboration (see also Henkel et al. 2013; Jarvenpaa and Lang 2011; Rolandsson et al. 2011). For example, West and O'Mahony (2008) find that autonomous communities that arise from the users on a voluntary basis offer more opportunities to contribute directly to projects and, thereby, are more successful than sponsored or firm-hosted communities, such as innovation contests, at attracting new members. However, while encouraging community growth, open access and transparency may also conflict with the firm's strategic desire to prevent outsiders from influencing its decision-making processes. Moreover, with too little control and direction over the community, the community effects for the firm may be small or even counterproductive (Dahlander and Magnusson 2005). For example, in the Henkel case where the design of a grilled chicken did not match the firm's strategic direction, Henkel was faced with the problem of either putting a product on the market that would possibly violate general safety regulations (i.e., encourage people to eat detergent) or creating unintended user frustrations.

While acknowledging the combined role of conflicting efforts of openness and control, most community studies still perceive tensions arising from the innovation process as dilemmas that impede innovation by creating "either–or" choices. Thus, failing to make appropriate trade-offs in the innovation process may limit the integration of users, block internal information flows, and prevent the implementation of new practices (Schaarschmidt and Kilian 2013; Lüttgens et al. 2014). For example, scholars show how a control mindset might decrease user motivation by imposing rules and routines (e.g., Pisano and Verganti 2008), authority (O'Mahony and Ferraro 2007), and license restrictions (Fershtman and Gandal 2007), as well as by limiting access to content, including access to the development process (e.g., Shah 2006). From a dilemma perspective, tensions always cause problems for firm and community collaboration by referring to the impossible choice of addressing *either* the demands of the users *or* the demands of the organization.

With this chapter, we aim to leverage the innovation potential of communities by exploring the combined role of conflicting demands in the innovation process, such as open participation and control of the process. Building on the system's theoretical notion of *boundary* (Luhmann 1995) and *paradox* (Luhmann 1993), we examine collaboration through the interdependencies between firms and communities, rather than through their individual properties. Thereby, this chapter proposes a more dynamic approach to innovation collaboration than is offered by current studies.

With this approach, we offer a novel understanding of the relationship between firms and communities, suggesting that firms desire to engage with external users or consumers, because they are separate from the organization and thus able to offer novel (and unbiased) contributions to the development process. However, the moment firms seek to adjust these contributions to organizational structure and constraints, the magic disappears: the innovation potential of the contributions is diluted. Following the story line of H.C. Andersen (1836), firm and community collaboration thus resembles the impossible love that you cannot have.

To better understand the nature of tensions arising from firms and community collaboration, the following sections look into the boundaries of communities and firms.

2.2 Boundaries of Innovation Communities—Or Not

From focusing largely on users as innovators, scholars now also address the community phenomenon and studies of online communities, and their role in stimulating innovation are extensive (West and O'Mahony 2008; O'Mahony and Lakhani 2011). In fact, enthusiasts claim that the increase of such community forms dramatically reshapes the industrial landscape (e.g., Castells 2011).

The classic concept of community originates from Ferdinand Tönnies' well-known dichotomy between "Gemeinschaft" and "Gesellschaft" (1887). However, while the classic "Gemeinschaft" form of community is characterized by strong loyalty to insiders, high barriers to outsiders, homogeneity, and low tolerance for diversity, such a context hardly fuels dynamic innovation (e.g., Gulley and Lakhani 2010; Granovetter 1982). Subsequently, many discussions related to community within the innovation field lack theoretical characterizations of community. They use the term simply to describe any collectivity, without considering what kind of social behavior is being generated (Adler 2015; O'Mahony and Lakhani 2011; West and Lakhani 2008).

The definitional confusion about community has raised a cloud over the concept and user innovation studies tend to use a minimalistic understanding of community as a voluntary collectivity, in which participants have a perception of having something in common with others. In general, this understanding highlights a specific form of *relationship* between individuals[3] and *patterns of exchange* through various forms of communication[4].

Typically, user innovation scholars characterize the community phenomenon as something that arises from the users on a voluntarily basis to meet their own needs (i.e., autonomous), such as within sports (Hienerth 2006; Franke and Shah 2003; Lüthje 2004) and open-source software (Lakhani and Von Hippel 2003; Lee and Cole 2003), or as something that is initiated and sponsored by a formal organization (Jeppesen and Frederiksen 2006). However, the setting may also change so that autonomous communities transform into sponsored communities, such as free and open-source software (FOSS) (Dahlander and Magnusson 2008) and vice versa, such as open-source communities like Mozilla/Firefox and Eclipse (West and O'Mahony 2008). In addition, a community is hardly restricted to a single medium, but often has both online and offline components (von Hippel 2007; Preece and Maloney-Krichmar 2005; O'Mahony and Lakhani 2011).

Not surprisingly, therefore, studies of innovation communities struggle with demarcating the community phenomenon describing community boundaries as fluid (Schreyogg and Sydow 2010; Faraj et al. 2011; West and O'Mahony 2008), highly permeable (Jarvenpaa and Lang 2011), and porous (O'Mahony and Lakhani 2011). Moreover, as scholars focus primarily on the users and the internal mechanisms for (freely) revealing and sharing their ideas, they tend not to consider the constitutive effects of boundaries beyond individual user intentions (Morner and Krogh 2009).

To better understand *how* boundaries in firm–community collaboration appear fluid, porous, and permeable, including their constitutive effects on innovation, the following introduces systems theory to explain the distinct boundary characteristics as firms collaborate with innovation-related communities. The initial idea is that a better conceptualization of the boundaries between firms and their innovation communities can shed light on their interaction (across boundaries).

2.3 Boundaries of Firm and Community Collaboration—The Transformation of Separate Worlds

Systems theory is a universal sociological theory of society describing how society consists of social systems (Luhmann 1995). A key element of systems theory is the divide between system and environment: a system is only what it is by virtue of its distinction from the environment. Therefore, the notion of boundary is essential and Luhmann offers a distinct analytical framework to better understand boundaries between firms and their environment, such as communities. Although organizations are in contact with their environment, external events, such as community participation in the innovation process, will always be operated from within the internal logic of the organization.

According to Luhmann (1995), organizations regulate their boundaries to the environment by appointing membership to the organization. Therefore, the boundary of the organization extends to the point at which the decisions of the organization are no longer in force—if you are not a member of the organization, you cannot be linked to the decisions in force. In other words, organizations establish their boundaries by the binary distinction between member and nonmember—and you are no longer part of the organization if it has decided to exclude you from membership. However, building on the findings of Lauritzen et al. (2013), we suggest that as firms incorporate communities into their innovation efforts, they challenge their organizational boundaries and thereby transform their initial distinction between member and nonmember.

The Distinction Between Member/Nonmember

Drawing on Spencer-Brown's theory of distinction (Spencer-Brown 1969), Luhmann argues that every operation (i.e., attribution of meaning) relies on a distinction between what is made meaningful in the firm (or community) and what is excluded (Luhmann 1995). For example, firms' distinction between members (inside the organization) and nonmembers (outside the organization) creates a "marked" side (including members) and an “unmarked” side (excluding nonmembers). What is marked is what the firm observes and as such gains meaning on the basis of something different—the other (unmarked) side of the distinction. In other words, the notion of member is meaningful for the firm only in opposition to nonmember. Figure 2.1 illustrates this distinction between member and nonmember.

As firms recognize that customers are not only users but also co-creators capable of contributing knowledge that can increase the quality and value of products, they increasingly incorporate customers (Bitner et al. 1997; Moeller 2008) and users (von Hippel 2005, 1976) into their innovation activities. Thus, the former excluded user (i.e., nonmember) is now included in the organization, such as through online user communities and innovation contests, and is recognized as a firm member with an active role to play in the design and support of products. Thereby, collaboration with external communities challenges firms’ boundaries as the community participants appear as both firm members and nonmembers simultaneously (see also Lauritzen et al. 2013). In the following, we investigate this dual membership through the notion of *reentry*.

Dynamic Firm Boundaries: Membership as a Paradox

Luhmann (1993) defines a paradox as a “reentry” of a distinction, which explains how the excluded side of a distinction is copied into the included side of the distinction by which both sides are being emphasized (marked) simultaneously.

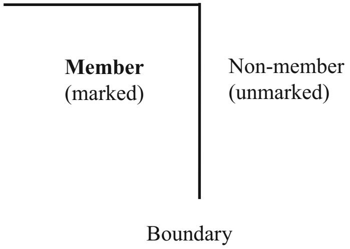

Fig. 2.1 Firm boundary as a distinction between member and nonmember

A *reentry* is a paradox because it is not possible for the community participants to be a firm member and a nonmember simultaneously. However, being both a member and a nonmember is required for the intended effect. Hence, paradoxes are more complex compared to trade-offs and compromises as their embodied contradictions are self-referential in nature, that is, each dimension of the paradox is complementary to its other dimension (Luhmann 1993). For example, when firms recognize consumers and users as valuable to their innovation efforts, it is mainly because these individuals are *outside* the organization and therefore capable of contributing novel ideas to the organization. When community participants become "too" integrated into the firm, with whom they collaborate, they risk being assimilated into the firm's norms and hierarchy, thereby losing their ability to provide "out-of-the-box" thinking and novel ideas (e.g., Lüttgens et al. 2014). However, if the community participants remain outside the firm hierarchy and control, they risk developing ideas that are wasteful to the firm (Dahlander and Magnusson 2005; Henkel et al. 2013).

Acknowledging these complex links between firm membership and nonmembership keeps the firm's decision-making about community involvement in constant oscillation between two overarching and conflicting demands: that of incorporating external individuals into the firm (as members) and that of avoiding those individuals who are becoming ordinary firm members. Despite being subject to the internal controls of the firm (as a member), community participants are thus simultaneously regarded by the firm as external sources (i.e., nonmembers) that contribute to the innovation process through open access. This so-called membership paradox fuels ambiguous tensions in the innovation process.

While other studies have pointed toward similar tensions in the innovation process emphasizing appropriate degrees of openness (Dahlander and Gann 2010) and a general innovation paradox (Miron-spektor et al. 2011; Leonard-Barton 1992), the notion of "reentry" explains *how* the dichotomous dimensions of control and openness relate to each other and evolve around a dynamic firm membership construct.

In contrast to dilemmas, managers can never resolve paradoxes, because paradoxes will always reemerge (Luhmann 1993). While dilemmas cause problems that need solutions by referring to the impossible choice, paradoxes pose synergies by emphasizing the simultaneous presence of contradictory elements (Janssens and Steyaert 1999). Indeed, the organization and management literature suggests that more innovation occurs when people are aware of paradoxes (Andriopoulos and Lewis 2009; Smith and Lewis 2011). As such, the core premise of a membership paradox within firm and community collaboration is not problem solving but accepting and navigating coexistence.

We therefore propose that if awareness of a general membership paradox within firm and community collaboration is raised, managers can embrace conflicting demands of control and openness through a better understanding of their complementarities, thereby leveraging synergies in the innovation process.

2.4 A Dynamic Framework of Firm and Community Collaboration: A Complex Love Story

Paradoxical tensions and outcomes appear particularly salient within firm and community collaborations, making understanding of the nature and dynamics of paradoxes a necessity. Raising awareness to a general membership paradox enables firms to better recognize the complex links between conflicting efforts of control and openness, inside and outside, while honoring their distinct characteristics.

Figure 2.2 illustrates how firm and community collaboration can be understood as a cycle that starts from the firm's construct of community (as an outside that is invited inside), which influences what the firm experiences in relation to firm membership and related tensions.

As firms engage in collaborations, a paradox of membership arises from the construct of community as an "outside" that is invited *inside* the organization. This membership paradox makes the mutually enabling nature of conflicting demands, such as openness and control, more salient, fueling new ambiguous tensions in the innovation process. These tensions resemble the pain that the Little Mermaid suffers when trying to transcend the boundaries to the human world. If the

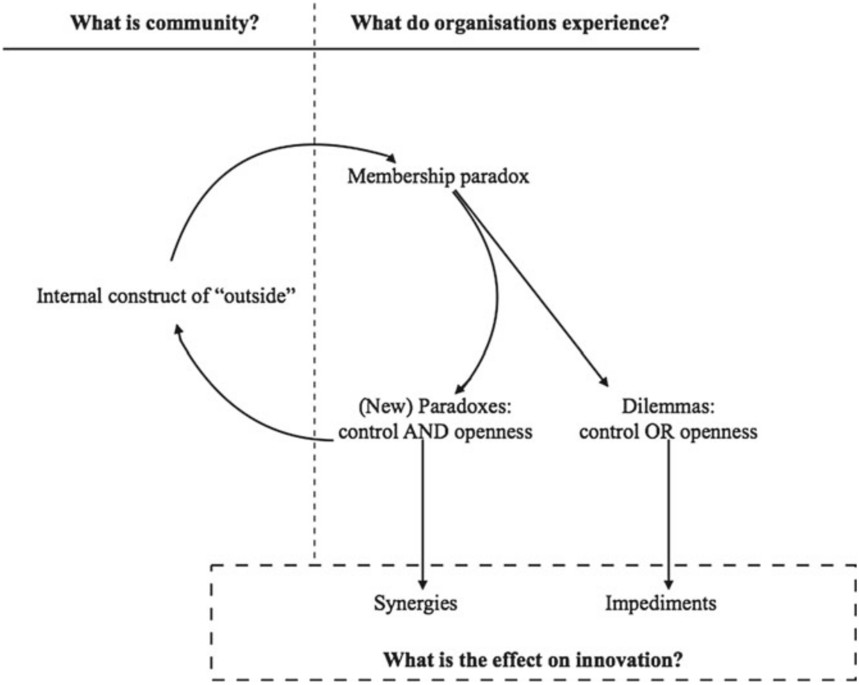
What is community?
What do organisations experience?
Membership paradox
Internal construct of "outside"
(New) Paradoxes: control AND openness
Dilemmas: control OR openness
Synergies
Impediments
What is the effect on innovation?

Fig. 2.2 A framework of firm and community collaboration highlighting their dynamic relationship

firm manages these tensions as dilemmas and trade-offs, such as exercising control through rules and license restrictions to minimize external access (i.e., openness), the outcome is often negative. For example, studies have argued that emphasizing control in the innovation process leads to decreased community motivation and workflow rigidity (Lüttgens et al. 2014).

If, instead, the firm acknowledges paradoxes and tries to deal with conflicting efforts of control and openness simultaneously, synergies are more likely to emerge. Acknowledging paradoxes, again, enables the specific community construct by encouraging community participants to perform simultaneously both as firm members (i.e., insiders) adhering to firm structure and as nonmembers (i.e., outsiders) contributing novel ideas.

As paradoxes can never be resolved but will always reemerge (Luhmann 1993), firm and community interaction undergoes constant iterations through the community construct, reentry of membership, and new paradoxes. Instead of explaining innovation through the individual properties of users, communities, and organizations, this model thus indicates that the source of innovation stems from the dynamic and *persistent* nature of tensions between firms and their innovation communities. Thus, tensions between firms and communities do not necessarily pose impediments to the innovation process, but may, in fact, form the germ for innovation.

2.5 Discussion and Future Research Directions

Although scholars increasingly investigate the user innovation phenomenon, innovation-related community studies form a relatively new research field. Predominantly, innovation community research builds on empirical observations of economic tendencies (e.g., Chesbrough 2003) and isolated industries (e.g., von Hippel 2005), and there is a paucity of theoretical development (also noted by Bogers et al. 2010; Faraj et al. 2011; West and Lakhani 2008). While the system theoretical framework that we have presented shows a way of conceptualizing boundary dynamics between firm and community, there are still many areas that are unexplored. Our suggested framework of firm and community collaboration offers a novel basis for researchers in the field of user innovation to develop new research questions investigating the dynamics at stake in firm and innovation-related community collaboration. In the following, we integrate our conceptual framework with user innovation literature and point toward three future research directions: What is community? What do organizations experience? What is the effect of a membership paradox on innovation?

What Is Community?

"What is community?" is a major question and point of debate within user innovation studies and beyond. So far, most scholars operate in a cloud of conceptual confusion using minimalistic definitions of innovation communities. Thus, there seems to be a gap in our understanding of the distinct form of innovation communities and their effect on innovation performance (also noted by Brint 2001). Here, an important challenge is to provide a theoretical grounding for user innovation studies that can account for the interplay between individuals, communities, and organizations.

To this end, systems theory is introduced as an alternative lens to investigate innovation communities. Introducing community as an internal construct of organizations' desired outside, this chapter answers calls for understanding interactions at the boundary between firms and community (O'Mahony and Lakhani 2011; O'Mahony and Bechky 2008). Describing firm boundaries as distinct yet dynamic, we have examined community as something that is interwoven in the organizational form. However, occurring from a fundamentally different rationale than the organization, community appears as an impossible fantasy of an outside that the organization can use to challenge its own boundaries.

Traditionally, user innovation research identifies firms and users as separate parts (von Hippel 2005), placing organizations and communities on a continuum between a community/commons-based and an industrialized/hierarchical mode of production (e.g., Lee and Cole 2003; Rolandsson et al. 2011). However, studies show that these distinctions overlap in online innovation-related collaborations (Dahlander and Wallin 2006) and we have illustrated how firm and community collaboration in fact fuels a general membership paradox. Future studies may further investigate how firms use communities as complementary assets (Dahlander and Wallin 2006) and explain how incorporating communities into innovation efforts presents paradoxes for managers in terms of handling opposite needs (e.g., for control and openness).

What Do Organizations Experience?

If firms employ innovation communities as an internal reflection device for their external environment, it has consequences for what stand out as relevant needs to be managed to leverage innovation. The status of such needs constitutes an increasing controversy in user innovation studies, namely whether opposing needs of firms and communities require one-sided trade-offs (e.g., Balka et al. 2014) or more dynamic approaches like "modularity" (Henkel et al. 2013) or a "symbiotic" approach (Dahlander and Magnusson 2005). While research has established that firms struggle with making appropriate trade-offs between control and openness in the innovation process (Dahlander and Gann 2010), this chapter extends such research by suggesting that firms can support demands for control and openness simultaneously through the navigation of paradoxes.

Describing boundaries between firm and community as a reentry of membership may appear to resonate well with discussions on hybrid organizations (e.g., Jay 2013; Mair et al. 2015). However, emphasizing the *dynamics* of organizational boundaries, we suggest a novel perspective to current discussions on hybrid organizations that tend to employ a more structural view. Traditionally, research uses the term "hybrid organization" in two prominent ways. The first relates to Powell's (1990) notion of "neither market nor hierarchy" and describes a hybrid, networked organizational form. The second describes organizations in which there are a combination of public and private logics, such as social enterprises, cross-sectorial collaboration, and public–private partnerships (Jay 2013; Mair et al. 2015).

Instead of discussing organizations or communities as a hybrid phenomenon (e.g., Jay 2013; West and Lakhani 2008), we suggest future studies to explore the increasing *desire* of firms to become what they are not by using community as an (internal) fantasy about their environment. This perspective indicates that—in *contrast* to the Little Mermaid (Andersen 1836)—organizations do not transform into a new (hybrid) form because they seek to transgress boundaries and combine conflicting logics or demands. Instead, we argue that firms experience new paradoxes, exactly because their organizational identity hinders them from becoming what they attempt to become (i.e., their environment).

Specifying boundary as *a re-entry* of the distinction between member and non-member, we emphasize the apparent impureness of the distinction between firms and community and ask new questions related to hybridity. For example, future studies may examine how communities become the best media for *illusions* of hybridity. And how firms' desire for hybridity produces new implications for management and creates new areas for competition (for a system theoretical approach to hybridity, see also Andersen and Sand 2012).

What Is the Effect of a Membership Paradox on Innovation?

Strong evidence points to the importance of involving and creating close linkages with external stakeholders, mainly users (Bogers et al. 2010; Dahan and Hauser 2002; Jaworski and Kohli 1993). However, customer orientation and close interaction with users yield insights that allow firms to enhance product development and serve customers increasingly well, but also narrow their cognition and range of action (Danneels 2003; Day 1999). Understanding a specific customer group may prove effective for customer satisfaction and demand forecasting. Nevertheless, the group in question also commits the firm to specific strategic decisions and can only provide a narrow view of the market (Hamel and Prahalad 1994). Thus, establishing close links to users may also impede flexibility and the search for new opportunities, as it locks the firm into a limited presentation of their environment.

With our framework, we have shown how dynamic firm boundaries frame organizational membership as an oxymoron, emphasizing both a firm distinct identity (i.e., firm membership) and external creativity (i.e., non-members). This constellation may allow for opposing strategic courses of close and loose linkage to be effectuated simultaneously, helping firms to maintain their independence and self-determinacy (e.g., ensure control of the innovation process), and yet be responsive to their customers (e.g., articulate openness and transparency). Thus, the actual value of innovation communities might lie in their potential to maintain the specific firm in relation to its environment—enhancing its capacity for innovation and change by fostering the cognitive flexibility that will allow the simultaneous inclusion and exclusion of resources.[5]

While recent community studies suggest that a dual identity between firms and community participants may lead to path dependency between the firm and the community (e.g., Langner and Seidel 2015), others argue that dual membership encourages flexibility and change (e.g., Lauritzen et al. 2013). We therefore encourage future studies to further clarify the notion of a general membership paradox within firm and innovation community collaboration and investigate its implications for innovation.

2.6 Theoretical Implications

Employing systems theory to examine the phenomenon of firm and innovation community collaboration, we have demonstrated how systems theory may explain relevant practical (user innovation) phenomena. As systems theory appears very abstract, e.g., using notions from biology as metaphors for society (Luhmann 1995; Maturana and Varela 1975), it may appear paralyzing for researchers to use systems theory in empirical studies. With this chapter, we hope to inspire researchers to look "below" the theoretical clouds of systems theory and use the analytics to produce novel insights into relevant phenomena. Moreover, introducing systems theory to the mainly empirically driven, predictive, and descriptive user innovation field, this research moves focus away from explaining users as innovative assets to describing how organizations attribute meaning to innovation-related communities. This research endeavor offers a dynamic theoretical framework to describe organizational implications of incorporating external individuals into their innovation efforts.

2.7 Managerial Implications

Within user innovation literature and the open innovation literature more broadly, there is a tendency to focus on the advantages and opportunities of incorporating external sources of innovation (Dahlander and Gann 2010). However, we argue 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 great many internal resources.

Describing a membership paradox arising from firm and community collaboration, this chapter opens for new understandings of contradictory managerial demands and ubiquitous tensions. For example, current community studies seek to understand the simultaneous experience of extrinsic and intrinsic motivations (Lakhani and von Hippel 2003; Jeppesen and Frederiksen 2006), while understanding altruism or the benefits of giving to others (Kollock 1999; Lakhani and von Hippel 2003). These different types of motivation vary in their orientation and may arise from both autonomous (self) interests and outside controls (Ryan and Deci 2000). Emphasizing a paradox perspective helps better informing how multiple forms of motivation jointly shape performance. These insights allow firms, managers, and community participants to take more informed actions by increasing managerial awareness of the dynamics behind unintended phenomena occurring in the innovation process, including the NIH syndrome and unintended community frustrations (Antons and Piller 2015).

In contrast to the story line of the Little Mermaid (Andersen 1836), we argue that although firms balance different rationales and conflicting demands, they do not transform into a new hybrid form "floating above the quarrels of conflicts." Instead, firms must remain in their unresolved relationships with their communities, accepting that their desire to become what they are not will always remain unsatisfied. 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.

Notes

1. This chapter builds on research developed in the PhD by one of the authors, Ghita Dragsdahl Lauritzen ("Firm and user community collaboration: A complex love story." PhD diss., Technical University of Denmark, 2015).

2. For a description of the Henkel case, see crowdsourcing.org, accessed March 31,2016.http://www.crowdsourcing.org/editorial/crowdsourcing-campaigns-caught-in-a-trap---or-simply-chicken-detergent/3755.
3. Since the creation of the Internet, the concept of community no longer has geographical limitations, as people can now virtually gather in an online community and share common interests regardless of physical location. Because of this, communities are now more commonly characterized by "the strength and nature of relationship between individuals" (Preece and Maloney-Krichmar 2005, 1). For example, relationship based on autonomy and voluntarism (von Hippel and von Krogh 2003; Jones et al. 1997; West and Lakhani 2008), common interest, purpose, and goals (Ren et al. 2007; West and Lakhani 2008), and the lack of legally binding contracts (Jones et al. 1997).
4. Forms of exchange include sharing, contributing, or co-creating (Jones et al. 1997), Internet-based across time and space (Ren et al. 2007), and face-to-face, electronic or "any other form" (von Hippel 2007).
5. This state resembles the famous thought experiment called "Shrödinger's cat" devised by the Austrian physicist Erwin Shrödinger. The scenario presents a cat that may be simultaneously both alive and dead, a state known as a quantum superposition (Gribbin 2011).

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3

How Crowdsourcing and Crowdfunding Are Redefining Innovation Management

Ferran Giones and Pyayt Oo

3.1 Introduction

Breaking down a large and complex task into smaller and simpler tasks has been associated with much of the last century's progress in industrial productivity (Maier 1970). This breaking down of tasks enabled adjustments in resource allocation to each of the new subtasks, as well as the capability to manage the new simpler tasks more closely, measuring productivity, and eventually paving the road for the development of "scientific management" in the daily operations of organizations (Kelly 1982). This approximation to organizing work successfully resonated not just with industrial organizations but also with other process-intensive

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organizations which gained in simplicity, effectiveness, and efficiency by adopting it. At some point, when internal resources were observed to be less efficient than external alternatives, the distribution of tasks and work crossed the boundaries of the organization, giving shape to the idea of outsourcing noncore activities to other organizations.

At the same time, the rapid development and adoption of information technologies started to open a new array of possibilities for organizations that were interested in adjusting their activities, within and outside their firm boundaries. For the last few decades, the concept of outsourcing has fully permeated all types of functions and processes in organizations, allowing not only tangible production activities but also all types of knowledge-intense and information-based services to be outsourced (Quinn 1999). Nevertheless, in both the industrial and knowledge areas, this course of change has been arranged as the externalization of a clearly defined task, with a measureable and a priori defined output. All this changes when outsourcing or externalization of tasks arrives at the organizational domains of creativity and innovation management processes.

This chapter explains how the large-scale outsourcing of two key functions such as the creative identification of solutions to innovation problems (crowdsourcing) and the funding for innovation projects (crowdfunding) have changed how organizations innovate. Crowdsourcing and crowdfunding leverage their disruptive power by using the "crowd" as a lever to build a new type of large-scale outsourcing. Specific emphasis is given to how the multiple roles of the participants, from provider of ideas to users, customers, investors, or brand ambassadors, create unintended impacts on the market structure and might introduce new opportunities and challenges for innovation management.

The chapter is structured as follows: first, a description of the origins and development of crowdsourcing is provided, identifying the different types and uses, and how they have become embedded in innovation management. Then, the concept of crowdfunding is introduced, describing the common elements with crowdsourcing, to then go into detail of how it is changing the way companies access resources and build markets for their innovative product or innovation projects. Lastly, an overview on how these phenomena have changed innovation management is given, together with a reflection on how the changes go beyond the intended effects of leveraging the crowd to solve a defined problem, suggesting the long-term transformative impact of crowdsourcing and crowdfunding.

3.2 Building Innovation Using the Power of the Crowds: Crowdsourcing

Breaking down a task and outsourcing it is not a novel concept, but doing it as an open call with an undefined audience is. As Howe (2006) defined, crowdsourcing “represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call”. From this early conceptualization of the concept derive some of the key singular elements of crowdsourcing. First, it still needs a leading actor that would open up the process. Second, compared with outsourcing, the crowdsourcing call is not sent to a single recipient but to a larger audience (network of people/organizations). Third, it is an open call, meaning that the objective or deliverable is not clearly predefined a priori; it will be the participants in the crowdsourcing call that will have to come up with potential alternative solutions to the proposed challenge.

Besides the open design difference of the crowdsourcing calls compared to outsourcing, an as-yet-untapped source of value is the capacity to leverage the “crowd”. Why does opening up the participation to a larger audience make such a difference? Being able to capture the contributions from a diverse group of participants, where each individual possesses knowledge or information that another individual might find valuable, is the first building block (Howe 2008; Surowiecki 2004). Then, the design of a contribution structure that allows for large participatory efforts, respecting the diversity of opinions, provides the additional block that helps to generate value in crowdsourcing (Seltzer and Mahmoudi 2013).

Thus, compared to outsourcing, the degree of control from the organization that acts as issuer of the call or challenge is much lower. As the objective is to generate unexpected solutions, part of the expected success relies on the audience reach of the call, but another substantial part relies on the dynamics across participants’ contributions. The advent of the Internet has helped to potentially open the crowdsourcing calls to anyone with access to a computer (Seltzer and Mahmoudi 2013), and has also become a process mediator with close to real-time support to the interactions among the participants (Prpić et al. 2015).

As a result, crowdsourcing gets positioned as a process that can enable individuals or organizations to find unexpected solutions to known problems, with the help of a large group of participants that take advantage of information technologies to contribute as they engage in the participatory effort.

Fitting Crowdsourcing in Innovation Management

As the organizations learn from the possibilities of crowdsourcing, a natural fit appears with the functions or tasks that are more uncertain and subject to the creativity of the individuals involved. An example is the use of crowdsourcing to substitute brainstorming, one of the most usual idea-generation techniques (for example, see My Starbucks Idea mystarbucksidea.force.com). Thus it becomes usual practice to introduce crowdsourcing in the early stages of the innovation management process, taking advantage of the known rules of the brainstorming technique, but getting additional protection against potential thinking constraints introduced by the presence of subjective evaluation of known peers.

Even in the simplest application of crowdsourcing as a substitute for brainstorming, it is possible to overcome the issue of "groupthink" (Prpić et al. 2015). For example, reducing the common problems observed in group-based creative innovation efforts such as the absence of diversity in the group (participants share backgrounds and/or cultural perspectives), the potential constraints as participants perceive that they are conditioned by previous participants' comments and their peers' observation, and the hierarchical structural differences among the participants in the group. As a result, crowdsourcing calls provide a better context to activate ideas and solutions that in other contexts would be counterintuitive or could jeopardize the interests of the participants, effectively loosening the constraints on the potential mobilization of knowledge competences and skills (Zhao and Zhu 2014). Additionally, large groups of participants have been observed to generate ideas equally novel and innovative to those generated by groups of experts (Poetz and Schreier 2012), reinforcing the use of crowdsourcing in innovative activities such as new product development.

The prominent role of the participants in crowdsourcing could motivate attempts to compare or assimilate it to user innovation. However, there are differences: in crowdsourcing calls, users and nonusers participate (Seltzer and Mahmoudi 2013). As previously described, the objective is to draw from a large audience and to generate participatory dynamics that could foster unexpected ideas as solutions. This marks a difference from user innovation where the contributions are proposed by users that suggest ideas that could meet their own needs (Bilgram et al. 2008).

Similarly, although crowdsourcing is an open process, it is different from open innovation (Laursen and Salter 2006) or open source (Seltzer and Mahmoudi 2013; Zhao and Zhu 2014). The directed nature of the crowdsourcing calls and the contribution boundaries to participants, both in content and form, limit the transformative impact creating a difference with open innovation efforts. At the same time, crowdsourcing projects are naturally limited in time and the outputs or contributions are owned by the issuer of the call, something that does not happen with open source projects (Hippel and Krogh 2003), where private and collective elements coexist and can be sustained over time.

The definition of crowdsourcing and its functional boundaries provides the needed reference to advance to the next section where further details and a function model are presented.

A Model for Crowdsourcing

As described by Zhao and Zhu (2014), a simple modelization of crowdsourcing identifies three key actors: (1) the organization that aims to benefit from the work of the crowd, also described as the issuer or assigner of the call for participation; (2) the crowd depicted by the participants that expect to be part of the work call, that are identified as the provider; (3) the platform that puts together the organization and the crowd and acts as intermediary (see Fig. 3.1). The role of the platform as a mediator

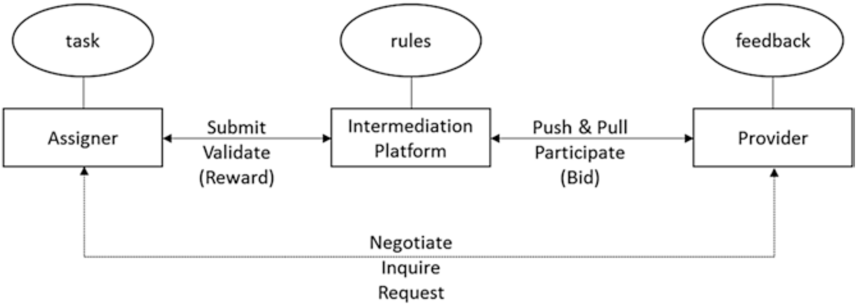

Fig. 3.1 Model for crowdsourcing
Source: adapted from Zhao and Zhu (2014)

of the relationship between the organizations that exposes the problem and the crowd has changed as information interfaces have benefited from technological advances. The platform is also defined by the rules and mechanisms that allow participation and interaction between the participants; it can be regarded as the enabler of the crowdsourcing initiative (Zhao and Zhu 2014). There are many active platforms for crowdsourcing projects; an example that shows the linkages with concepts such as open innovation is Ideaken (see www.ideaken.com).

The model describes the type of actions that take place when actors interact in the development of the crowdsourcing call. The trigger of the process is when the "issuer" or "assigner" submits the call in the intermediary platform. Following the model layout proposed by Zhao and Zhu (2014), this trigger moment is then followed by a sequence of actions by each of the actors involved.

This first step requires the assigner to have already identified and defined the task it needs the "crowd" to work on. The submission of the call in the intermediary platform also implies that the assigner is aware of the rules used by the platform when it comes to participatory dynamics governance. At this point, the intermediary platform needs to issue a validation to the assigner that the call can be opened; at the same time the type of reward mechanism should also have been defined.

The second step starts when the call is open and providers can start to participate in it, similar to a bidding process where participants act as providers and pitch their proposal. A dual mechanism of push-and-pull guides the interactions between the platform and the providers: platforms push calls to their audience, but providers can also request to participate in certain types of calls. The objective is that providers' feedback (as contribution proposals) gets into the platform and successfully fits with the assigner's task call.

Lastly, there are direct interactions between the assigner and provider that might be completed through the platform or out of it. For example, as the providers submit their proposals, they might need additional information so they might inquire on specific issues. Similarly, the assigner might need to introduce additional requests or have to negotiate how to implement or use the provider's feedback.

Managing Crowdsourcing Calls

Understanding the actors, relationships, and expected participatory dynamics described in the crowdsourcing model raises a question on how to successfully orchestrate crowdsourcing calls. The involvement of different actors with different incentives and motivations points toward the necessity of governance mechanisms that offer structure and facilitates the generation of innovative ideas or solutions at the same time.

While in an outsourcing call the issuer or assigner selects the participant, in crowdsourcing the participation decisions comes from the individual. Thus, it becomes essential to ensure that participants will proactively engage with the call. There are evidences that suggest that a weak definition of the problem, with limited context details, and no feedback on the participants' inquiries will result in a low engagement (Seltzer and Mahmoudi 2013). On the other hand, a well-defined crowdsourcing challenge offers a clear framework for all types of participants to "compete" with their bids, even if they have limited tacit or expert knowledge in the problem or situation that the issuer describes (Poetz and Schreier 2012).

Besides the clarity of the challenge description and the responsiveness to the inquiries from interested participants, a further understanding of the motivations and incentives for participation provides additional clues on how to build successful crowdsourcing calls. Dividing the motivational factors into intrinsic and extrinsic (Zheng et al. 2011) types helps to identify the potential levers. Extrinsic factors include the use of a clear compensation scheme (can be pecuniary or other equivalent rewards) and/or public recognition for the participant. Intrinsic factors would include the call being designed in a way that would fit with the internal needs and desires of the participant, leading the participant to take the preparation of the bid proposal more like a hobby than a work project. Public acknowledgment has been observed to work as both an extrinsic motivation and also an internal driver for action for some profiles of participants (Zheng et al. 2011).

The definition of the incentives for participating in the crowdsourcing call is implicitly interrelated to its objectives. Following the suggestion of Prpić et al. (2015), there are at least two different types of calls: those that aim for specific and objective contributions from the crowd and those that expect submissions of subjective content. The calls for specific contributions aim to achieve an impartial result by activating the participation of a large crowd; it could be a more simplistic participation like voting or choosing among options, the final objective being to achieve an unbiased result. The audience of this type of calls should be as similar as possible to the final target of the product or service under development; otherwise there is a risk of biased results. The alternative is to build a call that aims for subjective contributions: in this type of calls, the perceptions, hindsight, and beliefs of the individuals are the expected source of "crowd" creativity.

As expected, these different types of crowdsourcing calls require different management mechanisms. It is not the same to lead the participation to a specific range of options with narrow space to contribute as to open up a creative contest where subjective contributions are subject to further constructive development without a predefined end goal. Thus, depending on the type of contributions that are expected, two mechanisms can be used: aggregation and filtering (Prpić et al. 2015). Typical projects that rely on aggregation are "crowd voting", where the large audience votes are expected to supersede experts' predictions, and "micro-task crowdsourcing", where a complex and large task is broken into pieces and each individual completes a small chunk (Prpić et al. 2015).

The alternatives are the projects that rely on the filtering capacity of crowdsourcing. This type of projects benefits from the diversity of individuals that contribute in the call, capturing unique ideas and being able to filter them through a selection process before implementing them. The main exponent of this type of crowdsourcing calls is "solution crowdsourcing" (Prpić et al. 2015), where a specific problem receives contributions that are pitched as solutions for a business problem. In this type of contest, the crowd acts both as the source of creative ideas, but also as the filtering mechanism that helps to elaborate and promote the most promising solutions (Majchrzak and Malhotra 2013). An example that combines many of the described concepts is the successful platform run by Dell Inc., named IdeaStorm (see www.ideastorm.com). This platform evolved from being simply an online suggestion box into being a source of crowd-validated insights and ideas on how to improve the products and services of the company.

Examples of successful crowdsourcing campaigns provide an illustration of the practical impact of the phenomenon and the success measures. As described by Gatautis and Vitkauskaite (2014), in 2013 Audi (car maker) launched a campaign where over 150,000 visitors where engaged in a competition to produce a TV commercial that resulted in 2275 competing versions (https://www.thinkwithgoogle.com/campaigns/audi-australia-land-of-quattro.html); similarly, also in 2013, Kleenex (tissue brand owned by Kimberly-Clark) started a campaign that attracted close to 200 submissions for new tissue box designs (Gatautis and Vitkauskaite 2014). In both examples, the organizers of the crowdsourcing call obtained benefits beyond solving the creative challenge that they were facing, and leveraged creative talent beyond what would have been their regular restrictions. Other more general examples of initiatives that have thrived thanks to crowdsourcing could be 99 Designs (www.99designs.com) or Threadless (https://www.threadless.com/) where participants help in the design and development of new products, or Squadhelp (https://www.squadhelp.com/) where they become idea generators and consultants for organizations (Zhao and Zhu 2014).

In these crowdsourcing calls the measures for the performance of the campaign go beyond the quality of the final selected solution; for example, in some calls the participants engaged can also take the role of being the first customers, thus a relevant metric for marketing-oriented crowdsourcing campaigns can also be the number of participants, the number of submitted ideas, or even the number of visits that the event page captured, which potentially increased the product and/or brand exposure (Gatautis and Vitkauskaite 2014).

Challenges and Opportunities in Crowdsourcing

Despite the promising advantages of introducing crowdsourcing as a valuable tool for innovation management in organizations, there are also limitations and risks that need to be taken into account. The "wisdom of the crowds" (Surowiecki 2004) might not always deliver unbiased results that can be directly used. For example, they can be affected by key influential users with an ambition to manipulate the results; the outcomes can also be biased if there is a lack of representativeness between the overall population (or target consumer group) and the crowdsourcing's participants profile (Seltzer and Mahmoudi 2013).

The outcomes of a crowdsourcing campaign are positively related to having a clear design of the call's objectives and requirements; a clear leadership and resource commitment from the issuer are the other needed components. Overall, the issuer of the call needs to acknowledge that its commitment goes beyond the initial conceptualization of the problem or challenge, to include the execution, feedback mechanisms, and execution of the reward system (if any).

In his early conceptualization, Howe (2008) already identified some of the rules that could make a difference for innovation managers interested in using crowdsourcing in their organization (see Table 3.1). These are still valuable insights into what is expected from the crowd and how a crowdsourcing call should be managed, from the initial considerations of choosing the type of crowdsourcing and engaging the right crowd, to the design of the rules, incentives, and governance mechanisms.

Table 3.1. Rules for successful innovation-focused crowdsourcing

Rule	Comments
1. Pick the right model type	Selecting the crowdsourcing model that fits with the innovation model is the first step. Tapping into the crowd to select among different predefined options is different from using it to create a new solution to a problem.
2. Pick the right crowd	Efforts to narrow and attract the target audience are at the core of any successful campaign. Once the attention is captured it needs to be sustained throughout the campaign or contest.
3. Offer the right incentives	Different audiences might require different reward system; intrinsic and extrinsic factors might require creative incentives that go beyond pecuniary compensations.
4. Keep your people	It is not outsourcing at large; to leverage the benefits of crowdsourcing organizations need to have the people and the governance mechanisms to support them.
5. Establish a project leader	Managing the participation of the crowd requires organizational responsiveness to requests and inquiries, as well as clear deadlines and a cut-off date.
6. Keep it simple	Clear definition of requirements and goals gives sense to why crowdsourcing exists; break a task down but keep the meaning and objectives clear.
7. Accept the crowd	Diversity of contributions from a large audience implies a disparity of outputs; accept that not all outputs will be contributions.
8. Use the crowd to filter	Leverage the crowd to get creative ideas but also to filter them; benefit from collective intelligence and keep the process transparent.
9. Balance control and openness	Respect the crowd and accept that in some cases the crowd dynamics might get misaligned with the initial objectives or particular goals.
10. Reward the crowd wisely	Give back to the crowd by going beyond the individual rewards, for example by helping the crowd to work more efficiently in future contests.

Source: adapted from Howe (2008)

3.3 Crowdfunding as a Disruptive Force for Innovation Potential in Organizations

Crowdfunding has been increasingly popular in recent years and has emerged as a new way to raise financial capital to support innovative ideas not only from nascent entrepreneurs but also from established organizations. It allows the general public to make a collective investment in individual entrepreneurs or businesses which need financing to start or grow. Through crowdfunding platforms such as Kiva, Kickstarter, and Indiegogo, entrepreneurs who have limited access to traditional funding sources such as banks, venture capitalists, and angel investors, raise billions of dollars to get their business off the ground since small amounts of money from a large number of ordinary people can add up quickly to reach the goal. According to a recent report by a UK-based crowdfunding center, 442 crowdfunding campaigns are launched globally on a daily basis and entrepreneurs raise more than $60,000 on an hourly basis (Clifford 2014). It has a disruptive impact on entrepreneurial financing processes in diverse contexts such as consumer products, real estates, and journalism. The first modern-day crowdfunding can be credited to a British rock band named Marillion, who in 1997 raised $60,000 from their fans' donations online. In 2000, the first crowdfunding platform named ArtistShare emerged and allowed artists to raise money for their new creative works from their fans. In the late 2000s, crowdfunding became popular among entrepreneurs and investors with the birth of Kickstarter and Indiegogo. In 2012, President Obama signed the Jumpstart Our Business Startups (JOBS) Act that allows entrepreneurs to sell their equity stakes in new ventures to the general public through the Internet. As of 2015, the global crowdfunding industry was a $34.4 billion market that more than doubled in comparison to 2014. With the emergence of this phenomenon and approval from government, crowdfunding has become a viable source for entrepreneurial resource acquisitions for those who have limited access to traditional financing sources due to lack of proven history.

Types of Crowdfunding

Although there has been a lack of a clear definition or taxonomy of the different types of crowdfunding options (Tomczak and Brem 2013), there are some common elements in most of the crowdfunding campaigns. The phenomenon of crowdfunding is mainly designed to raise financial capitals through the Internet. Individuals and organizations can either choose an all-or-nothing (AON) or keep-it-all (KIA) strategy. In an AON strategy, crowdfunders' pledges are only collected if the goal is met by the end of the campaign. In a KIA strategy, pledges are collected even if the fundraising goal is not met. For example, the issuer or assigner has a goal of $20,000 and has only raised $18,000 at the end of the campaign. In an AON strategy, the issuer will not receive any funds since the goal is not met. But, in a KIA strategy, the whole $18,000, which has been accumulated during the campaign, will still be received. Usually, platform fees are higher in a KIA model than in an AON model. Research has found that an AON strategy is much more likely to be successful at achieving the fundraising goal.

There are multiple options available for entrepreneurs looking for the right fit between their situation and type of crowdfunding they can use. Some options are (1) donation-based crowdfunding, (2) reward-based crowdfunding, (3) lending-based crowdfunding (i.e., peer-to-peer lending), (4) royalty-based crowdfunding, and (5) equity-based crowdfunding. Depending on the type of campaign, the impact on economic values and social values is different (see Fig. 3.2), offering a visual classification of crowdfunding types (Meyskens and Bird 2015).

Donation-based crowdfunding allows individuals and organizations to raise money from the crowd and crowdfunders contribute in the form of donation without any form of return. They are socially or intrinsically motivated to donate money for a worthy cause. Examples of campaigns range from funding for education to paying medical bills. GoFundMe

		Economic Value	
		Low	High
Social Value	Low	Reward	Equity
	High	Donation	Debt

Fig. 3.2 Crowdfunding and value creation
Source: adapted from Meyskens and Bird (2015)

is one of the personal fundraising platforms for donation-based crowdfunding. Every day, users of GoFundMe raise over $4 million. As of November 2015, the most funded campaign in GoFundMe is “Saving Eliza”, a campaign to raise $2.5 million to fund a clinical trial for the treatment needed by children who were born with Sanfilippo syndrome, a rare degenerative disease. Within 26 months, the campaign raised over $2 million through more than 36,000 donations.

Reward-based crowdfunding is arguably the most popular type. It allows start-ups and small businesses to raise money through various crowdfunding websites such as Kickstarter and Indiegogo. Here, providers contribute to the campaigns and get rewards for their contribution. Rewards are different depending on the number of pledges and the issuer of the campaign, ranging from thank you notes to meeting the creators, and distributing some accessories such as T-shirts and hats. Alternately, creators also treat crowdfunders as early customers and presell products/services that sometimes do not exist yet. After successful campaigns, issuers collect the money and give rewards as promised but there is no legal obligation to deliver rewards.

As of November 2015, Kickstarter has helped entrepreneurs and start-ups raise over $2 billion from almost 10 million crowdfunders since its inception. It has more restrictions than Indiegogo in terms of country and type of projects: although anyone in the world can contribute, Kickstarter is only open to creators from 19 countries. Also, it does not allow campaigns for personal causes. Indiegogo is more open and affords more freedom. In November 2015, creators from 224 countries had used the platform to raise financial capital for anything considered legal; about 15 million people from all over the world visited the Indiegogo website each month. The most funded campaign in reward-based crowdfunding is “Pebble Time”, a smartwatch designed and built by a California-based maker. It raised over $20 million during its 31 days of campaign. It is not only the most funded but also the fastest funded campaign, raising twice its goal within an hour. Research has found some factors that could increase the chance of success in crowdfunding: Mollick and Kuppuswamy (2014a) found that campaigns with videos and early updates are more likely to succeed; social networks of entrepreneurs also affect their success. In addition, Colombo et al. (2015) also found the reciprocity effect: individuals who supported other campaigns in the past have better chances to succeed.

Lending-based crowdfunding, also known as peer-to-peer lending or debt-based crowdfunding, allows individuals or organizations to borrow money from the crowd as a loan without collateral using an Internet platform and to pay it back with interest. Lenders sometimes have not only the financial goal of getting interest but also a socially intrinsic goal of helping others. Some popular platforms in this type of crowdfunding are Kiva.org, LendingClub.com, and Prosper.com. As of November 2015, LendingClub alone had funded over 13 billion loans to borrowers, and Kiva, which connects people through lending to alleviate poverty, helps individuals from 83 counties borrow over $785 million with a 98.45 % repayment rate. Research shows that lenders respond positively to a loan request when it is framed as helping others than investing for an opportunity.

Equity-based crowdfunding allows entrepreneurs who have limited access to traditional venture capitalists and angel investors to raise financial capital from the crowd in return for an equity stake in their ventures. Since there is a need for a higher level of regulations, equity-based crowdfunding is not legally allowed in many countries. Recently, the US Security Exchange Commission (SEC) has allowed regular citizens to invest in equity crowdfunding with some restrictions. Equity crowdfunding is especially important to provide financial capitals for start-ups and small businesses that need between $20,000 and $2,000,000: friends and families might afford to contribute to ventures if the required financial capital is less than $20,000 while venture capitalists may think it is not worthwhile to invest in ventures that need less than $2,000,000. Thus, equity crowdfunding fills that gap and helps start-ups that need financial capital in that range. Because of its lesser popularity than other types of crowdfunding, research has not been developed in this type until recently (Tomczak and Brem 2013). A research study by Ahlers et al. (2015) reports that internal factors such as financial roadmaps, risk factors, number of board members and their education level have significant impact on fundraising success.

Royalty-based crowdfunding might be the newest type. Like in other types, issuers of call can raise money from the crowd and pay back a percentage of revenue from their venture. Thus, entrepreneurs do not lose their equity stake in the venture while investors earn a regular income from gross sales. However, it is mostly appropriate for products/services that have high profit margins because loyalties are added to the expense. Products or services with no or low variable costs such as developing mobile applications are better suited, as profit margins are higher for additional sales of the application.

Does Crowdfunding Decrease Barriers for Innovation?

Since it has been substantially difficult to raise external financial capital, many start-ups and small businesses cannot fill the funding gap between internal sources such as family and friends, and external sources such as banks and investors. Crowdfunding fills the gap by providing this financial capital. In addition to that, it also allows entrepreneurs and small business owners to test their product in a presale consumer environment before introducing it to the market. Since most products/services are still in development stage, entrepreneurs and business owners can get feedback from providers on how to make their products/services better. Since commercially attractive innovations are developed by customers who are the primary beneficiaries, they can provide insightful suggestions during product development; this feedback can help local firms or entrepreneurs understand customers' needs and wishes so as to avoid wasting resources in new product development that customers are not willing to buy. Moreover, testing new innovative products in customer environment helps firms identify potential product problems or weaknesses. By modifying products based on customers' feedback before market introduction, firms can produce better-quality and more commercially innovative products by collaborating with those customers. For example, crowdfunding backers warn entrepreneurs who are trying to develop an innovative bag that recharges electronic devices while in motion that their charger is not compatible with the electrical voltage used in some countries. This feedback allows entrepreneurs to solve this issue at an early stage. In addition, platforms like Ideaken create a community where an individual can share his/her innovative idea and other people in the community can collaborate to innovate in return of reward and recognition. Thus, crowdfunding and crowdsourcing help to address challenges of innovation faced by individual entrepreneurs trying to start new ventures and enable managers from established organizations to identify commercially innovative opportunities.

Downsides of Crowdfunding

Although crowdfunding provides numerous benefits to entrepreneurs, there are also drawbacks that come with it. First, an open call to the general public is a double-edged sword for entrepreneurs. On the one hand, it allows entrepreneurs to expose their ideas to potential investors around the world. On the other hand, the exposure comes with risks. Without proper protection of intellectual property in advance, it allows people to steal creative and innovative ideas. Second, unlike traditional investors such as venture capitalists who can provide strategic guidance and expertise about the future direction of a new venture, crowdfunders usually lack the ability to provide insightful feedback. Besides these drawbacks for entrepreneurs, crowdfunders also face numerous uncertainties. In a reward-based platform, about 75 % of projects fail to deliver rewards on time (Mollick and Kuppuswamy 2014b), and it is not unusual that they fail to deliver any of the promised rewards at all (Mollick 2014). Thus, crowdfunders should be aware of these downsides.

Dynamics of Crowdfunding Campaigns

The following graphical layout (see Fig. 3.3) of a typical crowdfunding project page from Kickstarter provides a visual understanding of crowdfunding in terms of actors, actions, and key metrics being used.

- Campaign page—Project page with description and an optional video that clearly explains the project.
- Project creator—Individual or groups of entrepreneurs from start-ups or established organizations; issuer of call.

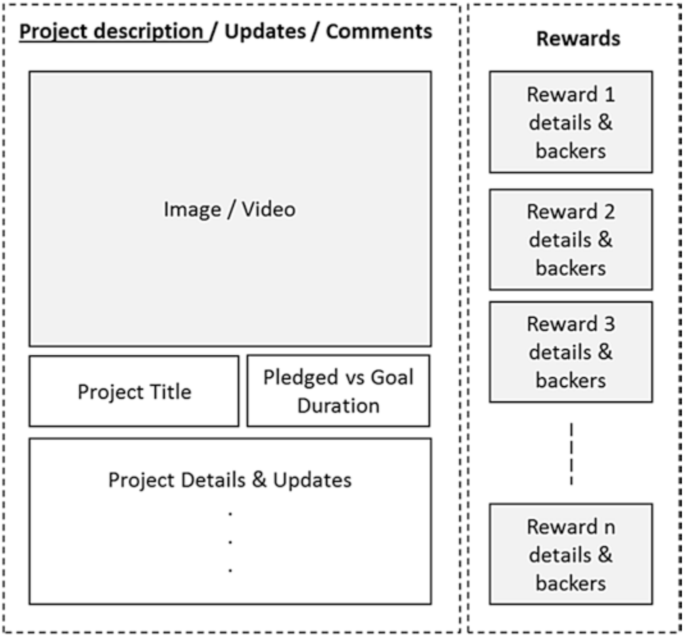
Project description / Updates / Comments
Image / Video
Project Title
Pledged vs Goal Duration
Project Details & Updates
Rewards
Reward 1 details & backers
Reward 2 details & backers
Reward 3 details & backers
Reward n details & backers

Fig. 3.3 Graphical layout of a crowdfunding campaign page

- Backer—Individual supporting the project; provider.
- Goal—Amount the project creator aims to raise.
- Pledges—Amount of money that is actually raised by project creator.
- Updates—Place where the project creator can add information about the project during and after the campaign.
- Comments—Place where backers can post their comments about the project and ask questions to the project creator.
- Duration—The number of days the campaign runs on the platform to reach its goal.

In order to understand how innovation managers or entrepreneurs can run a successful campaign, a closer look at the dynamics of the campaign is needed. A recent study by Murray et al. (2015) provides the process model of persuasion in crowdfunding (see Fig. 3.4).

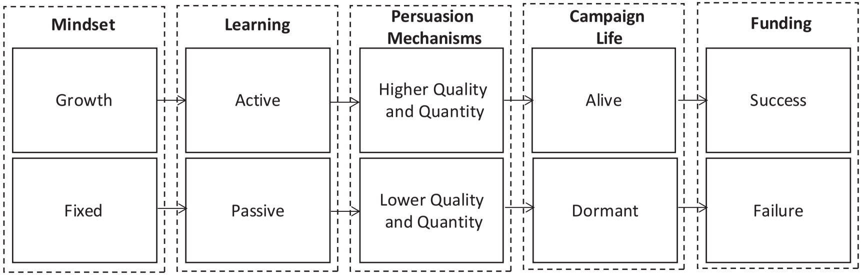
Mindset
Learning
Persuasion Mechanisms
Campaign Life
Funding
Growth
Active
Higher Quality and Quantity
Alive
Success
Fixed
Passive
Lower Quality and Quantity
Dormant
Failure

Fig. 3.4 Process model of persuasion in crowdfunding
Source: adapted from Murray et al. (2015)

This sequential process distinguishes successful from unsuccessful crowdfunding projects. Entrepreneurs can either have a growth or fixed mindset. Issuers of call with a growth mindset view crowdfunding campaigns as an opportunity to test their product in the marketplace via a novel way of raising financial capital while those with a fixed mindset view crowdfunding campaigns as an opportunity to solely raise financial capital for their product. These different mindsets apparently impact on the next step.

Both entrepreneurs with growth and fixed mindsets realize that they need to learn about crowdfunding before launching their campaigns since it is a new phenomenon for them. However, the way they learn is different. Those with a growth mindset learn actively by approaching experienced crowdfunding entrepreneurs and gaining insightful knowledge before starting their campaigns, while those with fixed mindset learn about crowdfunding just through observation of previous campaigns and do not try to approach experienced crowdfunding entrepreneurs.

After learning about crowdfunding, persuasion mechanisms of entrepreneurs play a role. Entrepreneurs can use different quality and quantity persuasion mechanisms that reveal information about products and themselves. These mechanisms include (1) highlighting their background such as education, prior experience in the industry, and prior experience of starting a business; (2) pitching the crowd with a compelling story; (3) connecting with their primary (family and friends) and secondary providers (followers from social network such as Facebook, Twitter, and Linked); (4) consistently updating during the campaign; and (5) contributing to other crowdfunding campaigns. Depending on the quality and quantity of these persuasion mechanisms, the campaign comes alive or remains dormant.

Campaigns that are alive gain interest from potential crowdfunders through different channels such as word of mouth, social media, and traditional media, eventually increasing the chance of success, while campaigns that are dormant gain no or less interest from potential crowdfunders, which in turn decreases the chance of success. Therefore, a combination of an interesting product/service, a strong personal network, and a persuasive campaign is the potential driver of a successful campaign (Brem and Wassong 2014). Table 3.2 provides some tips from crowdfunding researchers and experts for successful campaigns.

Table 3.2 Tips for successful crowdfunding campaigns

Tips	Comments
1. Select the right type of crowdfunding	Choosing the right type (reward, equity, donation, etc.) of crowdfunding campaign is one of the most important steps.
2. Solve a problem	Proposing a solution to a problem that people face in an innovative way.
3. Prepare	Spending time to learn about crowdfunding platform, and prior success story, including a quality video, no spelling error in description, informing people in social network.
4. Set a right goal and duration of campaign	Setting a right goal depending on individual projects and type of crowdfunding campaign; 30 days duration works best.
5. Start strong	Informing all people in primary network about the campaign and request them to contribute early and spread the word.
6. Contribute to other campaigns	Contributing to other campaigns before launching can increase the chance of success because of the effect of reciprocity.
7. Assemble a team	Forming a team is important. Campaigns created by teams are three times more successful than those created by individuals.
8. Update consistently	Informing the progress of product development can show effort and transparency by project creator(s).
9. Describe breakdown of costs	Dividing the costs for separate activities and showing to potential crowd funders allow them to realize where their money will go.
10. Structure the reward strategically	Adding reward in the final stages, giving tangible rewards, publicizing name of crowdfunders could help.

3.4 Redefining Innovation with Crowdsourcing and Crowdfunding

The impact of crowdsourcing and crowdfunding on innovation management goes beyond the campaign or call goals. From a broader perspective, both phenomena have contributed to modifying the boundaries of innovation management in emergent and established organizations. Nevertheless, there are specific activities in the innovation management process where the transformative impact of these phenomena has been particularly substantial.

Using as reference the innovation process framework from Brem (2011), we can propose a similar linkage between crowdsourcing and crowdfunding as with innovation and entrepreneurship perspectives of the innovation process (see Fig. 3.5). In this context, the crowdsourcing activities have found particular support among organizations in need of help to identify new ideas or filter them (idea management), or to establish a linkage between a problem and an opportunity (opportunity recognition), or to refine a possible solution or idea (research opportunity and idea development). Similarly, organizations that have been using crowdfunding were likely to expect support in the first steps as they brought a new product to the market (commercialization), or were interested in getting further traction for an idea or product they were launching (diffusion).

These phenomena have had an impact on different areas of the innovation process, and this difference in their application area provides a hint on how they can evolve in the future. While crowdsourcing and crowdfunding are gaining adoption and being introduced in new organizational contexts or fields, the outcomes of crowdfunding can have further long-term impacts. One of the causes for this longer-term impact is that there is no a priori limitation that we often see in crowdfunding campaigns, where the volume of the funds collected is not capped. Therefore, in comparison with crowdsourcing, there is no a priori call that constrains the number of solutions that are implemented, but instead there is a stronger focus on maximizing the potential value of the campaign.

An alternative reflection on the outputs of crowdsourcing and crowdfunding campaigns is to observe what happens when they fail. Surprisingly, recent findings from a sample of projects in Kickstarter found that most

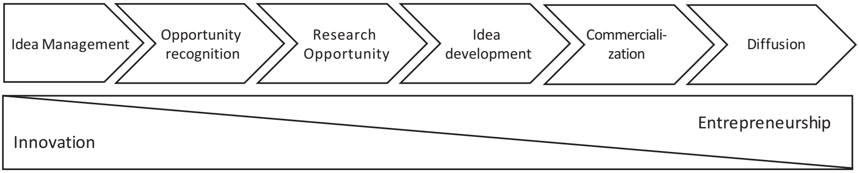

Fig. 3.5 Innovation process and linkage with innovation and entrepreneurship
Source: adapted from Brem (2011)

entrepreneurs continued with their project after failing to achieve their funding goal (Mollick and Kuppuswamy 2014b). The concept of a failed crowdsourcing campaign is somewhat more difficult to grasp. It could be a situation where the solutions proposed by the crowd did not meet the minimum requirements of the issuer of the call, or that the participation was weak and no fully developed ideas emerged; in these cases, it is more probable that the potential project idea is abandoned.

On the positive side, the observation that 90 % of the crowdfunding (reward-based) campaigns turn into full organizations (Mollick and Kuppuswamy 2014b) gives further evidence of the impact on the more entrepreneurial part of the innovation management process (see Fig. 3.5). While a well-managed crowdsourcing campaign can be the sparkle of a successful new product or service, a successful crowdfunding campaign is seen as a good predictor of further funding from traditional and alternative sources as well as the beginning of a new firm.

Evolution and Challenges for Crowdsourcing and Crowdfunding Platforms

The last decade of evolution in crowdsourcing platforms provides an indication of what we can expect from the emerging crowdfunding platforms. The surge of platforms for all types of crowdfunding (reward, donation, and equity) has led to a consolidation process, in particular as new regulations have been introduced for equity crowdfunding (Stemler 2013). The regulations have set new boundaries but are also expected to foster the reputation and responsibilities of the existing platforms. The increasing maturity of the platforms for crowdfunding can also be seen in the specialization and niche positioning of some of them. For example, even in the leading platform Kickstarter, it has been observed that from 2010, there is an increasing presence of technological product projects, while the number of personal or social projects has been declining (Samanci and Kiss 2014). Whether intended or not, as the crowd becomes larger, specialization helps to improve the connection between the involved parties.

Further evidence on the evolution of the platforms and their connection with innovation managers or entrepreneurs can be seen in how they have been adopted and used. In particular, the competition between Indiegogo and Kickstarter has shown how two different crowdfunding models can coexist. The KIA rules set by Indiegogo has helped this platform attract lower-risk projects that could have high ambitions but also low starting costs (Cumming et al. 2015). The challenging AON mechanism that Kickstarter has traditionally defended keeps attracting innovators and entrepreneurs with radical product concepts where the perception of uncertainty is in both the crowd and the founder (Cumming et al. 2015). Using again the innovation process as a reference, it could be argued that KIA mechanisms could further support diffusion activities in an innovation process; while AON mechanisms in reward crowdfunding are particularly suitable in the commercialization activity, providing support to the hypothetical question of whether not to start the production of the product.

Future Opportunities for Crowdsourcing and Crowdfunding: Social Innovation

As crowdsourcing and crowdfunding are applied to new contexts, new opportunities appear to ignite or transform how innovation is managed. A singular opportunity emerges in the field of social innovations.

Contrary to the economic theory expectations that projects with positive externalities might never get started, the use of technological platforms to leverage the power of the crowd has been a positive surprise (Seltzer and Mahmoudi 2013; Davies 2014). The concept of civic crowdfunding has gained traction as a tangibilization of the societal participation as investors to create social value: for example, finding solutions to social problems, engaging individuals in responsible and healthy behavior, helping unattended or marginalized social groups, or promoting environment-friendly actions by individuals and organizations.

The development of civic and socially driven crowdfunding opens the door to another dimension of impact for these initiatives. It can potentially modify the traditionally passive roles of individual citizens and activate potential contributions by knowledgeable actors (Davies 2014).

Unexpected Consequences and New Expectations for Innovation Management

Although crowdsourcing and crowdfunding are recent phenomena, they are changing consumer behavior. As the lines between product or service creation and consumption become increasingly blurry, concepts like co-creation gain strength to explain the new role that consumers expect to play (Zheng et al. 2011; Perks et al. 2012). In this sense, crowdsourcing and crowdfunding impact on this trend, giving a taste of co-creation to a much larger collective.

It is plausible that those that participate in crowd contests or fundraisers are eager to try again. The experience of being partially responsible for others' success (and proudly be part of it), or having been part of a successful social initiative, or having achieved a positive return from a risky, but limited, investment in a project or product would be the new type of relationship that some customers or consumers expect to have.

As a result of these changes the separation between production and consumption becomes even more blurry (Ordanini et al. 2011); for example, it could also be expected that the co-creation expectations of consumers (Perks et al. 2012) will not stop with their participation in isolated crowd platforms, and they will demand further involvement. For innovation managers, this implies an additional effort to flexibilize and open their innovation processes to benefit 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 (Brem and Bilgram 2015) that otherwise might not have ever been identified. From a broader point of view, innovation managers should expect to not only engage lead users, but also tap on the whole diversity of talented individuals that define the emerging creative class (Howkins 2013); 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 recent phenomena 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.

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4

The Voice of the Crowd—An Innovation Mining Study on Autonomous Driving

Michael Bartl and Juan Rosenzweig

4.1 Introduction

There is little doubt that the Internet has changed the way consumers communicate. An increasing number of users actively gather together online and communicate in web forums, blogs, and various kinds of user-generated content (UGC) platforms. They exchange personal experiences and opinions about products and their usage and talk about opportunities for solving product-related problems. Some of them even develop product modifications and innovations, which they post online and share with other community members. This turns online communities into powerful sources of innovation (Füller et al. 2006; Bartl et al. 2012; Bilgram et al. 2008). Within this context organizations are experimenting with a variety

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of new and modified innovation research approaches promoting the role of consumers as valuable cocreators of products and services (von Hippel 2005; Chesbrough 2003; Prahalad and Ramaswamy 2000; Cui and Wu 2016; Gemser and Perks 2015). One example is the concept of crowdsourcing with the underlying idea of taking tasks traditionally performed by companies and outsourcing them to an undefined, generally large group of people in the form of an open call (Howe 2006). Other advancements are made in developing further qualitative research approaches with netnography as a prominent example (Bartl et al. 2016b; Kozinets 2002; Brem and Bilgram 2015; Wiles et al. 2013; Zhang et al. 2013). Evolved from ethnographic research, the core idea of netnography is to gain unbiased, unobtrusive consumer insights by "listening in" the user conversation. The advantage of the researcher's in-depth qualitative analysis of consumer quotes is the strength of netnography and, at the same time, its limitation. In order to manage the exponentially growing data volumes of UGC, new quantitative approaches relying on automation in text analysis of software-based information retrieval are on the rise. The aim of this chapter is to 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. Sections 4.2 and 4.3 describe the field of autonomous driving as a disruptive field of innovation which is chosen to showcase the innovation mining method. Section 4.4 describes the five methodological steps of innovation mining. Section 4.5 summarizes the study results followed by a concluding outlook in Sect. 4.6.

4.2 The Innovation Path of Autonomous Driving

Childhood dreams from the televisions series of Knight Rider are coming true. The Knight Industries Two Thousand (KITT) was a self-driving Pontiac Firebird Trans Am packed with lots of artificial intelligence supporting Michael Knight and the Foundation for Law and Government to fight down numerous villains. In the 1980s the self-driving KITT was a science fiction scenario for the audience. Today integrated camera, radar, laser, infrared, and ultrasonic technologies make it possible to record and interpret all relevant data from the car's surroundings. Then, a control unit backed with lots of computing power can take over and drive the car without any human intervention. The autonomous car is definitely not a gadget for a few enthusiasts, it will be the most impactful and disruptive innovation in the history of the automobile with enormous social and economic implications. Moreover, it is exciting that we are right now experiencing the birth of this innovation that will be around for the next centuries.

First estimations state that autonomous cars can contribute \$1.3 trillion in annual savings to the US economy alone, with global savings estimated at over \$5.6 trillion (Morgan Stanley 2013). There are many drivers for the overall savings as illustrated in Fig. 4.1.

For example, improvements in fuel consumption can be achieved when driving smoothly or using cruise control compared to manual breaking and throttling. Furthermore, self-driving cars could prevent 90 per cent of road traffic accidents, which are mainly caused by human error. Over

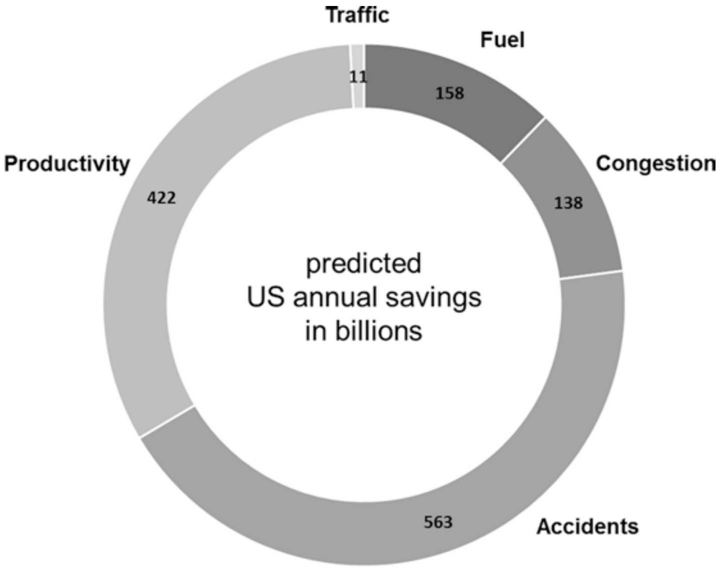
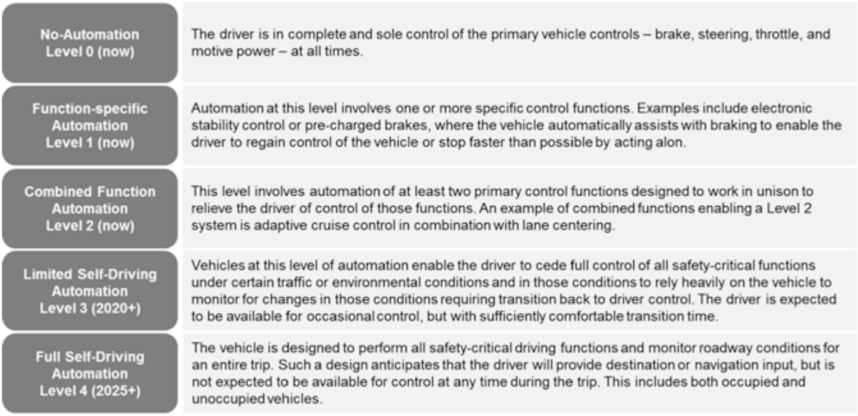


Fig. 4.1 US annual savings of \$1.3 trillion (adapted from: Morgan Stanley 2013)

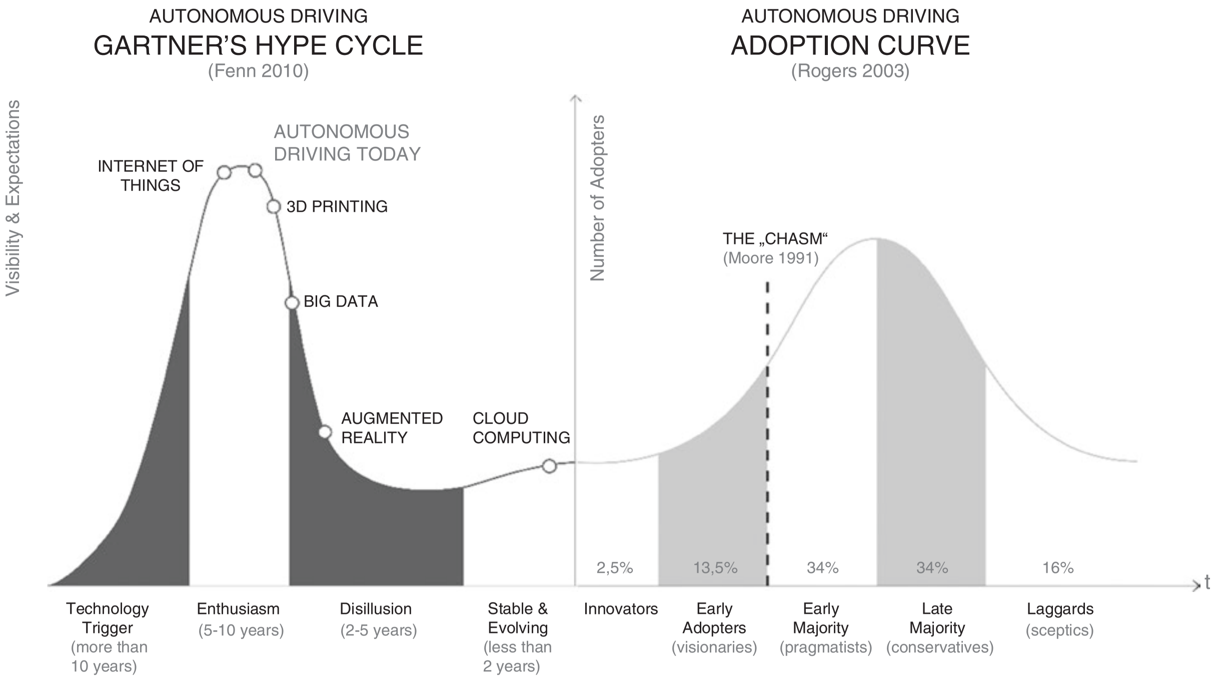
40 per cent of fatal crashes involve alcohol, distraction, drug involvement, and/or fatigue. When you take into account the loss of earnings, household production, medical and emergency services costs, travel delay, and administration costs, this adds up to a massive amount of money. There are also huge productivity gains as occupants do not have to drive anymore and can use their new free time. Better traffic management on roads with connected and autonomous cars will lead to less congestion. These saving predictions will, however, only apply in a world of fully autonomous cars. This is level 4 of the National Highway Traffic Safety Administration (NHTSA) model of technology penetration shown in Fig. 4.2.

Beside some analysts' estimations of the expected economic impact the authors want to include an additional perspective on the innovation path of autonomous driving (AD) using Gartner's hype cycle combined with Roger's diffusion model of innovation. The hype cycle offers a suitable tool to evaluate the current stage and relative maturity of the technology in the early phases of its life cycle (Fenn 2012). The model can be used to indicate consumer attitudes towards technology and can serve as a basis to analyze opportunities and investment risks regarding a certain technology (Linden and Fenn 2003). The shape of the hype cycle curve in Fig. 4.3 illustrates the media overenthusiasm through the period of disillusion to an eventual understanding of the technology's relevance and role in the market (De



No-Automation Level 0 (now)	The driver is in complete and sole control of the primary vehicle controls – brake, steering, throttle, and motive power – at all times.
Function-specific Automation Level 1 (now)	Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alon.
Combined Function Automation Level 2 (now)	This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.
Limited Self-Driving Automation Level 3 (2020+)	Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time.
Full Self-Driving Automation Level 4 (2025+)	The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

Fig. 4.2 Modified from NHTSA autonomous driving classification system


AUTONOMOUS DRIVING
GARTNER'S HYPE CYCLE
(Fenn 2010)
AUTONOMOUS DRIVING
ADOPTION CURVE
(Rogers 2003)
Visibility & Expectations
AUTONOMOUS DRIVING TODAY
INTERNET OF THINGS
3D PRINTING
BIG DATA
AUGMENTED REALITY
CLOUD COMPUTING
Number of Adopters
THE „CHASM“
(Moore 1991)
2,5%
13,5%
34%
34%
16%
t
Technology Trigger
(more than 10 years)
Enthusiasm
(5-10 years)
Disillusion
(2-5 years)
Stable & Evolving
(less than 2 years)
Innovators
Early Adopters
(visionaries)
Early Majority
(pragmatists)
Late Majority
(conservatives)
Laggards
(sceptics)

Source: Adapted figure based on Gartner's Hype Cycle (Gartner,August 2015) and Rogers Diffusion Curve.

Fig. 4.3 The innovation path of autonomous driving (adapted from: HYVE Science Labs 2015)

Marez Lieven and Gino 2004). AD is positioned right now at the peak of the curve within the enthusiasm phase, which is characterized by rapidly increasing content on the topic offered through various media channels such as TV, newspaper, magazines, and especially social media. The current peak of inflated expectations will be followed by a trough of disillusionment.

At this stage we will experience a rather low maturity of AD in the user domain. This is due, on the one hand, to the missing case scenarios of reasonable use and, on the other hand, to the lack of triability (e.g. test drives) of the new technology. Both factors represent mandatory requirements for customers' willingness to accept self-driving cars. Furthermore, according to the diffusion of the innovation model (Rogers 2003) the relative advantage over existing solutions, the compatibility with existing values, the relative complexity, and the observability will determine the pace of user acceptance and the course of the traditional *adoption curve* starting with the innovators and early adopters. A decisive point in Fig. 4.3 will be the entering stage of the diffusion curve. This is a familiar exercise for auto manufacturers when it comes to the introduction of a new car model. However, in this case self-driving cars cannot be treated simply as a new series. The innovation is too disruptive in all dimensions to do so. It has to be treated rather as the next wave of technology and a new S-curve companies need to jump on. Right now it seems that many automobile original equipment manufacturers (OEMs) are thinking of overcoming the entering stage of the diffusion model by simply continuing current car model strategies and at the same time scaling up advanced driver assistance systems until they arrive at a fully autonomous version. This intended seamless transition to AD may be attractive in preserving existing business models but won't be adequate for the degree of disruptiveness self-driving cars offer for new business opportunities.

4.3 Adding the Voice of the Crowd to Autonomous Driving

In order to understand the development of research in AD in the last years, it is important to take a look at the existing literature. The literature review of Rosenzweig and Bartl (2015) led to 399 peer-reviewed academic contributions identified form various academic literature databases. The search is based on specific terms such as “autonomous driving”, “self-driving car”, and “driverless car” either in the title, keywords, or abstract. The findings show a continuous increase of publications over time. In the last five years more articles have been published than in the whole two decades before. A journal count analysis shows that the IEEE, the world’s largest professional association for the advancement of technology, contributed a large share of published contributions on the topic. This corresponds with the findings of a conducted topic analysis which reveals that more than 90 per cent of all publications focus on technology development of robotics, autonomous systems, vehicular technologies, and so on, while only 1 per cent of the published work has a research focus on user acceptance of AD. This lack of knowledge on the user perspective and their acceptance of the technology is currently the most pressing research gap and makes self-driving cars a showcase for a technology push innovation. This research study intends to add the user perspective by analyzing the largest existing user data set on autonomous driving which is formed by several hundreds of thousands of consumer statements in social media.

The development of the web and social media content has led customers to discuss their thoughts, opinions, experiences, and feelings online, creating a massive, publicly available data source (Egger and Lang 2013). This immense data source can help us identify sentiment, affect, subjectivity, and other emotional states in online text leading to new thrilling opportunities to understand the general public and consumers in almost every topic (Pang and Lee 2008). Social media analysis as a foresight method can detect emerging consumer needs long before the general public recognizes them (Chan and Franklin 2011; Keller and von der Gracht 2014; Olson et al. 2012). Web-monitoring methods are particularly appreciated for their holistic analyses, earliness and forwardness, and future orientation while including present aspects as well as the current context and exibility (Landwehr 2007). Particularly, social media content on a big data scale is appreciated as a useful source of information because it is the social web where critical discussions develop their own dynamics faster and on a broader reach than other forms of media (Francisco 2008; van Liere 2010). Thereby, the content of social media posts delivers nonredundant and diverse knowledge and information

(Hecht and Gergle 2010; Rodan 2010). Thus, social media monitoring is a tool for generating foresight during the emergence of an issue, trend, or topic such as autonomous driving. This vague information in its early phase of development is described as a weak signal (Ansoff 1975, 1980). Social media analysis can serve as an instrument to detect weak signals to which companies respond and upon which they base their decisions (Keller and von der Gracht 2014).

4.4 The Method of Innovation Mining

Innovation mining is a particular form of social media analysis that focuses on innovation-related topics (Bartl 2015; Bartl et al. 2016a). Whereas common web-monitoring techniques are mainly used to gather insights about brand perception or media impact (Croll and Power 2009; Egger and Lütters 2013), innovation mining aims to match technologies and product attributes with user applications and adoption behaviour. Considered mainly a quantitative method it relies heavily on key technologies such as artificial intelligence, automatic web information retrieval, and natural language processing for tracking and analyzing Internet content in search for patterns, trends, and valence (Pang and Lee 2008; Kruse et al. 2013). Web monitoring in general is not only considered one of the fastest-growing forms of media, but is also regarded as a scientifically well-grounded analysis of UGC (Egger and Lang 2013; Gensler et al. 2010). UGC is perceived as being impartial and unbiased, while it offers the chance to understand the needs and doubts of the potential customers as well as the used language within a certain topic (Egger and Lütters 2013). Characterized by extensive volunteering effort, lack of central control, and freedom of expression (Rheingold 1993), it creates a basis for identifying and understanding opinions, desires, tastes, needs, and decision-making influences of customers in a passive nonintrusive manner (Kozinets 2002). A vast part of UGC develops in online communities, which are considered as thematically focused platforms where knowledge is exchanged regarding specific product domains. Such communities work as meeting places for users to discuss new product ideas, opportunities, and product improvements (Kozinets 1999), where continuous discussion regarding opinions, attitudes, needs, and discontent concerning all kinds of topics, products, brands, and companies is expressed (Bartl et al. 2012; Egger and Lang 2013; Füller et al. 2006).

Figure 4.4 shows the five-step approach of innovation mining. Whereas the first and the last steps are specifically aligned to the context of innovation, steps two to four represent the commonly applied core process of social media analysis (Egger and Lang 2013).

The search and collection process focuses on the gathering of textual content, available in sites open for public reading access and based on Information Retrieval (IR) (Robertson 1981). In order to gather all the possible UGC regarding AD, the web-monitoring tool InMap was used for the study at hand, provided by the technology company Insius and developed in cooperation with the University of Cologne. Like other IR systems available to the public, such as Google, Bing, Yahoo, Twitter, and Facebook, the search tool uses Boolean keyword combination-based query language. In order to analyze the field of AD a general search including "autonomous driving" OR "self-driving car" OR "self-driving cars" OR "driverless car" OR "driverless cars" OR "autonomous vehicle" OR "automated driving" OR "piloted driving" was conducted. The search led to around 471,000 documents including one or more of the searched terms within user posts. The search concentrated on the English language without any specific geographical limitation with a focus on

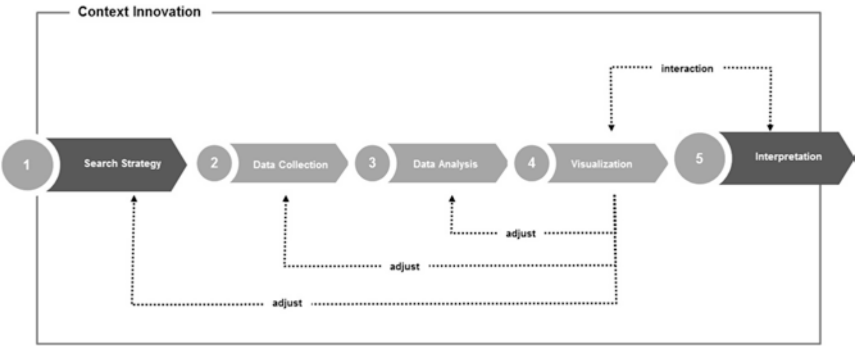


Fig. 4.4 The five-step approach of innovation mining

including technology affine UGC sources. The social chat on Facebook and Twitter was not included in this data set.

As the search results include content published by editors as well content created by users a further sub-step was required referred to as "clean-up". In this sub-step a manual selection process of irrelevant websites where UGC cannot be found such as patent sites, research sites, and so on are eliminated, which led to the reduction of the results to around 381,000 documents. Furthermore, as in the available sources UGC and non-UGC are still combined, the remaining results are analyzed to see if they fulfil the three main aspects of UGC by the Organisation for Economic Co-operation and Development (OECD) (publication requirement, creative effort, and creation outside professional routines and practices; OECD 2007), while also eliminating duplicates. Finally, machine-learning techniques were utilized. For this process 1529 results were manually analyzed, classified, and used to train a classifier to order the rest of the unclassified texts. This final sub-step led to a total of 106,305 documents defined as UGC with a precision of 99.5 per cent, and a recall of 91.5 per cent (see formulas presented in Fig. 4.5).

$$\text{precision} = \frac{\left|\left\{\text{relevant documents}\right\} \cap \left\{\text{retrieved documents}\right\}\right|}{\left|\left\{\text{retrieved documents}\right\}\right|}$$

$$\text{recall} = \frac{\left|\left\{\text{relevant documents}\right\} \cap \left\{\text{retrieved documents}\right\}\right|}{\left|\left\{\text{relevant documents}\right\}\right|}$$

After the search and collection procedure, the in-depth analysis of the 106,305 retrieved documents followed. The process of the analysis is described in this section while actual results are presented in the following chapter. As a first step documents are analyzed to be classified on the overall sentiment, based on document sets where the general sentiment is

$$precision = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retrieved\ documents\}|}$$

$$recall = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{relevant\ documents\}|}$$

Fig. 4.5 Precision and recall formulas

known due to a star system ranking, manual classifications, or sentiment ratings. Also, unsupervised machine-learning approaches can be trained to classify with the available data either in a binary approach (positive or negative) or continuous between two bounds. The second step focuses on a more detailed analysis, breaking the documents into smaller textual entities first, such as sentences, phrases, or words. Using tokenization techniques, sets of text can be divided according to specific rules in order to identify particular words, word phrases, sentences, or passages taking into consideration special exemptions such as abbreviations or enumerations. In addition, in this step the bag-of-words method can be utilized along with word frequency distributions to eliminate information that is not valuable such as articles ("a", "an"), conjunctions ("and", "or"), and direct speech ("I", "you", "me", etc.) if necessary.

Furthermore, sentence detection techniques have to be applied to break down documents into coherent sentences, which can be further analyzed in a highly simplified explanation through aspects that are represented by nouns (e.g. car) and sentiments that are represented by adjectives or adverbs (e.g. good, bad, poor, etc.). To identify the nouns, adjectives, and adverbs, Part-of-Speech Taggers (POS-Tag) from natural language processing can be used where each word is classified into its respective category (nouns, adverbs, adjectives, conjunctions, etc.) and then mapped. This classification then leads to several possible sets of combinations such as "Noun-conjunction-noun-verb-adverb-adjective" that would match "Design and quality was very good" (Egger and Lang 2013), reflecting that sentences including both nouns and adjectives are regarded as candidates for bearing customer opinions. Other aspects such as distance between different words are also analyzed. Further rules apply to understand the sentiment of a sentence such as polarization, meaning the inclusion of a negation (e.g. "not good" or endings such as "n't") where the sentiment although having a positive adjective (good) changes to a negative perception. The basic idea is the analysis and understanding of different word combinations or POS-Tags as complete sets of words. After the determination of the opinion, the candidate's further normalization, aggregation, and pruning steps are performed for summarization. Finally, the results are also analyzed on a world level, through the analysis of word frequency distributions within and across documents, smaller text entities that prove helpful to gain insights into topics, most relevant vocabulary within a topic, as well as specific vocabulary such as automotive brands names.

Finally, after the analysis of the results is concluded, proper visualization techniques to understand the gathered data such as tag clouds, network representation, pie and bar charts, line graphs, data series plots, and bubble charts are used. These give the ability to define selected information for a thorough analysis through specified time frames, within certain phrases, through geographical regions, to differentiate among sources, and so on. The results of the search are presented in detail in the following chapter.

4.5 Study Results

In order to find out how users actually refer to autonomous driving a frequency analysis of the most used terms was conducted as presented in Fig. 4.6. Despite the fact that the term “autonomous driving” is more accepted in the academic literature on the topic, also encapsulating a broader technical perspective, the results showed that from the users’ perspective “driverless car” or “self-driving car” are much more used and accepted terms. “Driverless car” can be observed to be the most popular term with 22,383 mentions throughout the data set. Such insight is highly valuable for companies in order to align product naming, communication strategy, and market introduction activities.

Understanding the most influential social media sources is valuable information in order to recognize where users talk about AD in the web, where the most engaged types of customers can be found, and how influence structures work. The vast majority of quotes are distributed in many diverse sources (see Fig. 4.7). A high volume of discussion regarding AD takes place in Reddit.com, which is the most impactful single source on the topic with around 10 per cent of the total discussion. It contains ten times more customer quotes than the second-placed UGC source quora.com with nearly 1 per cent, followed by arstechnica.com, with similar impact on the topic as ask.fm. Reddit is a leading social news aggregator on the Internet. Arstechnica is a technology, news, and information website

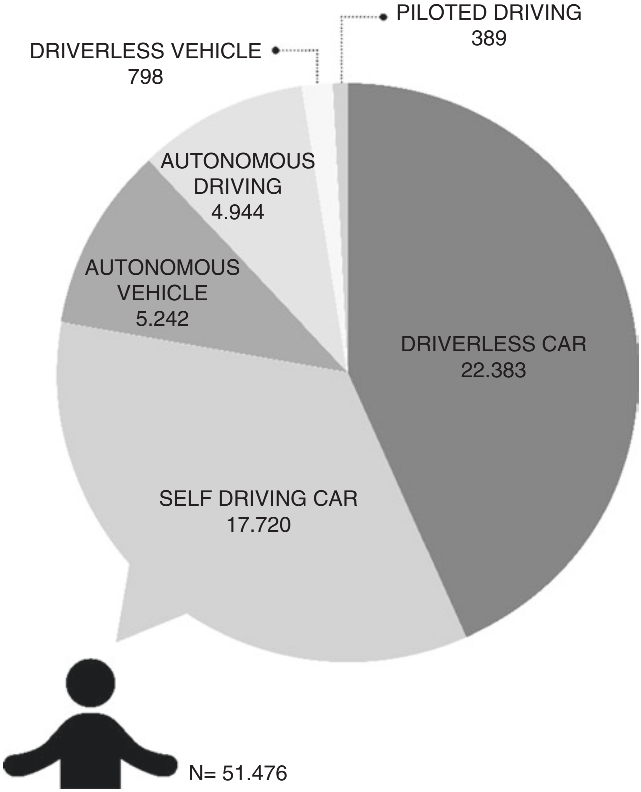


Fig. 4.6 Nomenclature analysis (adapted from: HYVE Science Labs 2015)

that publishes news, reviews, and guides where the writers are mainly postgraduates and research institution workers. They are both considered as technology-focused media where early adopters and most knowledgeable users of technology can be found while also being regarded as top technology discussion sites. Quora, on the other hand, is a question-and-answer website where questions are asked, answered, edited, and organized by its community of users. Recently valued at nearly $1 billion, it is among the top 200 websites globally.

Moreover, analyzing the topic evolution over time, it can be observed that there has been a strong and rapid growth since 2010. Compared to the literature review analysis (Rosenzweig and Bartl 2015), which has a

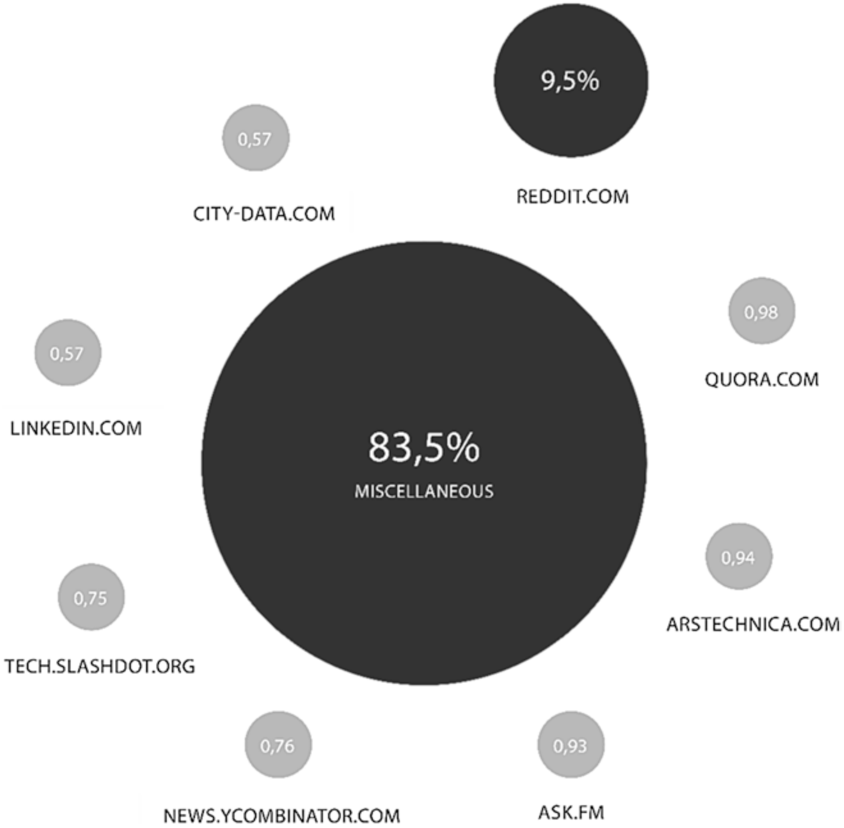


Fig. 4.7 UGC data sources (adapted from: HYVE Science Labs 2015)

steadier and constant growth of publications over the years, this can be due to the fact that posts and news have much more sudden reactions compared to the formality and reaction time of the academic literature on the topic. The interest in the topic can also be related to the official Google driverless-car debut in 2010. Since then the volume of the AD discussion has been doubling every year. In a more detailed monthly view shown in Fig. 4.8, two peaks, the first in May 2014 and the second in March 2015, can be found. Relating this high UGC volume to the main sources, the most impactful single discussions can be identified. The highest volume in customer discussion can be observed in March

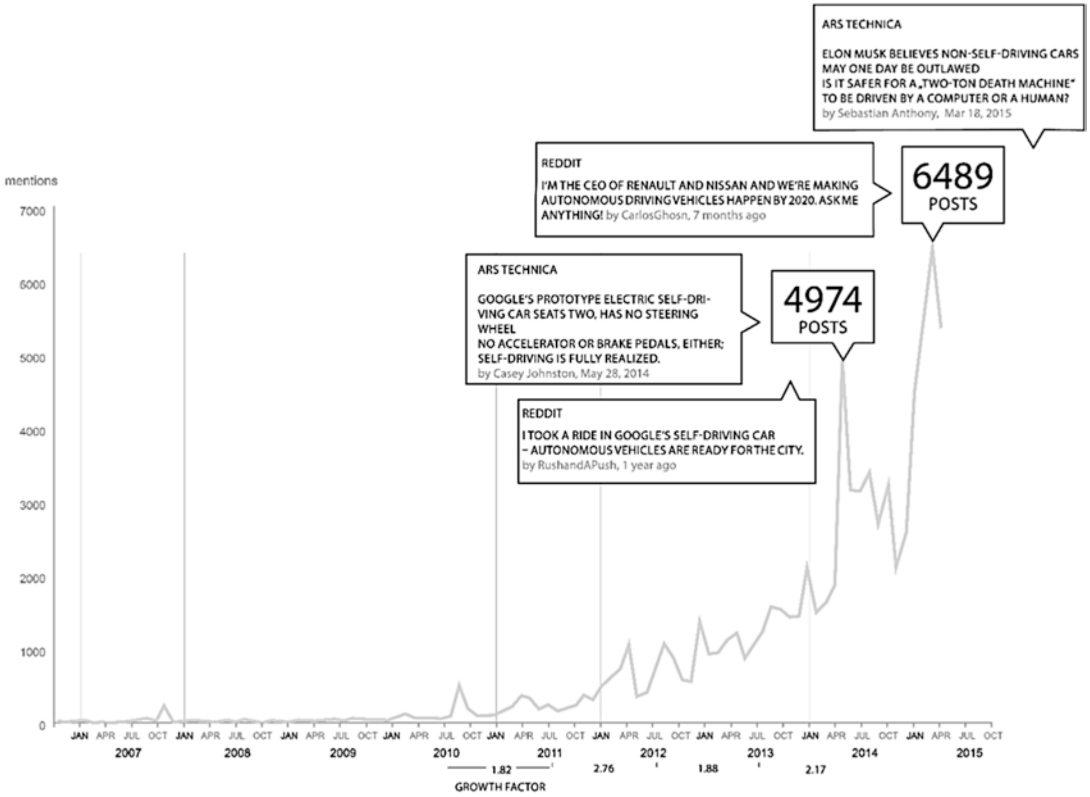


Fig. 4.8 Consumer conversation over time (adapted from: HYVE Science Labs 2015)

2015 with 6489 posts. This was triggered partly by Elon Musk's (CEO of Tesla Motors) comment that non-self-driving cars would someday be outlawed. In the same month the most impactful discussion was when Carlos Ghosn (CEO of Renault and Nissan) opened a forum of open questions regarding the topic and promoted it through Twitter. The second month with the highest volume of discussion is May 2014 with 4974 posts when Google revealed its prototype Google Car for the first time. Another impactful discussion in that month includes an article from a reporter that "took a ride in Google's self-driving car" and was debated in Reddit.

In order to understand how people talk about AD in more detail, the inherent concepts of the 106,305 documents were further analyzed with the help of a network map. "Concepts" are defined as nouns which carry a polarization, being either positive, negative, or neutral, depending on the adjectives or adverbs (sentiment carriers) with which they are mentioned in a sentence. The most mentioned "concepts" within the concept map (see Fig. 4.9) are positioned nearer to the centre while the importance decreases towards the outside. The number in the circles represents the recurrence of each concept in percentage. The polarization of the "concepts" is reflected through colours. Yellow are neutral, red are negative, and green are positive concepts. Therefore it can be observed that the most important concepts in the AD field are discussed with a neutral position and are without surprise "car", which is mentioned in 76 per cent of the comments, followed by "vehicle" in 20 per cent of the comments, and "technology" in 10 per cent of the comments. An interesting fact to state is that positive Internet discussions occur twice as much as negative ones. This is in contrast to many of the traditionally conducted and survey-based market research studies, which show a much more sceptical picture of consumer attitudes towards AD. This may be explained by the fact that UGC is contributed by (lead) users who generally like to deal with innovative and advanced topics (Jeppesen and Laursen 2009). They face needs and requirements months or even years before the bulk of the marketplace encounters them.

Deeper understanding on the positive, negative, and neutral concepts is achieved through contextual and background information given to each concept by the concept drivers. Drivers are defined as the polarized words

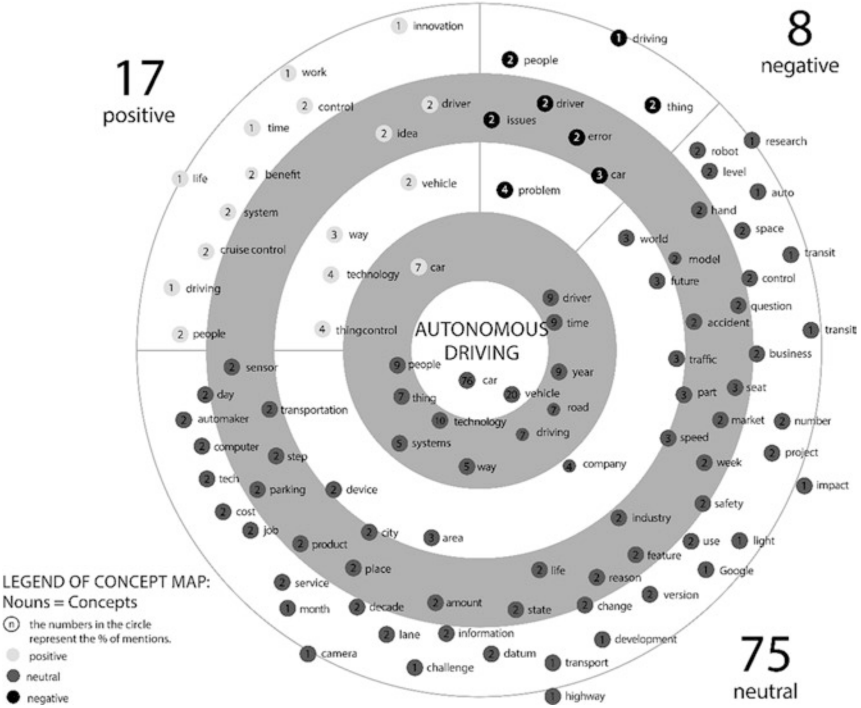

17
positive
8
negative
75
neutral
AUTONOMOUS DRIVING
LEGEND OF CONCEPT MAP:
Nouns = Concepts
ⓝ the numbers in the circle represent the % of mentions.
positive
neutral
negative

Fig. 4.9 Concept network map including the 100 most important concepts of AD (adapted from: HYVE Science Labs 2015)

co-occurring with the respective concept. These drivers act as indicators of readiness of the technology from the user perspective. The results of the driver analysis are shown in Fig. 4.10. Within the top positive concepts the main drivers that make this concept positive are “fully autonomous”, “smart”, “safe”, “modern”, and so on. On the other side the appearance of the driver “expensive” among the top negative concepts reflects the current user perspective of the still high prices of technology. The main other negative drivers are “less”, “average”, “inevitable”, and “dangerous”. The driver “electric” appears highly ranked in the top neutral concepts signalizing the continuous mentioning of electric gears in the AD context.

To analyze the competitive field of AD it is of high importance to understand how traditional automotive industry stands versus digital players. A frequency analysis of the competing brands developing AD

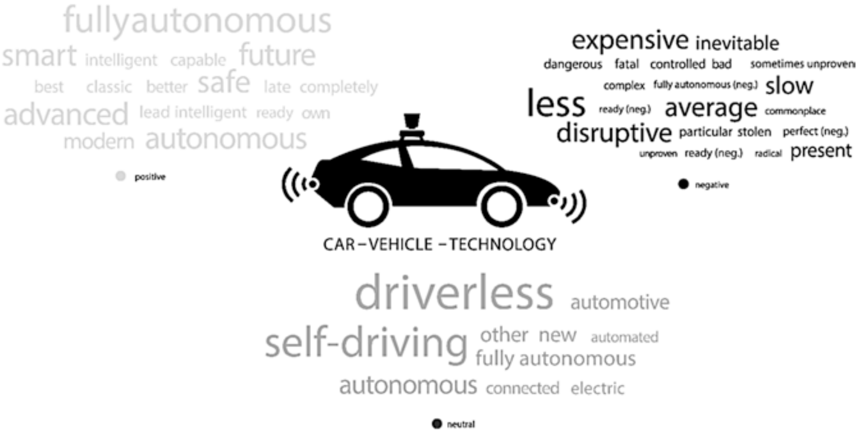

fullyautonomous
smart intelligent capable future
best classic better safe late completely
advanced lead intelligent ready own
modern autonomous
positive
expensive inevitable
dangerous fatal controlled bad sometimes unproven
complex fully autonomous (neg.) slow
less ready (neg.) average commonplace
disruptive particular stolen perfect (neg.)
unproven ready (neg.) radical present
negative
CAR–VEHICLE –TECHNOLOGY
driverless automotive
self-driving other new automated
fully autonomous
autonomous connected electric
neutral

Fig. 4.10 Positive, negative, and neutral drivers for the concepts "car", "vehicle", and "technology" (adapted from: HYVE Science Labs 2015)

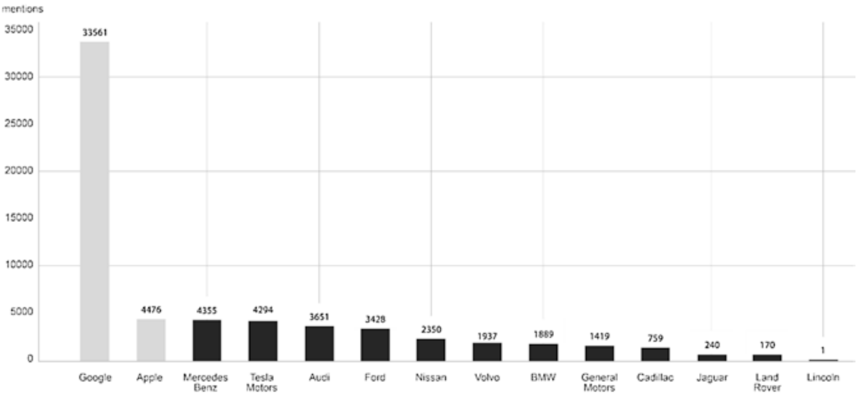


Fig. 4.11 Brand name mentions within posts on AD (adapted from: HYVE Science Labs 2015)

technology was conducted in order to understand the presence of each of the main brands in the public online discussion. Figure 4.11 reflects the number of times each brand is mentioned throughout all the documents, either with a sentiment or without a sentiment in the sentence.

The data clearly reflect the intense efforts of Google to be the first to offer the technology and to be successful in communicating its advancements to the public, as well as positioning itself as the technological leader in the users' perception. Google manages to be mentioned more frequently than all other brands together with a total of 33,561 occurrences. Furthermore, it is important to notice that Apple, despite not having officially made any announcements regarding AD and being supported only by rumours, comes in second place with 4476 mentions. This makes the two biggest digital players the leading brands in the AD discussion. Tesla, a third player from the Silicon Valley, is positioned in the top five followed by the majority of the traditional automotive players of which only Mercedes and Audi are positioned in the top ranks.

A concluding analysis was dedicated to the positive concept "time" with its most influential driver "free time". This driver demonstrates the consciousness of the customer of one of the main benefits that AD technologies bring: to engage in different activities rather than driving. The potential of regained time in the car is huge, that is the average US driver spends around 465 hours per year driving a car (Frazzoli 2014). Hence, the question is what users would do with their new free time? The most frequently mentioned activities by users reveal the word "Internet" and "Email", which are mentioned more than 8000 times (see Fig. 4.12). The concepts "TV" and

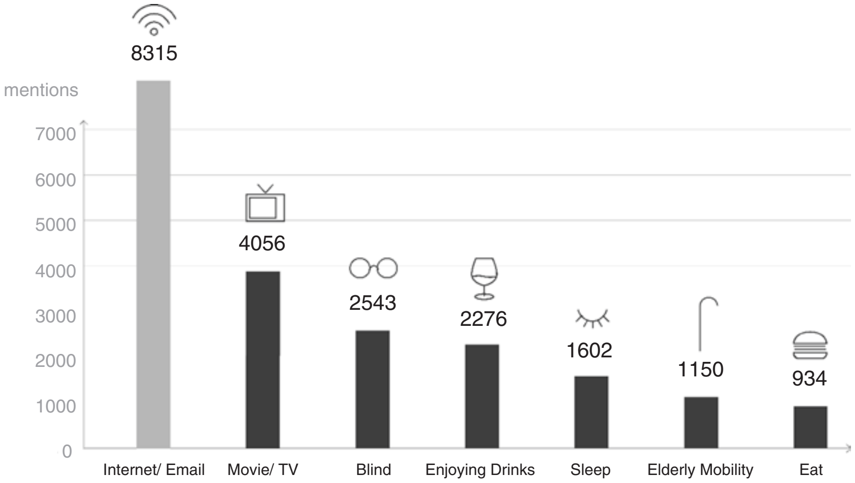


Fig. 4.12 Activity mentions related to AD (adapted from: HYVE Science Labs 2015)

"Movie" reflect another main category of activities the users discuss. The extensive chat regarding blind people driving cars can be directly related to Google's successful campaign showing a blind man taking a ride to a Taco Bell in a self-driving car. Surprising is the high volume of discussion on the wish of enjoying a glass of beer or wine ("Enjoying Drinks") and enabling elderly people to win back some of their lost freedom of movement. Hence, automated mobility seems to become an important catalyst of future social interaction. The categories of sleeping and eating complete the more than 20,000 mentions on possible activities in a self-driving car.

4.6 Outlook

The field of automotive innovation is notably radical because it is embedded in a whole ecosystem where traditional players and nontraditional players are involved. Some known players in the game are OEMs, suppliers, logistics, and passenger and freight transportation. In addition to the advantage of fewer accidents one major outcome of autonomous driving will be that the occupant will have a substantial and increasing free time budget within the car. The competition to get a share of the consumer's time budget has already begun. Just as a thought experiment, think about what known industries could do to serve their customers in the setting of fully autonomous cars. Warner Brothers, Barnes & Nobel, EA Games, and publishing houses want to bring their entertainment offerings and offered content to the car to reach a new audience. As shown in Fig. 4.11 companies like Google and Apple have already great prospects of bringing their services into the self-driving car. Car rentals or companies such as Uber see new opportunities for passenger transportation. Insurances develop new offerings. Designers and manufacturers of furnishings could think of new concepts to revolutionize the interior of cars. Fast food restaurants or food delivery services could utilize autonomous distribution services. The same applies to logistics companies such as DHL, Fedex, and UPS. The energy providers could think of movable charging stations which can load, store, and release energy as part of a revolutionary decentralized energy system. Steel and carbon companies can think of totally new coachwork concepts. Nestlé and

Unilever can invent new healthy snacking concepts for break time. Travel Agents such as Thomas Cook and TUI will have a huge playground to offer amazing experience routes or traveling arrangements where one is driven overnight to the holiday destination of one's choice. A provider of office accommodation can develop fleets of mobile offices to add them to their mortar and brick office offerings. When you think about all this through experiment and the hypothetical scenarios derived, it becomes obvious that AD cannot be mastered by a single industry. There will be new partnerships, collective efforts, business models, and joint developments and ventures to profit from the new time budgets consumers can spend on competing activities such as working, relaxing, travelling, being entertained, eating, and so on. Based on these thoughts the authors want to term AD the master class of open innovation. One needs to utilize a collective brain and collective problem solving to handle all the new dimension of the demand side. Right now it really seems to be a field predominantly driven by technology push. Strongly missing is the consumer perspective as well as thoughts on use case scenarios and business model generation. This innovation mining study adds the perspective of the crowd to address the existing research gap.

An important future challenge in innovation management will be to find the right role for social media in the process. One key to answering this challenge will be to pick the best available mix of approaches that fits each company individually. Generally, innovating companies have two basic options. First, they can actively involve and engage customers using cocreation and crowdsourcing techniques. Second, they can utilize already existing user-generated data pools. Both netnography and innovation mining belong to this second group of exploration methods with the aim of analyzing, interpreting, and integrating the voice of the crowd in innovation activities. The two techniques form a symbiosis with netnography emphasizing the qualitative dimension of generating in-depth consumer understandings based on smaller data samples and intensive manual work of the researcher. Innovation mining is emphasizing the quantitative dimension, especially regarding data volume and processing speed. Using a metaphor, netnography is the tool which could be characterized as a microscope whereas innovation mining represents the telescope. In times where the amount of accessible user data is rapidly increasing year by year up to an inconceivable volume of data, automatized approaches to utilize the voice of the crowd will naturally gain attention. In the context of innovation management the first studies on innovation mining in the field of autonomous driving, augmented reality, and chemicals proved to have very promising results in detecting weak signals and exploiting information arbitrage to support foresight and a user-centric view on technology acceptance (Stockinger 2015; Bartl 2015; Francisco 2008). However, there are still some inherent limitations in a process of automated web crawling based on natural language-processing algorithms. The aggregated format still cannot always reflect human intelligence and language skills to read "between the lines" and interpret consumer insights. There will be an equilibrium of quantitative and qualitative research to fully utilize social media for innovation with a huge need to catch up with quantitative methods in times where data is called the new oil in a digital economy.

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5

Innovation in the Spanish Twittersphere: An Ontology and Stakeholders' Salience Analysis

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Israel González-Carrasco, Nora Lado,
and José L. López-Cuadrado

5.1 Introduction

Over the last few years social media has exploded across the Internet with people everywhere creating and sharing enormous quantities of information and media content. Tools and technologies for managing and analyzing the vast quantities of data exchanged over the Web have provided the means for analysis of this content. Big Data analysis can be used to support the management power of social media sites.

This research presents the result of analyzing over 200,000 tweets published in the Twitter Social Network between May and December 2014.

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The tweets were related to the context of innovation in Spain as they are written in the Spanish language. The analysis includes, among other elements, the media that generates the tweet, the innovation sectors, the provenance of the tweet, the events that are promoting innovation actions, where to get funds to make an innovation, which are the main innovative companies and the different sectors preferred by innovative people. Taking into account these topics, an ontology of innovation-related terms in Spanish has been defined for the analysis.

The objective of this research is twofold: (i) to determine the importance of the innovations, taking into account their mentions on the Twitter Social Network and (ii) to identify the main stakeholders in innovation-related issues and estimate their salience according to different metrics. For achieving this goal, a rigorous multidimensional analysis has been conducted based on big data techniques. The research team has also defined a conceptual ontological model for the definition of the corpus to be applied in this context. For this task, the authors have based their data on previous research about innovation and stakeholder theory, its main players and the media used for promoting the innovation. Results obtained with this research have useful implications for enterprises, especially for those who are involved in innovative sectors and primarily seek to respond positively to the technological changes by means of innovative successful applications. Moreover, results obtained also point to Twitter as a system used and applied to stimulate and foster an organizational culture based on the innovation. Finally, this research explores the different concepts of the users of Twitter and their role in the global innovation system, as well as the diverse media involved in the communication and promotion of innovation. The main stakeholders are identified and compared in terms of their salience, considering both dimensions: power and legitimacy. Thus, this study tries to shed light on how these perspectives are articulated from what authors call the economic order and the institutional order within the innovation system, which are crucial for an integrated understanding of the dynamics of these innovation processes.

According to industry rankings Twitter is the most popular social media platform in the world and its capability of rapid communication distribution is considered a vital communication platform in cases of recent large-scale events (Morstatter et al. 2013). Taking all this into consideration, the

Twitter Social Network is a prime platform for developing a framework that allows for information retrieval to support analysis and management of Big Data on social media. Evaluation of the data produced on this platform offers a comprehensive peek into the needs and interests that are occurring on the Twitter Social Network with reference to the innovation sector in Spanish and its most relevant stakeholders.

Therefore, this research is a comprehensive analysis of the needs and interests that are occurring on the Twitter Social Network about innovation. This analysis has been standardized with the creation of a specific ontology and using Big Data techniques. Finally, the significance of this proposal is validated through a case study focused on innovation and the microblogging services of Twitter.

This chapter consists of six sections and is structured as follows: Sect. 5.1 introduces the aims and goals of the proposal; Sect. 5.2 reviews the relevant literature about the state of the art; Sect. 5.3 presents the techniques and methods included in this research; Sect. 5.4 discusses the proposed taxonomy and the framework architecture; Sect. 5.5 shows the Twitter case study; and finally, Sect. 5.6 presents the conclusions.

5.2 Background

Social Media Role in Innovation Sharing Value

Innovation is a broad concept including scientific inventions, patents and technological or customer-oriented innovations. This wide range covers breakthroughs or radical innovation to incremental innovations. In general, we can define innovation as follows:

> [T]he intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, organization or wider society. (West and Farr 1990, 9)

This traditional definition is for stakeholders as customers, suppliers, partner organizations, communities or governments to whom innovation creates value (Lee et al. 2012). However, there is a new stream of research that signals the 'shared value' as the desired goal of all types of innovations.

In the contemporary world, social media offer an opportunity to share value among the different stakeholders involved in innovation in general. In this sense, social media enable organizations and institutions to participate in online dialogue with stakeholders and potentially permit them to be closer to their stakeholders. Social media has being defined as a unique collaborative environment characterized as the organization and its stakeholders, and the public can be a generator and a diffusor of content (a sender) and/or a receiver of content. According to Reitz (2012) this type of environment is adherent to an open systems model because the organization delivers outputs and receives feedback from the public. As a consequence, the organization can improve and leverage its responsiveness capacity to the evolution of the public's needs. The capacity of adaptation and adjustment to environmental changes is a requirement for the survival of an organization in a turbulent environment.

Several studies have pointed out the different roles of social media during the different phases of new product development processes. Kohler et al. (2009) and Filieri (2013) have shown that through cocreation initiatives based on the Web and social media, marketeers may promptly obtain information about customer needs and the best way to innovate and satisfy them. Filieri (2013) has analyzed the case study of an international food company that decided to outsource to their customers the idea generation and screening stage of the development process of a new product. The company attained substantial positive results in terms of both innovation and market intelligence generation. In addition, customers involved in the early stages of the development process of the new product allowed the company to better predict how customers will react to future offers of new products, minimizing the risk of future launches and providing relevant information for prioritizing innovation projects. Sigala (2012) concluded that for enhancing the idea generation process it is not only the quantity of consumer-submitted ideas by social media that matters; on the contrary, it is mainly the online interactions, dialogues and discussions that reveal much richer information for innovation.

Not only customer involvement in the idea generation and screening stages may be fostered by social media. Many companies have begun exploring the use of social media to tap the intellectual capital of their employees for innovation purposes (Dahl et al. 2011). Organizations can use social media for actively cooperating and interacting with individual customers or customer communities, employees and other stakeholders in the complete cycle of the cocreation development process of the new product, thus incrementing innovation success (Gruner et al. 2014). For instance, they can foster interaction through all the stages of new services or environmental product development processes: scanning and searching, idea generation and evaluation (e.g., Sigala 2012; Ngai et al. 2015); designing and testing new services (Dahan and Hauser 2002; Fuller et al. 2006, 2008; Rowley et al. 2007); developing/supporting social innovation communities that improve customer relationship management (e.g., Dahan and Hauser 2002); better understanding and prediction of innovation adoption and diffusion (Belvaux 2011); and launching, as this increases product awareness more than traditional advertising campaigns (Lopez and Sicilia 2013). The study of Peltola and Mäkinen (2014) indicates that there may be general benefits in considering social media as part of new product development practices; information might be distributed and more developed, improving the interfunctional coordination level. More ideas may be screened in a more rigorous way, and multifunctional approaches may become more integrated in daily routines. In general, social media tools may increase the potential absorptive capacity of the organizations in a wide range of innovation stages (Peltola and Mäkinen 2014) incorporating different stakeholders' views (Peltola and Mäkinen 2014).

Both interactivity and instantaneous characteristics of social media have impacted communications among firms and their stakeholders. And the impacts also work in reverse: the stakeholders' power and impact have been amplified by the penetration and growth of social media adoption. By participating in the dialogue, organizations have some influence on the conversations stakeholders are having about them. More significantly, this dialogue between organizations and stakeholders serves as a basis for the acceleration of the diffusion of innovations, to cultivate relationships (Tao and Wilson 2015) and strengthen firm innovation capabilities. This seems to promote stakeholders to raise their voices. In brief, social media empowers the stakeholders (Ruehl and Ingenhoff 2015).

Social Media and Big Data

Over the last few years the use of social media platforms such as Twitter has exploded. People all over the world continually create and share enormous quantities and types of content at an ever-increasing rate. Big Data analysis can be utilized to support the management power of social media websites. The recent success of media-sharing services has caused the exponential growth of community-contributed Big Data on the Web. The volume of data produced is of such magnitude that retrieving relevant information from this data trove is increasingly difficult, not only because of the data volume produced, but equally because of the varied nature and format of the content of these data. Besides the fact that social media platforms have become important and pervasive for social networking and content sharing on a global level, the technologies used in the development of these platforms and the services they provide to a broad user base are constantly evolving and developing (Grassi et al. 2011). Prominent examples of the high volume of use of social media platforms include, Facebook, MySpace, Digg, Twitter and JISC on the academic side. Because of their ease of use, speed and reach, social media is rapidly changing the dynamics of societal public discourse and the setting and cementing of trends and agendas in a broad range of topics including environment, politics, technology and entertainment (Nettleton 2013). In this sense, social media is of the greatest importance in influencing many types of users and environments with an increasingly engaged public which demands, evermore intensely, the need to find a variety of content from different paradigms (Yates and Paquette 2011). At the same time, social media is greatly enriching and offers the tools for new relationships subject to a largely globalized and demanding society (Crespo and Antunes 2013).

Due to the heterogeneous nature of the information that can be distributed with social media, and the large number of potential social media platform users, the analysis of social network populations and the data produced and consumed by these users can create a picture of the aggregate structure of a user's social world (Guy et al. 2010). Therefore, the extraction and visualization of data from social networks for analysis and in support of management across Big Data on social media have become vital to solving problems in different investigative fields (Guy et al. 2010; Endarnoto et al. 2011).

It is important to consider that recent research suggests that while news may be unpredictable, indicators can be extracted from online social media as reliable predictors of change as can be seen, for example, in economic and commercial indicators (Barbier and Liu 2011). Furthermore, in social media, Big Data extraction is often difficult, as many sites restrict access to Big Data tools to collect data through their service channel. One important problem, relevant to social networks, is that data are consumed in real time so the time for which this type of data is valid is extremely short. Consequently, to accomplish proper research, it is crucial to develop a component that allows useful Big Data extraction from social media sources. For this critical work a semantic model is proposed based on the retrieval information for representation of content which is acquired from social networks focused on the innovation sector.

Social Cognitive Theory and Stakeholder Theory

The Social Cognitive Theory posits that a person's behavior is partially affected and controlled by the influences of social network (i.e., social systems) and the individual's cognition. Bandura's social learning theory emphasizes the importance of observational learning, imitation and modeling. His theory integrates a continuous interaction between behaviors, personal factors and the environment. While social factors are important cognitive processes that help to understand innovation adoption behavior and innovation diffusion, this theory has being used to better understand innovation diffusion (Ratten and Ratten 1998; Ratten 2015). The role of social media in the diffusion and adoption of innovations can also be studied within the framework of social cognitive theory (Chiu et al. 2006; Zhou et al. 2014). Social media offers new sites for social connections and new contexts for social interactions. According to Bandura (2001) the diffusion of new ideas, innovative behavior patterns and new social practices is now being fostered by social media. Nowadays, the symbolic environment occupies a major part of people's everyday lives. As a consequence, the social construction of reality is increasingly mediated through electronic acculturation and social media participation.

According to the social cognitive theory, the social media characterized by multilinked relationships can raise the adoption of innovations since they deliver more factual information and mobilize tougher social influence factors.

Social factors are important cognitive processes that help understand the behavioral intentions of innovation adoption and innovation diffusion. Bandura's social learning theory emphasizes the relevance of a continuous interaction between behaviors, personal factor, in particular cognition, and the environment. In this environment main influencers are pertinent to identify whether we want to understand innovation diffusion. Here we can find the link to the contribution from stakeholder theory.

In stakeholder literature, the identification of the main stakeholder is considered a big challenge. As a consequence, the literature offers a variety of classification schemes, for instance, Freeman's (1984) distinction between 'can affect and affected' that achieves a milestone position. At present, the denominated salience model is one of the main classification models in literature (see, e.g., an application in Álvarez-Gil et al. 2007). The salience model is also used in the innovation context (Vos and Achterkamp 2006). The method we have developed does not focus on identifying stakeholders in general, but rather on identifying stakeholders in a particular context, in our case in social media contexts. Stakeholder salience is issue-based (Buysee and Verbeke 2003), indicating that some stakeholders may have more influence on certain topics. Stakeholders are defined as any party involved actively or passively in innovation. We have adopted and adapted Freeman's (1984) original definition of stakeholders to suit our investigation objectives. We view a stakeholder as any individual or any group of individuals who can be or is affected by innovations. Following Vos and Achterkamp (2006), we include any group which can affect or influence innovation achievement and diffusion (actively) or can be affected by innovation achievement (passively).

5.3 Techniques and Methods

In this section are detailed the most relevant techniques and methods included in the proposed solution in order to perform an analysis of the knowledge, needs and interests that are occurring on the Twitter Social Network about innovation.

Massive Information Retrieval (MIR)

The need to store and retrieve written information since the first use of paper has been increasingly important. Soon after the invention of computers it was realized that these machines could be used to store and retrieve large amounts of information (Singhal 2001). The field of information retrieval has come a long way in the last 40 years, and it is now easier to store and quickly retrieve information (Pasca and Harabagiu 2001). Techniques developed in the information retrieval field have been used in many areas and spawned many new technologies used on the Web today (Yu et al. 2003). With exponential growth in the amount of Big Data information being produced daily, information retrieval plays an increasingly important role today and will be increasingly important in the future.

Taking into consideration our own personal search habits it's not surprising that about 85 % of Internet users use search engines and search services to find information (Lynch 2008). Information retrieval is concerned with the retrieval of unstructured data, and the development of efficient methods of accessing information in huge texts has been guided by user demand for the retrieval of precise and complex information. Accurate retrieval of such relational concepts is challenging as they are essentially determined by semantics. For example, Vallet et al. (2005) present a retrieval information model based on a semantic search and Castells et al. (2004) present portals which typically provide simple search functionalities that may be better characterized as semantic data retrieval, rather than semantic information retrieval.

In this sense, the accurate retrieval of relational concepts is possible because we can precisely describe relational concepts using semantic annotations (Murdoch and Detsky 2013). Techniques developed in the field have been used in other areas yielding new technologies used by people on a daily basis.

Big Data

Big Data analytics, where advanced analytic techniques operate on Big Data sets, is about two things: 'Big Data and analytics' and how the two have teamed up to create one of the most profound trends in business intelligence (Bhoola et al. 2014).

Big Data is the term for massive data sets having large and more varied and complex structures with the related difficulties of storage, analysis and visualization for further processing and results (Sagiroglu and Sinanc 2013). Big Data and its analysis are at the center of modern science and business and it is difficult to avoid mentioning Big Data today given the broad recognition data value, and the products obtained through analysis of large data sets. These data are generated from online transactions, emails, videos, audios, images, click streams, logs, posts, search queries, health records, social networking interactions, science data, sensors, and mobile phones and their applications (Zikopoulos and Eaton 2011).

Examples in the literature are available in a wide number of areas from genomics (O'Driscoll et al. 2013) to medical records (Murdoch and Detsky 2013); McKinsey Global Institute specified the potential of Big Data in five main topics (Manyika et al. 2011):

- Healthcare: clinical decision support systems, individual analytics applied for patient profile, personalized medicine, performance-based pricing for personnel, analyzing disease patterns and improving public health.
- Public sector: creating transparency by accessible related data, discovering needs, improving performance, customizing actions for suitable products and services, decision making with automated systems to decrease risks and innovating new products and services.
- Retail: in-store behavior analysis, variety and price optimization, product placement design, improving performance, labor inputs optimization, distribution and logistics optimization and Web-based markets.
- Manufacturing: improved demand forecasting, supply chain planning, sales support, developed production operations and Web search–based applications.
- Personal location data: smart routing, geo-targeted advertising or emergency response, urban planning and new business models.

However, the Web provides some opportunities for Big Data tool use: for example, social network analysis and understanding user intelligence for more targeted advertising; marketing campaigns and capacity planning; customer behavior and buying patterns; and sentiment analytics (Salim 2012). Platform developments have experienced tremendous growth over the past few years in terms of size, complexity, number of users and a variety of use cases (Lin and Ryaboy 2013). Therefore, this research discusses the analysis and management of Big Data on social media, an area of exploitation in Big Data research.

Semantic Models

The Semantic Web is a new-generation Web in which the contents are more than a huge amount of information and poorly structured services, so let's use the information space that is usable for processing by machines, in addition to providing and facilitating used developing semantic models in different domains (Viinikkala 2004). There are different semantic models for knowledge management that can be applied in different domains like natural language, Virtual Reality, Neural networks, massive games, Expert Systems, Robotics, Systems Planning, Image Recognition, Translators, Troubleshooting, Systems Evolution and Machine Learning among others. However, models based on semantic knowledge for social network environments have not yet been fully exploited, constituting an open research area.

The semantic models use techniques like Content-Based, Collaborative Filtering and Knowledge-Based, according to Wang and Kong (2007). Thus, the conceptual semantic models that apply to different domains make use of these techniques for the development of various systems with multiple approaches. The systems make use of semantic models that involve integration and knowledge management through different techniques. For example, the case-based reasoning (Watson and Marir 1994), the techniques of problem solving that use knowledge (Kolodner 1992) or knowledge based on ontologies (Guy et al. 2009).

Ontologies can provide mechanisms for organizing and storing generic components including conceptual schemes on databases and application programs. In fact, ontologies are a new focus on research and development of new technologies in social networks (Pisanelli et al. 2002; Guarino 1998). Therefore, ontologies are developed and applied to a wide variety of emerging application areas, such as business modeling, diagnostics, decision making, planning and adaptation process modeling and systems.

Ontologies

Considering the semantic models, it should be noted that there are major advantages in using semantic models based on ontological knowledge, since such models are able to generate a broad area of knowledge with little information. Besides, they can cover the semantic contents of specific forms. Thus, it is possible to obtain a vast amount of information applied to different domains and products on the Web.

The ontologies for knowledge representation allow capturing representation primitives necessary to formalize knowledge about a given field. Moreover, they aim aim at providing a language that can be used to describe the classes and the relations between them that are inherent to documents and applications on the Web. Furthermore, they potentially provide a well-founded field for representation and exchange of structured information mechanisms.

Therefore, the general or common ontologies include vocabulary related with things, events, time, space and behavior, among others (Mizoguchi and Ikeda 1998). For example, Ontolingua is a system for describing ontologies in an established format that allows easy translations into a variety of systems for knowledge representation and reasoning. This includes the definition of classes, relations, functions and objects to keep the ontology in a single, readable form by a machine while it is used in systems with different capabilities like syntax and reasoning (Farquhar et al. 1997).

Analysis of Information

Individuals increasingly rely on Web-based sources for innovation sectors. Moreover, various business sector organizations are constantly publishing large volumes with information on innovation. Therefore, this information must be exploited by using semantic technologies. Besides, many decisions come from watching the information stream stored on the Web, selecting relevant data, analyzing it and acting accordingly, thus this process is very important for the companies and people in the innovation sector.

Consumption of Visualization and Information Retrieval will gradually increase and become faster and more efficient, thanks to better quality, reliability and transparency as well as fine-grained granularity of the data.

Consequently, consumption behavior of data on the Web tells us that emotions can profoundly affect individual behavior and decision-making, in related fields such as our everyday life, commerce, tourism, education, health and innovation sectors. Therefore, Big Data techniques are the fundamental building blocks of the Semantic Web.

The integration of Semantic information is crucial in many domains, such as bioinformatics, medical domains and other life sciences with a growing amount of data gathered in repositories. Integrating these datasets using the Visualization and Information Retrieval approach opens new possibilities for discovering better data on querying and visualization. Information visualization for information retrieval can be applied in different fields for the depiction and retrieval of information items (Koshman 2006). Li et al. (1991) present information visualizations applied to information retrieval semantics on the Web. Endarnoto et al. (2011) present an information extraction technique to get data on traffic, which can be presented in a map view as an Android mobile application. The common goal of these visualizations is to represent an abstract information space for document representation.

Sentiment analysis has been applied for research in online communication because it gives researchers the ability to automatically measure emotion in online texts (Pang and Lee 2008). However, the research by Davis and O'Flaherty (2012) evaluates the automated sentiment-coding accuracy of a broad range of tools. Overall, automated sentiment coding seems to have limited reliability in all types of social media monitoring tools. Thus, we claim that the sentiment analysis in Twitter is not accurate because of methodological limitations and because only a very small part of the comments in the Twittersphere contain sentiment. Consequently, it seems that content analysis is more relevant and richer than sentiment analysis.

5.4 Proposed Solution

Taxonomy

Information retrieval concerns the characteristics associated with the innovation sector which has been selected, whereby, through the monitoring of a set of criteria, an expert determines the characteristics. Thus, the users mention, through a social network, their characteristics relative to different criteria of innovation sectors. For this case study, the following criteria were selected: Apple, BBVA, Google, Microsoft, Samsung and Telefonica. BBVA is also providing innovation technologies to customers through a virtual prepaid card. Thus, it is an enterprise submerged in the innovation sector.

Therefore, by analyzing this content it is possible to identify the characteristics of the criteria based on the words employed by users. Figure 5.1 shows the taxonomy of the innovation technology model criteria. The criteria have been defined and formalized in the form of an ontology, which is the formal representation of a shared conceptualization (Gruber 1993). The terms, relationships and rules have been formally described in a defined language. The aim of the developed ontology is to provide a closed domain for the study and analysis of knowledge about innovation.

Architecture

This section shows the main elements of the framework employed for the analysis of the tweets based on the proposed ontology. This architecture is the core of an online platform called Twittiment.[1] Twittiment is a monitoring tool of the Twitter Social Network and it allows the articulation and organization of information by different topics and by analytical models defined, generated and maintained by the researchers or experts in the domain. The framework is able to capture all relevant information regarding a brand, an event, a sector, and so on, isolating sources of insights, identifying areas of interest and detecting associations (Villanueva et al. 2016).

The analysis performed with this platform is based on academic models, and is always adapted to key elements of the analyzed domain allowing quantitative and qualitative analysis of information mentioned on Twitter.

As shown in Fig. 5.2, the proposed architecture is based on three modules that interact with each other in order to

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[1] http://www.twittiment.com/

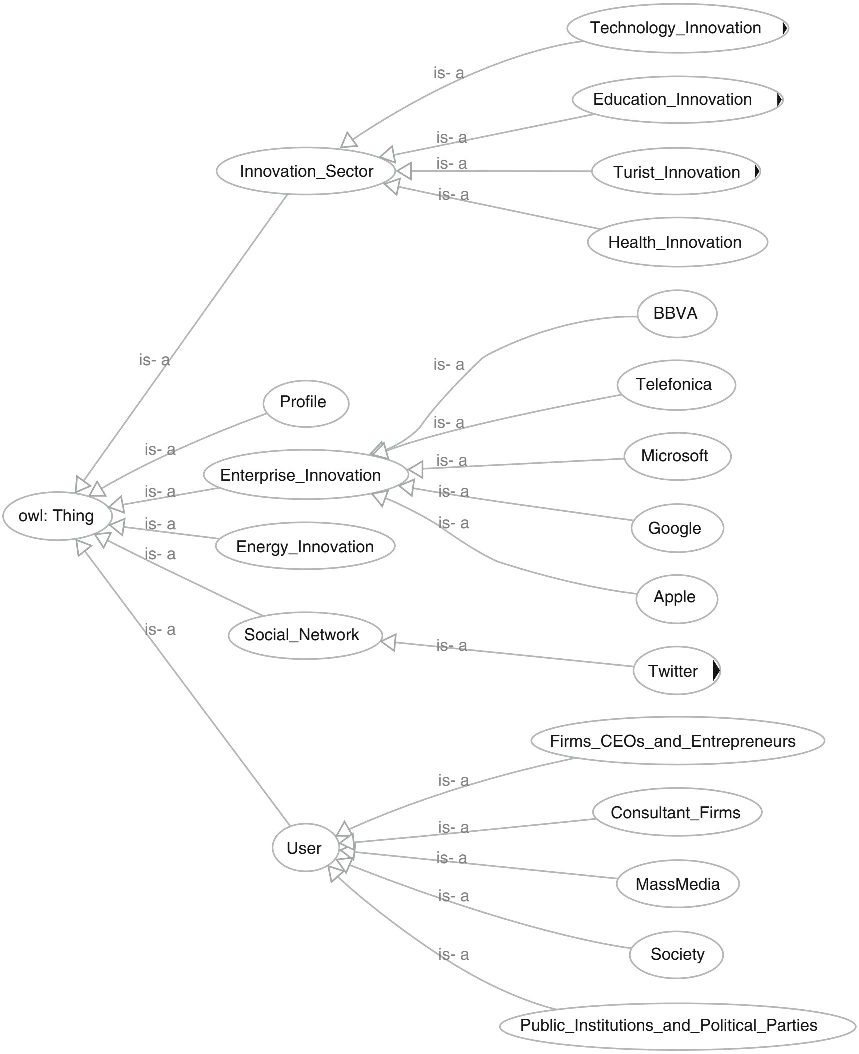
Technology_Innovation
Education_Innovation
Innovation_Sector
Turist_Innovation
Health_Innovation
BBVA
Telefonica
Profile
Microsoft
Enterprise_Innovation
owl: Thing
Google
Energy_Innovation
Apple
Social_Network
Twitter
Firms_CEOs_and_Entrepreneurs
Consultant_Firms
User
MassMedia
Society
Public_Institutions_and_Political_Parties
is- a

Fig. 5.1 Taxonomy defined in the research

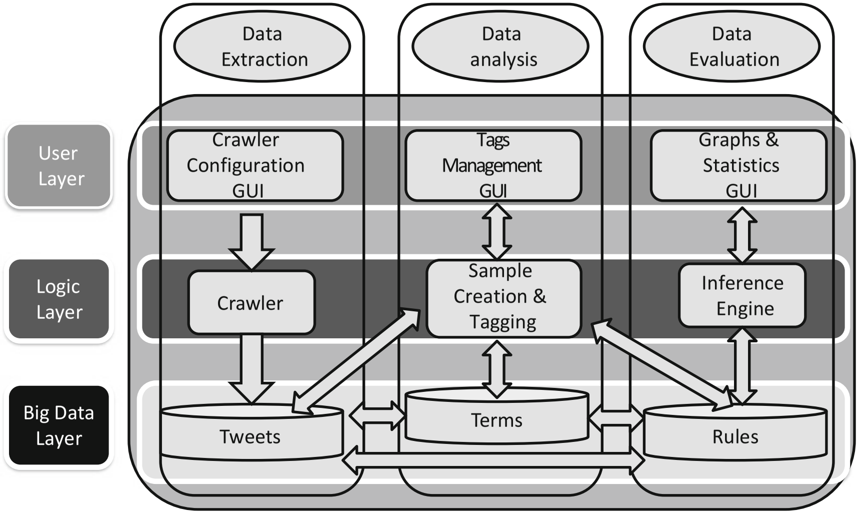
Data
Extraction
Data
analysis
Data
Evaluation
User
Layer
Logic
Layer
Big Data
Layer
Crawler
Configuration
GUI
Tags
Management
GUI
Graphs &
Statistics
GUI
Crawler
Sample
Creation &
Tagging
Inference
Engine
Tweets
Terms
Rules

Fig. 5.2 System architecture

- Retrieve the tweets related to a set of terms (Data extraction).
- Revise the main words found on these tweets according to a given set of terms. In this study these terms are based on an ontology (Data analysis).
- Evaluate the tweets according to a set of criteria based on selected terms (Data Evaluation).

The data extraction module is in charge of downloading all the tweets that fit with a set of conditions established according to the domain. The download of tweets is based on a crawler that uses the Twitter API to obtain the tweets. A simple user interface helps the user to configure the words to be taken into account by the crawler. Such words are defined as taxonomy for a given topic. In the context of the framework, a topic can contain multiple subtopics, and a topic at the lowest level can have one or more terms related to it.

As a result of the data extraction module a raw set of tweets is downloaded. The criteria for the selection of the tweets are based on words: if a tweet contains one of the words specified in the domain, the tweet will be downloaded. Once all the tweets have been obtained, it is necessary to analyze the results in order to filter the relevant information. As the number of tweets downloaded could be extremely high, first of all the framework selects a sample of *N* tweets where *N* could be configured by the user according to the characteristics of the domain to be analyzed. Such tweets are randomly selected in order to obtain a representative set of tweets. The sample selected is clustered by similarity in order to detect retweets. Finally the word frequency is computed over the sample in order to detect the most relevant words of the domain.

Once the word frequency has been calculated, the user can define tags and assign one or more words to each tag. In this way a set of rules is defined in order to categorize the tweets. Thus, a given tweet could be assigned to one or more tags. The relationship between words and tags is domain-dependent. In this way the same word could be classified in a different way according to the domain. When all the tags have been defined, the framework performs an evaluation over the sample set. As a result, the user receives information about the number of tweets tagged in the sample test, allowing the user to check that every tweet has been correctly tagged. In this process the user could refine the tag definition in order to improve the classification results.

When all the tags have been defined and the sample classification is all right, the whole set of tweets can be classified. As a result, the framework provides statistical graphs based on the defined rules.

5.5 Validation

The Twitter Social Network is used as a tool for analyzing tweets since it allows the users to write plain-text short-length messages, with a maximum of 140 characters, called tweets, on a variety of topics and different domains on the Web. For this research, a total of 212,086 tweets for the period from May to December 2014 were analyzed. The statistics for the extraction, analysis and filtering process are shown in Table 5.1.

In Table 5.1, the 'Tweets' column indicates the total number of tweets, 'Tweets Filtered' shows the number of tweets discarded manually (according to the experts' criterion), 'Tweets Classified' is the number of tweets that have at least one criterion, 'Virality' indicates the total number of retweets and 'Unique twitters' is the number of Twitter users who have written at least one tweet.

In the first validation test, 4269 tweets were filtered following the criteria of tweets related with at least one of the following enterprises: Google, Apple, Telefónica, Microsoft, BBVA and Samsung. Figure 5.3 shows the number of tweets and the percentage of each enterprise which discusses innovation in Spanish. In this case, Google is the enterprise that is mentioned the most in the tweets analyzed.

Furthermore, a specific analysis about technology and innovation in Spain has been conducted. For this purpose, several criteria about technology and innovation have been defined, such as 3D, TIC, Systems, Big Data, Platforms, Mobile App, Social Media, Start-up and Disruptive Technology. Figure 5.4 depicts the number of tweets that mention each

Table 5.1 Statistics of the extraction, analysis and filtering process in number of Tweets

	Tweets	Tweets filtered	Tweets classified	Tweets with hashtag	Virality	Unique twitters
Innovation in Spanish	212,086	23,428	103,186	109,246	79,183	83,952

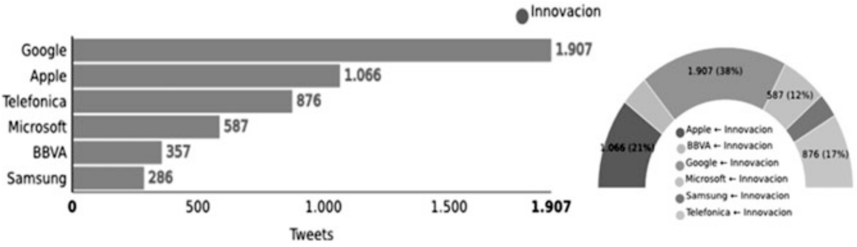

Fig. 5.3 Tweets about enterprises and innovation in Twitter

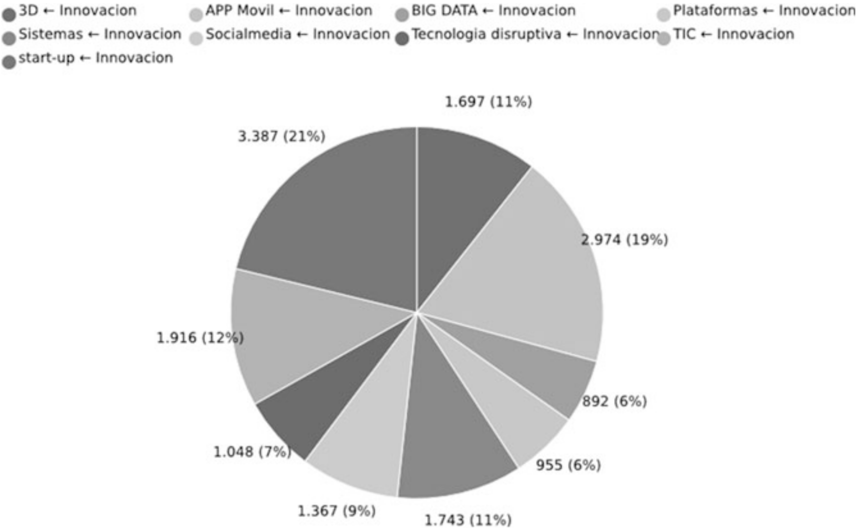

Fig. 5.4 Analysis of technologies in the context of innovation in Spanish

criteria and the corresponding percentage. In this case, the total number of tweets classified regarding these criteria were 15,979.

Finally, Fig. 5.5 shows the cloud of hashtags about innovation extracted from the tweets included in this research. The color of the word is associated with each of the technologies analyzed or is a tweet related with one enterprise (see Fig. 5.3). Moreover, the bigger the word appears in the cloud, the more mentions it has in the tweets analyzed. For example, Google is the enterprise that is mentioned the most in relation to Innovation within the corpus of tweets included in this research.

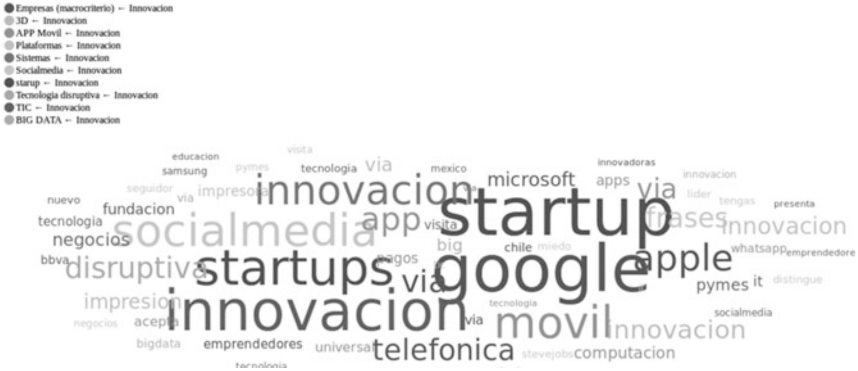

Fig. 5.5 Cloud of Spanish hashtags about innovation

5.6 Stakeholders Typology

In previous studies (Saurabh et al. 2014) the major stakeholders identified in a particular innovation ecosystem were higher-education institutions, industry, government, R&D labs, funding agencies, venture capitalists, high-net-worth individuals and the civil society. In our case, we propose and apply a new methodology to identify major stakeholders in social media for the innovation concept. Twitter has been chosen considering its capacity to impact and disseminate innovation-related issues.

The classical salience model of stakeholders considers power and legitimacy as its main aspects (Álvarez-Gil et al. 2007). In the social media context, the power of influence of a stakeholder comes from the part of the content in the Twittersphere related to innovation generated by stakeholders, and the capacity to spread this created content. In particular, the volume or part of the contents generated and the audience, the followers, of this stakeholder are indicators of its power. In terms of legitimacy, the degree of interest aroused by the content generated by stakeholders is crucial in the Twittersphere. A measure that reflects the degree of dissemination of this content, retweets in our case, is an indicator of this legitimacy. In addition, if some stakeholder is mentioned as a reference in a tweet about innovation created by other tweeters, it is also a signal of its legitimacy in the innovation context.

In this part, we are relying on the Users and Profile criteria included in the ontology shown in Fig. 5.1.

Construction of a Stakeholder's Typology

After a preliminary review of the data about innovation in Twitter, we were aware about the extensive atomization of users talking about innovation in the period of analysis. We focused on the period from May to December 2014. In this eight-month period 92,301 different twitters contributed to the Twitter conversation. We performed a preliminary analysis and realized that even when a lot of users exist, not all them have the same importance. For this reason we decided to follow an approach that enables the identification of key stakeholders for the entire period.

The identification of stakeholders comprised two iterative steps: In step one, we identified the key actors based on three main characteristics; in step two, we looked at all the identified users and then grouped them in homogeneous stakeholder categories.

Step one. Considering the most relevant indicators of the twitters' influence and power, we considered three different criteria or metrics: (i) effort, (ii) engagement and (iii) audience (Lado et al. 2015).

We looked for the 20 most active twitters, defined as those users who wrote most tweets in the period under study; in other words, the users who made a greater effort to post more content on issues related to innovation.

In addition, we selected the 20 most relevant users from the point of view of the engagement generated. To do this, we identified the users with the biggest total number of citations received in the period. Specifically, we used the sum of the mentions and retweets received.

Finally, the third criterion used was the number of followers. We again focused on the 20 twitters that showed greater potential audience, and thus selected the users with a greater number of followers.

This process allows us to identify the 56 top twitter influencers in the innovation context.

Step two. To categorize the users into different stakeholder categories, we first looked at the characteristics of each twitter's account (e.g., name, bio, country, activity) in order to have a clear idea about the user profile. Then, we clustered/grouped them in homogeneous categories. We coded each user manually according to the information each user displayed in his/her Twitter profile. Two expert researchers performed the categorization of the stakeholders in the innovation environment and validated the final classification. They constructed the categories of the stakeholder groups iteratively during this coding phase.

The result of the researchers' agreement is the identification of five different stakeholder categories:

- Firms, CEOs and entrepreneurs: Corporate accounts in Twitter of enterprises, managers and entrepreneurs as creators of content on innovation-related issues. They are the real innovators.
- Mass media: Official accounts in Twitter of newspapers, magazines, TV, radio, bloggers, and so on.
- Public institutions and political parties: Official accounts in Twitter of any public organization at a global, national or local level and the political parties.
- Consultant firms: All firms of experts providing professional services in innovation-related aspects.
- Individuals (public): The rest of the twitters including any particular or user accounts.

Stakeholders Analysis

The 56 tops twitters that conform to the different stakeholders are directly (written) or indirectly (mentions received) related with almost 60,000 tweets that talk about innovation in the period under review. In other words, as a whole this subset of key users represents less than 1 % of total users but together explains more than 26 % of content generated in that period. The great concentration of contributions and activity in the Twittersphere allow us to identify the most relevant stakeholders.

Considered together, the five groups are composed of 56 users who have written on average 242 tweets per day, meaning that on average each of these twitters have issued or have been mentioned in 5.2 tweets per day. This is a clear indicator of the influence of these users on content generated and spread on Twitter. The analysis of the daily percentage represented by this group of users is stable over time; however it also presents some specific peaks of representation. The most relevant peak, in June 2014, corresponds to the World Cup Football 2014 in Brazil, where several computer-related innovations were implemented. The other peak, in November, is related to an international award to a Spanish researcher for his medical innovation for cancer treatment. In both cases, the peak corresponds to a very special and specific event. In general, the contribution of the identified stakeholders to the innovation conversation in Twitter follows a stable pattern over time. This reveals a constant effort over time of the stakeholders in contributing to create and viralize innovation-related content.

Adapting the classical salience model of stakeholders that considered power and legitimacy as their main indicators (Álvarez-Gil et al. 2007) to our context requires new metrics. On Twitter the power of influence of a stakeholder comes from the part of the content in the Twittersphere related to innovation created by this specific stakeholder. It is a metric reflecting power in terms of content creation. Another indicator of power is the capacity to spread the created content, reflecting power in terms of the diffusion of innovation-related content. In particular, the volume or part of contents generated and the audience, the followers, of this stakeholder are proxies of its power. Regarding legitimacy, the degree of interest raised by the content generated by stakeholders is central in the Twittersphere. A measure that reflects the degree of interest generated by this content, retweets, is an indicator of this legitimacy. Finally, if some stakeholder is mentioned as a reference in a tweet about innovation created by other tweeters, it is also a signal of its legitimacy in the innovation context.

In order to have a clear idea about the dynamics and behavior of each group, we used four metrics—effort, engagement, followers and reach—as indicators of the salience of users on Twitter (Lado et al. 2015). To operationalize the four indicators we developed the following measures/metrics:

- Power_1. Effort: Total number of tweets created over time by a stakeholder.

- Power_2. Reach: The potential impact on Twitter of the content generated by each stakeholder. It is effort multiplied by followers.
- Legimitacy_1. Engagement: We measured the number of tweets that mention (retweets, replies and common mentions) each stakeholder during the period.
- Legimitacy_2. Followers: Followers of each stakeholder.

Table 5.2 and Fig. 5.6 compare the stakeholder categories over the different salience indicators.

In Table 5.2 we see that Consultant firms, Public Institutions and CEOs are the groups that create more content about innovation. When we focus on the potential reach of the content generated by each group, we observe the importance of Mass Media. This highlights the power based on the spread content capacity that characterizes this group. Mass media are the stakeholders that enjoy the highest level of legitimacy. As Ashforth and Gibbs (1990) claim, "like beauty, [legitimacy] resides in the eyes of the beholder" (p. 177). As perception, legitimacy is socially constructed (Santana 2012), in our case, in the Twittersphere by the twitter community.

Another important aspect is the capacity to obtain engagement with the public. Once more the leaders are the Mass Media, but the group of Public Institutions and CEOs also has a great influence. This might be a signal of the credibility of this stakeholder category together with its perceived expertise about the topic.

We constructed an index calculating the mean of the two power measures and the two legitimacy measures and reescalating them. Figure 5.6 compares both indexes. This allows us to compare the stakeholder's salience in its relevant dimensions.

Table 5.2 Daily mean values of salience indicators by stakeholders

	Power 1 (effort)	Power 2 (reach)	Legitimacy 1 (engagement)	Legitimacy 2 (followers)
Consultant firms	4.57	9726	0.59	179275
Firms, CEOs and entrepreneurs	2.33	9675	2.65	215636
Mass media	0.60	40718	5.15	488867
Public institutions and political parties	3.19	19454	2.77	14351
Individuals	1.06	8137	0.02	135287

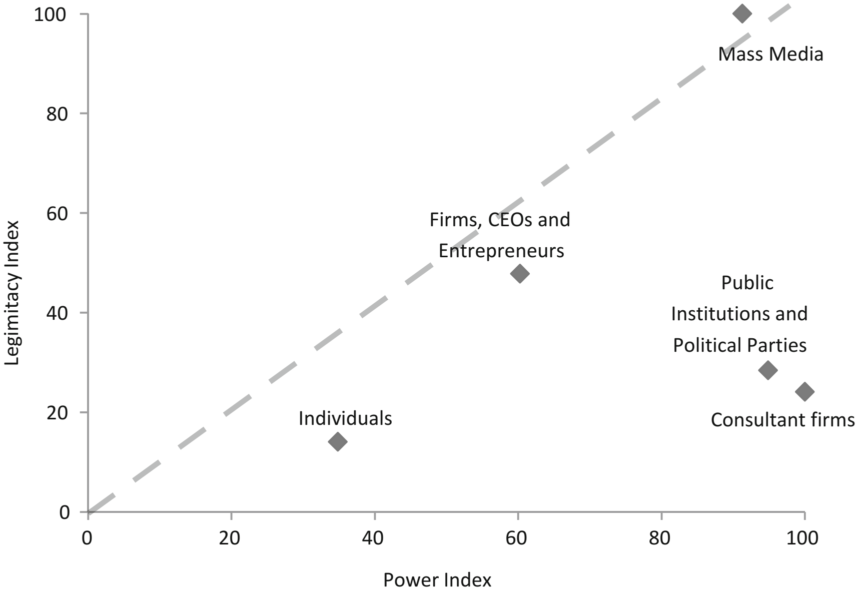

Fig. 5.6 Legimitacy and power index

5.7 Conclusions

Social Cognitive Theory and Stakeholders Theory contribute to better understand the role of social media networks in the innovation knowledge diffusion and to identify their main actors. This theoretical framework guided our research whose main goal was to determine the importance of innovations, taking into account their mentions in the Twitter Social Network. For achieving this goal, a rigorous multidimensional analysis was conducted based on big data techniques. The research team also defined a conceptual ontological model for the definition of the corpus to be applied in this context.

A framework was applied for the extraction of tweets and big data analysis. This framework was configured based on the concepts of the proposed innovation ontology. The framework also allows the analysis of terms in the retrieved tweets in order to refine the ontology, identify new concepts and determine the relevance of each concept within the innovation domain.

The results obtained in this research for the Spanish domain determine which are the most quoted companies, for the period from May to December 2014, related to the innovation concept and what are the keywords used in the tweets analyzed.

The stakeholders' analysis allows us to identify and validate a stakeholder typology in the context of innovation in Twitter. The five categories represent (a) professional experts or consultant firms (b) enterprise owners and their managers, firms, CEOs and entrepreneurs, (c) the 'four powers' or mass media, (d) formal organizations of the government and public services, that is, public institutions and political parties and (e) finally, the rest of the individuals interested in innovation.

From the comparison it can be said that each group has a different role with regard to the generation, dissemination and propagation of the issues. Mass media ranks very high in terms of legitimacy and power. Firms, CEOs and Entrepreneurs are the following stakeholders in the ranking in both dimensions. Consultant firms and Public Institutions and Political parties enjoy high levels of power but not very high legitimacy. Individual twitters, as can be expected, rank low in both dimensions.

Moreover, the results obtained with this research have useful implications for enterprises, especially for those who are involved in innovative sectors and primarily seek to respond positively to the technological changes by means of innovative successful applications. Public institutions wishing to foster and promote an innovation orientation seem that have room to improve their legitimacy in the Twittersphere. A more active role in such a context could be one possible strategy. The quality of their content and the adaptation of these contents to the interests and needs of the society and market could improve their engagement and consequently raise their legitimacy. For a more in-depth analysis of the different roles of the stakeholders in the creation and diffusion of innovation-related content a dynamic analysis should be performed.

Future goals in this line of research will be focused on expanding the criteria for defining the concept of innovation and the number of companies studied and on implementing a dynamic analysis.

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6

Urgent!…To Reward Innovation in Information Technologies with a Real Focus on Value Generation

Emigdio Alfaro

Innovation in information technologies (IT) is commonly treated as a purpose in itself; however, from this point of view, managers, especially the chief technology officers or IT managers, do not necessarily take into account the value generation of IT for their organizations in which these types of operations and projects are developed and implemented, resulting in the consequent loss of value. In this chapter, a logical sequence for evaluating the value generation of innovations in IT is presented which consists of the following themes: (1) How do organizations generate value? (2) How do innovations in IT generate value? (with a general literature review and a focus on cases from South America); and (3) How can organizations calculate the value generation of innovations in IT? Finally, some conclusions and recommendations for future research are presented.

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6.1 How Do Organizations Generate Value?

The value generation of organizations (profit and nonprofit organizations), the common errors of the analysis of value generation of the investments or expenses of projects and operations, the management indicators of value creation in the organizations and the value generation of innovations have been treated from diverse points of view (Gitman and Zutter 2012; Cuthbertson and Furseth 2012; Mollick and Faria 2010; Wood n.d.; Gitman 2007; Goldratt and Ptak 1999; Avraham Goldratt's Institute 1999c; Barnhart et al. 1994; Chappell and Cheng 1984; Tobin 1969; Goldratt and Cox 1984). In a general manner, it is possible to say that only two types of organizations exist: for-profit organizations (companies or firms, and corporations) and nonprofit organizations (committees, associations, foundations and governmental institutions). Firms can be both private and governmental and nonprofit organizations include nongovernmental development organizations, universities established by law (not-for-profit universities), religious institutions, public hospitals, ministries, regional governments, municipalities and supervisory entities among others. In this section, the mentioned themes are explained.

The Value Generation of Profit and Nonprofit Organizations

It is very important to understand that the value generation of profit and nonprofit organizations must not be evaluated with the same considerations. In respect to the value generation of firms, Cuthbertson and Furseth (2012) indicate that

> [v]alue creation is the ultimate goal of the firm, but sustainable value creation requires that value is created for everyone involved: the customer, the service provider, the supplier, all the stakeholders. The customer tends to be the initial focal point for driving value, but everyone needs to gain over the long term for the interrelationships to be sustainable. (p. 7)

A large and diverse literature exists for measuring the value generation of firms (profit organizations), based mainly on financial indicators such as (a) the capital gain which is "the amount by which the sale price of an asset exceeds the asset's purchase price" (Gitman and Zutter 2012, 48); (b) the yield rate of an asset, which is the risk-free yield rate plus the beta coefficient of the systematic risk multiplied by the difference between the yield rate of the market and the risk-free rate (Gitman 2007, 216); (c) Tobin's Q, which is the ratio between the stock market valuation of existing capital assets divided by the current replacement cost of the assets (Mollick and Faria 2010; Barnhart et al. 1994; Chappell and Cheng 1984; Tobin 1969); and (d) indicators based on the information of financial statements such as the profitability ratios return on assets and return on equity (Gitman and Zutter 2012). In this respect, Cuthbertson and Furseth (2012) indicate that

> [v]alue is a complex issue. However, it is important to note that even in considering solely economic value in a private sector organisation, values may still vary. For some organisations the value is in market share, for other organisations the value is in profit, for others turnover is the key metric and so on. The successful service firm delivers the relevant value. (p. 8)

Moreover, on the basis of the analysis of Goldratt and Cox (1984), both for-profit organizations and nonprofit organizations must meet the needs of at least three groups of stakeholders: (a) shareholders (in the case of profit organizations or firms) or founders (in the case of nonprofit organizations), (b) market (in the case of firms) or target population (in the case of nonprofit organizations), and (c) workers. It is clear that shareholders have invested their money to obtain more money. In the case of the founders of a nonprofit organization, they seek recognition through the improvement of the satisfaction of a certain type of need according to the subject area of benefit for the target population, which can clearly be seen in the nongovernmental development organizations (another name for the official nonprofit organizations which can receive funds of the international cooperation through the government offices, according to the laws of some countries). For firms, the market is composed of the current and potential customers, the intermediate customers and the end users (end consumers), who have needs that must be satisfied. In the case of nonprofit organizations, the market is the target population for the implementation of the projects. It is also important to note that if the needs of workers at all levels (managers, intermediate bosses and workers without managerial positions) are not satisfied, sooner or later, the consequences will manifest. For summarizing the consequences, it is possible that dissatisfied staff will not support the achievement of organizational objectives and at the first opportunity will withdraw from the organization or, even worse, will take various actions considering their own personal benefit (in an ethical or unethical manner) rather than the benefit of the organization.

As a summary, for the cases of profit organizations, the value generation is represented as the improvement of the financial indicators, which require the improvement of stock value, the improvement of profitability or the improvement of the net present value of the firms; although, in the case of nonprofit organizations, the value generation is represented mainly by the improvement of the value for the target population, and not only by the improvement of the financial indicators. These considerations must be taken into account for evaluating the value generation of the diverse types of operations and projects in the organizations.

Common Errors in the Analysis of the Value Generation of Investments or Expenses of Projects and Operations

Before starting any project or operation in an organization, it is necessary to verify that it will really generate value with basic financial calculations in the case of firms. If the project will not generate value, why would the managers want to implement it? Based on the analyses of Goldratt and Ptak (1999) and Avraham Goldratt's Institute (1999b), commonly, the wrong reasons for implementing operations and projects are the following: (a) managers have the budget and don't know what else to spend it on (this is a problem for governmental and private organizations of medium and big sizes); (b) if managers don't spend the money of the budget for this year, then they will not receive that money for the next year (this problem is as common as the previous one, and both are closely related); and (c) it is a decision of the "top management." This last point indicates that the words of the owners or the "top management" are sacrosanct or final; however, if the top management makes a wrong decision, highlighting this error and finding the best solution for the problem is the combined responsibility of the managers and the employees who do not hold a managerial position. Obviously, they must be prepared to do this with the right technical and behavioural approach. Handling this in the right manner will reap benefits and appropriately recompense the promoters of the ideas or solutions as their action would have saved hundreds of thousands or millions of dollars of the firm. Such remuneration would be logical, and, if not, the personnel could highlight these achievements to get a new job.

In addition to the analyses of Goldratt and Ptak (1999) and Avraham Goldratt's Institute (1999b), it is important to consider the lack of ethics. Commonly, nonvalue projects or operations are carried out due to unethical practices of directors or managers, among which are the following: (a) the project will be conducted by a related firm (owned by one of the shareholders or linked to one of the shareholders, commonly the chairman), which will collect more money due to its services than a common firm which develops that type of projects; (b) the managers or the promoters of the projects have received unethical incentives; and (c) the managers want to avoid or reduce their potential responsibility for failures in operations or projects by hiring a provider with very high prices of goods or services and not necessarily with better personnel or better quality.

For nonprofit organizations, the managers should not develop projects that do not generate value, although in this case the value is not necessarily financial. The managers must ensure that the proposed operations or projects will generate better health, education, security, nutrition, environmental protection, religious culture and so on in the target populations, according to the purposes of the creations of those organizations. Also, this value generation should be quantified. Some critical examples are the value generation of many governmental hospitals, the value generation of the regular basic education and the value generation of religious institutions.

The value generation of many governmental hospitals is measured by the increase in the number of attentions (consultations, clinical examinations, surgical operations, and so on), but not on the basis of the generation of better health units for people who are treated in these hospitals. Similarly, the value generation of regular basic education is measured based on the number of students who complete the fifth year of high school, but not according to who finish the fifth year of high school with better reading comprehension skills and better ability to perform basic mathematical operations, indicators that are very low in diverse developing countries. Also, the value generation of religious institutions is measured in terms of the increase in the number of registered members; however, measurements of compliance with ethical and moral principles in their daily lives of enrolled people are not taken into account.

Based on the analysis of Avraham Goldratt's Institute (1999a), it is important that continuous improvement and value generation of organizations are considered from the point of view of workers. Therefore, when a group of workers is ordered "to improve" the situation in the organization in the first month, "to continue the improvement" in the second month, "to continue the improvement even more" in the third, fourth, fifth and sixth month, and when they have improved the goals of the operations and projects within six months, it is totally illogical to dismiss this group of workers because a manager thinks that the same goals can be achieved with fewer staff. Such a lack of common sense in the behaviour of managers is what usually causes delays or prevents continuous improvement in many organizations.

We must not forget that many operations and projects need the integration of various functional areas of an organization. On the basis of the analysis of Goldratt and Ptak (1999), all senior and middle management should help prioritize projects according to the convenience of the organization and not of themselves. Commonly, many managers "promote" the purchase or development of operations or projects for their areas, avoiding the improvement of processes for priority areas of the organization and focusing instead on their own processes.

The Management Indicators of the Value Generation of the Organizations

The lack of utility of some management indicators and the actions that must be realized for contributing to the value generation are explained in this section, among which are the following: (a) sales and payment of commissions of sales to the vendors, (b) the payment of a percentage of the net profit to the chief executive officer, (c) the number of meetings or number of realized events and the advance report about the awareness of an issue in the town, and (d) the number of presented documents or presented reports and the advance report of the achievement of a goal of the operating plan. In the case of sales and payment of commissions of sales to the vendors, for example, a firm might have a policy of giving 2 % of the sales value to the salesmen, and due to that, all the vendors will try to sell the biggest amount. Imagine that salesmen A and B work very hard and obtained sales worth US$ 100,000 and US$ 80,000 respectively; hence, salesman A receives a commission of 2 % × US$ 100,000 = US$ 2000 and salesman B receives a commission of 2 % × US$ 80,000 = US$ 1600, an amount which is less than what salesman A receives. After the analysis of the financial results during the period, the accounting analysis evidenced that the contribution margin (the value of sales minus the variable cost) of vendor A was US$ 40,000 and that of salesman B was US$ 50,000 (greater than the contribution margin of salesman A); this means that the firm gave a greater compensation to the salesman who generated a lower contribution margin for the firm. In the case of firms with this type of policy, the stimulus is inadequate because better sales do not necessarily imply a better contribution margin; so the policy must be instead the payment of the percentage of the contribution margin and not the percentage of the sales.

Next, the case of the payment of a percentage of the net profit to the chief executive officer is explained. When the net profit is calculated with the absorbent cost system it has an error in its definition, because it is considered using the following formula: Product's Unitary Cost = Product's Unitary Fixed Cost + Product's Unitary Variable Cost; also, the fixed unit cost is defined as the total fixed cost divided by the number of produced units. This definition leads one to believe (as the calculations express) that when double or triple the number of units is produced, the net profit increases as the product's unitary fixed cost is reduced, and, as a consequence, the cost of sales is reduced and the gross profit increases. According to Noreen, Smith and Mackey (1995) and Avraham Goldratt's Institute (1999a), the mathematical calculation of the product's unitary fixed cost didn't generate problems in the early twentieth century, but is now presenting problems because the proportion of fixed costs has increased significantly, contrary to the beginning of the twentieth century. Nowadays, with the absorbent cost system, it is possible to believe that a firm has generated money when it has really lost money, due to the differences of fixed costs which are not included in the cost of sales and are introduced instead into the value of the inventory. This was a very common practice in the manufacturing firms of massive consumption from the 1970s until the mid-1990s, as chief executive officers generated fictitious profits for obtaining commissions over the net profits which they received as remunerations (Avraham Goldratt's Institute 1999b).

The management indicators based on the number of meetings or number of realized events, and the advance report about the awareness of an issue in the town are explained next. If we analyze the progress in raising awareness about a subject in the population, we should first evaluate whether they know the subject and then whether the solutions for this issue have been applied for in reality; however, indicators such as the number of meetings or the number of realized events commonly appear on the operational plans or strategic plans of organizations, reflecting the number of people made aware; in this regard, progress in the number of meetings or the number of realized events is also reported. This causes the progress report of the operating plan to appear as being fulfilled according to the chronological progress which was planned initially, but it does not reflect the real progress in the achievement of their purposes.

Additionally, the number of presented documents or presented reports and the advance report of the achievement of a goal of the operating plan are presented. If we check the progress in achieving the goal of many operating plans, we should assess the progress on activities and projects that have been raised in the operating plan; however, in various organizations we see that the number of presented documents or the number of presented reports for reporting progress are regarded as synonyms of the progress in the implementation of the activities and projects of the operational plan. As described in the previous paragraph, this situation causes the progress report of the operating plan to appear as being fulfilled according to the chronological progress which was planned initially, but it does not reflect the real progress in the achievement of their purposes.

On the basis of the analysis of Avraham Goldratt's Institute (1999a), the measurement of the value creation of firms based on the coverage of needs of shareholders (to measure the amount of generated money) is easier than the measurement of the satisfaction of the market needs or the satisfaction of the workers. It does not mean that the satisfaction of the market needs or that the satisfaction of the workers is less important. It is simply easier to have an objective parameter as the generation of money for measuring the management activity. The generation of money in this case is not the generation of net income accounting necessarily for value, as it could be the generation of the contribution margin (sales value minus variable costs of sales) or saving fixed costs. There are different types of indicators to measure the generation of financial value, but the best-suited indicator for firms could be the net present value calculated on the basis of the direct cost, the Tobin's Q (ratio which is calculated dividing enterprise value in the market by the replacement value of assets) and the return on investment (analyzed as the Return on Assets (ROA) or Return on Equity (ROE)), as mentioned in the previous section.

In the case of nonprofit organizations, the measurement of the performance based on the coverage of current or future needs of the target population according to the creation of the organization is more objective. This situation is clear for nongovernmental development organizations which have methodologies based on the logical framework, with clear parameters oriented toward the expected results before the beginning of projects (something that many firms could imitate).

Commonly, the managers or specialists design a very detailed project plan for constructing an industrial plant or building. They should do something similar for implementing or developing any type of project. They must make a cash flow forecast for a planning horizon that is at least equal to the period of planning of the long-term strategy. To remember that the long-term concept is not static and is related to the size of the organization, the economic sector and the particular situation of the organization, and that it may be 20 years, 5 years, 3 years, 2 years or 6 months, as in the case of mining or oil companies, pharmaceutical companies, food-manufacturing companies, high-tech enterprises and micro-enterprises, respectively.

Based on the analysis of Alfaro (2012), Sosa and Alfaro (2011) and Alfaro (2007) for the evaluation of IT projects of firms, it is necessary to consider as inflows (a) the increases of contribution margins which were generated by the project and (b) the savings generated by the project. In addition, based on the analysis of the mentioned authors, it is necessary to consider as outflows (a) the investments in the project and (b) the expenses which were incurred by the project. Then, a calculation of the net present value of the net flow to a minimum attractive rate of return (discount rate) must be realized. If the money is generated in a reasonable and attractive amount, very well; but, in the contrary case, it really does not make sense to run the project or continue it. To spend that money on another operation or project would be better than to waste it in the current operation or project, and much less at times when the liquidity is low for the firms.

Value Generation of Service Innovations

The concept of value generation of service innovations has been explained by diverse authors (Lusch and Nambisan 2015; Cuthbertson and Furseth 2012; Wood n.d.). Wood (n.d.) explains that "[i]nnovation is the process by which the value of the creation or idea is realized" (p. 4). Lusch and Nambisan (2015) also explain that the conceptualization of service innovation emphasizes

> (1) innovation as a collaborative process occurring in an actor-to-actor (A2A) network, (2) service as the application of specialized competences for the benefit of another actor or the self and as the basis of all exchange, (3) the generativity unleashed by increasing resource liquefaction and resource density, and (4) resource integration as the fundamental way to innovate. (p. 155)

Additionally, Lusch and Nambisan (2015) propose a framework of three parts for service innovation as follows:

> (1) service ecosystems, as emergent A2A structures actors create and recreate through their effectual actions and which offer an organizing logic for the actors to exchange service and cocreate value; (2) service platforms, which enhance the efficiency and effectiveness of service exchange by liquefying resources and increasing resource density (facilitating easy access to

> appropriate resource bundles) and thereby serve as the venue for innovation; and (3) value cocreation, which views value as cocreated by the service offer(er) and the service beneficiary (e.g., customer) through resource integration and indicate the need for mechanisms to support the underlying roles and processes. (p. 155)

Cuthbertson and Furseth (2012) indicate that "[t]he value of any innovation lies in the value driven by the service firm and created for all involved: the firm, the firm's customers, and the firm's suppliers" (p. 7). Additionally, Cuthbertson and Furseth (2012) further explain that "[t]he same model can be used in the commercial and public sectors, as this is not just a consideration of economic utility or economic value, though this may be dominant in some circumstances" (p. 8), and indicate that

> [t]o deliver the relevant value, an organization must have the resources necessary for successful innovation in the form of tangible, financial and intangible assets, as well as people and technology. Within innovation capacity lies the foundations of service innovation success. (p. 8)

Cuthbertson and Furseth (2012) also propose their Service Innovation Triangle, which includes (a) the value is the innovation outcomes, (b) the management is the innovation ability (composed by the business model, the service systems and the customer experience), and (c) the resource (tangible assets, financial assets, intangible assets, technology and people) is the innovation capacity (p. 7). Then, on the basis of the mentioned literature in section one, section two presents how innovation in IT generates value.

6.2 How Do Innovations in Information Technologies Generate Value?

In this section, some considerations and cases for understanding how IT operations or IT projects generate value are described for profit and nonprofit organizations.

Understanding the Value Generation of Information Technologies

To contribute to the analysis of value generation of IT, Lusch and Nambisan (2015) proposed the following questions:

- In what ways can IT support the different roles of beneficiaries in value cocreation—as ideator, as designer and as intermediary?
- How can online communities facilitate unconstrained knowledge recombination by beneficiaries (actors) in the service ecosystem? What technological/contextual characteristics mediate or moderate such a function by online communities?
- What adaptations do actors need to make in their internal processes to facilitate value cocreation, and how do these processes/mechanisms interact with the digital infrastructure?
- In what ways can IT enhance the transparency (role, process and outcome) of value cocreation activities in a service ecosystem? How does the digital infrastructure interact with other strategies and practices to enhance such transparency? (p. 163)

In the same way, in contributing to the analysis of value generation of IT, Melville et al. (2004) proposed the following questions:

Focal Firm:

- Is the IT resource associated with improved operational efficiencies or competitive advantage?
- How does the IT resource generate operational efficiencies and competitive advantage?
- Competitive Environment
- What is the role of industry characteristics in shaping IT business value?
- What is the role of the resources and business processes of electronically linked trading partners in impacting the value generated and captured by the focal firm?
- Macro Environment

- What is the role of country characteristics in shaping IT business value? (p. 62)

Ceric (2015) explained the factors that influence the use of Information and Communication Technologies (ICT) in the following contexts: (a) Technological (factors: ICT integration and ICT compatibility), (b) Individual (factor: user's ICT knowledge), (c) Organizational (factors: Organizational Culture, IT Support, Alignment between ICT and Organizational Strategies), and (d) External Environment (factors: Suppliers, Trends in the market and Partner Company). Gupta (n.d.) also proposed the five core value disciplines for harnessing the potential of IT as follows: (a) First Core Value: Strategize and Plan IT, (b) Second Core Value: Optimize and Improve IT, (c) Third Core Value: Promote Business and Customer-Centric IT Orientation, (d) Fourth Core Value: Innovate with IT, and (e) Fifth Core Value: Manage and Measure IT Performance. In this respect, Melville et al. (2004) proposed the IT Business Value Model as follows:

1. Focal Firm, which is influenced by "Industry Characteristics" and "Trading Partner Resources & Business Processes" of the competitive environment. The focal firm includes the "IT Business Value Generation Process" (which includes the IT Resources—technology and human—influencing the business processes and the business processes influencing the business performance) influencing the "Organizational Performance."
2. Competitive Environment, which is influenced by the "Country Characteristics" of the Macro Environment, and includes the "Industry Characteristics" and the "Trading Partner Resources & Business Processes" influencing the Focal Firm.
3. Macro Environment, which includes the "Country Characteristics" influencing the "Competitive Environment." (p. 61)

Melville, Kraemer and Gurbaxani (2004) also defined the constructs of the IT Business Value Model as follows:

1. Focal Firm, composed of

   a. IT Resources, composed of

      i. Technological IT Resources (TIR) are the infrastructure (shared technology and technology services across the enterprise business applications).
      ii. Human IT Resources (HIR) are the technical skills (programming, systems integration, database development, etc.) and the managerial skills (collaboration with business units and external organizations, project planning, etc.).

   b. Complementary Organizational Resources (Organizational resources complementary to IT, categories of which include non-IT physical resources, non-IT human resources and organizational resources, and examples of which include organizational structure, policies and rules, workplace practices, culture, and so on.
   c. Business Processes are the activities underlying value-generating processes (transforming inputs to outputs) such as inbound logistics, manufacturing, sales, distribution, customer service, and so on.
   d. Performance, composed of

      i. Business Process Performance, which includes operational efficiency of specific business processes, measures of which include customer service, flexibility, information sharing and inventory management.
      ii. Organizational Performance, which includes overall firm performance, including productivity, efficiency, profitability, market value and competitive advantage.

2. Competitive Environment, composed of

   a. Industry Characteristics, which include industry factors shaping the way in which IT is applied within focal firms to generate business value, including competitiveness, regulation, clockspeed, and so on.

   b. Trading Partner Resources and Business Processes, which include the IT and non-IT resources and business processes of trading partners such as buyers, suppliers and competitors.

3. Macro Environment, composed of the Country Characteristics (Macro factors shaping IT application and IT business value generation, including the level of development, basic infrastructure, education, research and development investment, population growth rate, culture, etc.). (p. 62)

Some Cases of Profit Organizations

In the BMI Information Technology Report Q4 2015, BMI Research indicated some innovative IT projects for profit organizations in some South American countries, as follows:

1. Peru

   BMI Research (2015a) indicated the following:

   a. Peru to Launch E-Money Project.

   "In April 2015, the Asociación de Bancos del Perú (ASBANC, Associations of Banks of Peru) announced the Peruvian E-money Project, which will provide access to e-money services to five million people by the end of 2020; also, Movistar Peru and MasterCard jointly launched Tu Dinero Móvil in January, [a] service which enables Movistar users to send and receive money transfers, among other functionalities" (p. 55).

   It is important to take into account that e-money projects in Peru require improvements in the IT infrastructure of the firms, in the available technology for the population and in the production capacity of governmental entities. The use of the Peruvian electronic document of national identification must be included in this solution for security reasons. The additional inflows coming from interests or fees for the use of the money must be contrasted with the additional outflows due to investments in IT infrastructure and the expenses on personnel, maintenance and other concepts.

b. Azteca Comunicaciones to Complete RDFO Project In 2016:

In November 2014, Azteca Comunicaciones announced that it expects "the deployment of its fibre optic backbone network (RDFO) in Peru in March 2016" (p. 56). This project involves the installation and maintenance of 13,400 km of fiber-optics, at a cost of around US$ 760 million, which will cover about 80 % of Peru's territory. It is also important to consider that the evaluation of the additional inflows must include the additional contribution margin because of sales to new clients. Additionally, it is necessary to consider the savings in comparison with previous technologies, which will be replaced with the RDFO.

c. Government Cloud Project (BMI Research 2015a):

"Fonafe, a government holding of 33 state-owned companies in the utilities and finance sectors, is in the fourth year of a five-year partnership with IBM, launched in 2011, to develop and manage a private cloud infrastructure" (p. 57). The Peruvian Government's expectation is that the project will save more than US$ 4.2 million over the five years, with 40 % of operating cost reduction. Additionally, "[t]he government also hopes that these savings will free more of the 10 state-owned companies' IT budgets for business development. Currently around 70 % of the ICT budgets goes towards IT support, while 30 % is used to develop the business" (p. 57).

2. Chile

BMI Research (2015b) indicated that

a. Telefónica Opens New R&D Centre:

"In December 2014, Spanish broadband and telecommunications provider Telefónica opened a new research and development (R&D) centre in Chile's capital Santiago. The R&D centre will focus on the development of Internet of Things technologies for smart cities and smart industries (mining and agriculture) projects. The new facility was partially funded by Corfo, Chile's state development agency" (p. 53).

In this case, for evaluating the generation of the firm Telefónica, it is necessary to specify the scope of development of Internet of Things technologies for smart cities and smart industries because of the amplitude of this theme. It is also necessary to evaluate the condition of the market infrastructure for aligning the improvement of the technologies.

b. SmartCity Santiago—Challenges and Opportunities:

"In July 2014, a group consisting of Enersis (Enel) and Cilectra launched the SmartCity Santiago project with an investment of USD10mn, the first such smart city infrastructure project in the country. The SmartCity is located in northern Santiago, and will act as a laboratory for testing of technological solutions for regular activities in the city. Areas identified for testing include public transport, automated utilities and street lighting, telemonitoring and smart automation/control systems. The project is proposed to last three years, acting as a reference for wider smart infrastructure deployment" (p. 53).

c. Third Data Centre for Synapsis:

"Local IT company Synapsis launched its third data centre in Chile in late 2013, boosting its coverage in the country to 1100 square metres and increasing the number of racks from 340 to 500. The company invested USD26mn in the Tier 3 data centre. The data centre has also been built to 'anti-seismic' specifications and includes sustainable energy sources" (p. 54).

d. IBM Opens Santiago Data Centre:
"The new centre in San Bernado has a storage capacity of 22.8 petabytes, and, combined with the Providencia centre, the company has about 3800 km of fibre optics installed" (p. 54). It is also important to note that IBM invested around US$ 22 million (p. 54).

Ariel and Fundación Telefónica (2011) explain as follows:

"Founded by Andrés Navarro in Santiago de Chile in 1974 as a venture capital investment between his family and one of the biggest Chilean oil corporations, Copec, SONDA has pioneered the provision of Information Technology services, systems integration and software development in the region. In 1984, SONDA began expanding internationally, establishing a subsidiary in Peru, and later in Argentina, Ecuador, Uruguay, Costa Rica, Colombia, Brazil and Mexico. SONDA is a public company where Navarro´s family holds 55 % of the stock, with more than 5000 clients, 250,000 users and 400,000 items of IT equipment under contract. In 2009 its total revenue was US$703 million. Developing and delivering solutions and services both for government and private sector clients in a wide range of areas, the firm has contributed to the modernization of diverse government agencies and helped companies to become more competitive. SONDA has created several innovative solutions that have had a major impact on the quality of life of citizens, such as a new identity system for Chileans, an electronic voucher system for health care services, an automated control system for traffic in big cities, and an electronic payment and clearing system for the new public transportation system in Santiago de Chile. In 2007, SONDA acquired the Brazilian Information Technology company Procwork, thereby becoming one of the main IT service providers in Brazil and one of the largest SAP integrators in Latin America" (p. 105).

3. Brazil
   BMI Research (2015c) explained that "Big Data Becomes Big Business" (p. 72). This report described that, according to the firm EMC, "[t]he outlook for M2M and IoT in Brazil improved earlier this month, with the government lowering taxes on M2M SIM cards. EMC believes that the IoT concept will represent 10 % of Brazil's total data traffic in 2020, up from just 2 % in 2013" (p. 72). IoT means Internet of Things and M2M is Machine-to-machine.
4. Argentina

BMI Research (2015d) indicated the following:

a. Data Network Investment to Enable New Services

“In January 2015, Telecom Argentina will invest around ARS210mn (USD24.36mn) to deploy a new fibre optic backbone network based on the dense wavelength division multiplexing technology in the country” (p. 63).

“Movistar announced in February 2015 its plans to invest ARS3bn (USD346.81mn) to deploy 4G LTE services in Buenos Aires Province. The operator aims to provide 4G technology in 53 municipalities by deploying more than 1300 LTE sites across the province. Movistar currently provides 4G services in certain areas of the province including Buenos Aires, Mar del Plata, Cariló and Pinamar” (p. 63).

b. M2M Gaining Momentum

“In December 2014, Argentina’s mobile operator Telecom Personal entered a partnership with US-based firm Jasper to launch internet of things (IoT) and M2M connectivity for business subscribers. Enterprise subscribers will be allowed to access a highly scalable platform to launch, manage and monetise their connected services internationally, according to Jasper. IoT offers advanced connectivity of devices, systems and services that extend beyond M2M, and includes various protocols, domains and applications. Jasper has previously partnered with Claro, Telenor, Vimpelcom, Tele2, Telefónica, AT&T, KPN, NTT DoCoMo and Etisalat to launch M2M initiatives. The IoT is expected to underpin telecom enterprise services offered across several sectors. The plans for connected devices will link transport, power and utilities to communications networks. Further to this, IoT plans will underpin retail and banking sectors as well as being linked to many other markets. Personal’s focus on building an IoT platform will enable it to cater to these industries’ growing needs. Many companies are turning to technology to lower costs and improve efficiency. Telecom operators have many opportunities to build revenues from these new sources in addition to providing more traditional communications services.” (p. 63)

Ariel and Fundación Telefónica (2011) explained as follows:

a. “Since 1984, when Adolfo Grobocopatel founded Los Grobo, the company has grown into one of the largest grain producers and agricultural service providers in the world—yet it owns no land, no tractors, nor harvesters. Los Grobo provides logistical and grain storage services to farmers, and produces soy, corn and wheat on a total of 300,000 hectares in Argentina, Brazil, Paraguay and Uruguay. Los Grobo’s innovative business model consists of an information-technology facilitated network of 3800 small and medium agricultural suppliers. At its headquarters, 100 people provide inputs such as seeds, finance, technical advice, sale and marketing of crops, and the deployment of technologies such as GPS and agricultural simulation models to help the network of farmers manage soil resources and deal with climate risk” (p. 10).

b. “Guerra Creativa provides design services by leveraging crowd sourcing in ways not previously seen in concept-to-design processes. If a client wants a new logo or webpage, Guerra Creativa will host a design contest for a fixed period (e.g., 21 days), then will enable the client to evaluate entries (often over 100), to select a winner. Guerra Creativa uses this process to design logos, websites, stationery, flash or 3D designs. Guerra Creativa also enables designers to interact and learn from each other, hosts exhibitions of their work online and provides feedback on the designs of others. A section of the site allows users to get exclusive tutorials, with step-by-step instructions for different techniques and advice from their interactive creative director. Currently, the community includes 3400 designers who have already uploaded more than 11,000 designs and a total membership of 6000 clients” (p. 10).

5. Colombia

BMI Research (2015f) indicates the following:

a. LG CNS to Enhance Colombia ICT Collaboration

“In April 2015, it was reported that LG subsidiary and IT services provider LG CNS was keen to boost ICT collaboration with Colombia. The South Korea-based company has revealed the ‘Korea-Colombia ICT cooperation plan’, which indicates that Korea’s e-Government system will be launched in Colombia following LG CNS’ successful launch of an e-ticket system in the capital of Bogotá. The plan will also help the company make inroads into other Latin American markets such as Chile, Brazil, Peru and Mexico" (p. 57).

b. Internet.org Enters Colombia

"In January 2015, US-based social networking site Facebook announced its plan to enter an agreement with Colombia-based telecoms operator Tigo to introduce its internet.org initiative in the local market. Facebook set up the internet.org initiative with the main aim of connecting billions of people in regions that do not yet have internet access. Through this initiative, Facebook will team up with telecoms operators in different countries to provide internet access at a more affordable price. Facebook may also sign additional agreements with other telecom operators in the country" (p. 58).

Ariel and Fundación Telefónica (2011) explain as follows:

a. "Established in 2008 by an engineering student at the Universidad de los Andes, Datatraffic S.A. is a company focused on providing innovative geo-referencing solutions to its clients, including vehicle tracking and location of points of interest on digital maps that are published on the internet. Datatraffic combines hardware technologies which allow a considerable reduction in operating costs for transport companies worldwide. By gathering real-time information about Bogota's traffic flow, integrating it with historical data collected by the transit official authority, and the emergencies reported to the city's 911 number, Datatraffic has developed mobility algorithms that help to find solutions to the city's traffic problems. In 2009, the company's revenues were US$95 million. The firm combines software development with hardware devices, creating new solutions for the Colombian market aimed at tackling the problem of petrol consumption among transport and oil and utility companies, for which petrol represents 40 % of their direct costs. Datatraffic tracks the exact consumption of each vehicle and manages the data in order to avoid internal theft. In 2009, Datatraffic won the silver medal in the 2009 'Imagine Cup' hosted by Microsoft" (p. 109).

b. "In 1999, Orlando Rincón founded ParqueSoft to help micro enterprises and entrepreneurs from underprivileged communities in the Valle del Cauca. Within an open space, enterprises are organized in blocks with different teams. Each one is a software company that designs, develops and sells different types of software, including optics, artificial intelligence, bioinformatics and tools for nanotechnology. Every two months, ParqueSoft organizes 8-week internships for 150 young people. The company is focused on creating social value. It provides support and infrastructure for business development and trains people to become more innovative, reliable, and competitive in the market. ParqueSoft is a non-profit and understands that all entrepreneurs in the network can help each other to grow their creativity and talent. A policy of 'zero bureaucracy' helps them reduce the rental and logistics cost to US$300 per year per person. Through its network of 15 science and technology parks, it provides administrative and business development services to 1000 software entrepreneurs, 300 companies and 500 clients in 42 countries all over the world. Since its foundation, this organization has created 967 jobs and 339 ventures. Unlike other incubators, ParqueSoft clients do not exit upon maturation; rather they give back by aiding the development of the network. In 2005, Rincón was nominated by Dinero Magazine in Colombia and the Schwab Foundation from the World Economic Forum as the 'Colombian Social Entrepreneur of the Year'" (p. 110).

6. Uruguay:

   Ariel and Fundación Telefónica (2011) explain as follows:

   a. "Kizanaro is a small Uruguayan sports information technology company. With 17 employees, it commercializes products and services for football teams as well as for media and entertainment. Through videos and specialized platforms, Kizanaro offers sports analysis software as a tool to evaluate the performance of a team and its rivals on the field. The company offers an innovative portfolio including K-Studio Professional, a software that analyses team and individual football tactics; K-Real Time, a system that allows the Head Coach to receive real time and objective data about the match; K-Scouting, a product that keeps track of individual players throughout the season and compiles a report on their performance in images and video; and Playmaker, a football moves editor that replaces the paper boards used to plan game tactics. Currently, Kizanaro's products are used by the Uruguayan national football team and by some Uruguayan professional first division clubs. In 2009, Red Innova chose Kizanaro to participate in the 'First Encounter of Innovation, Technology and Internet' for Spanish and Portuguese-speaking markets as one of the 15 most innovative companies in Latin America. It also won first place in the Imagine Cup Uruguay worldwide innovation prize run by Microsoft" (p. 122).

b. "In 1997, Alberto Amorim and Martín Palomeque created a new concept in traffic lights and with it a firm named Telemáforo. This new concept improves the impact of the red light in a traffic light by adding a luminous panel that diffuses messages and images. The screen consists of red light emitting diodes (LEDs), synchronized and controlled by an electronic circuit. The centrally-controlled software enables the client to choose the place, the time and the composition of the message broadcast via the screen. The firm's clients are mainly municipalities that use the system to broadcast security messages to drivers and pedestrians. Some of the messages are 'Please don't drink and drive. Walk. Take the bus. Take a cab. But don't return with a drunk driver. Your destiny is yours.' Telemáforo's system has 160,000 visual impacts per month in Uruguay. Other cities in Argentina, Bolivia, Peru and Spain are in the process of installing Telemáforo in their municipalities. In 2011, Telemáforo's main goal is to enter the Brazilian market" (p. 122).

Based on Alfaro (2012), in the case of profit organizations, some IT with some elements that should be considered for the analysis of the financial value generation of their acquisition and implementation are presented for the cases of IP telephony, Information System for taking Pre-Sale Orders, Information System for controlling Visits of Promoters, Virtual Shop and ERP Information System. In the acquisition and implementation of IP telephony, the savings of the costs of phone calls between the subsidiaries of organization and the savings of calls to other telephones of suppliers or customers (phone calls to national or international organizations or people inside or outside the country) must be considered. With IP telephony, the savings of the organization are possible when the other parts of the communications have also IP Telephony; however, these savings should be higher than the cost of the IP telephony centre, the IP telephones as extensions, the improved wiring (if required) and maintenance costs. It is also important to consider that if the current situation is that the phone calls are missed because diverse problems exist with the telephone centre, causing loss of sales, then the additional sales that would be obtained with the IP telephony must be included. Otherwise, a financial return would not be possible and only an increase of the outflows could be obtained.

The Information System for taking Pre-Sale Orders allows the increase of sales, because it allows sellers—in the form of pre-sale—to take orders directly on cell phones. This system allows the checking of the stocks of the orders and the checking of the customer credit online, before the sale is closed. Sales increase as the firm can reach more customers faster and, at the same time, the firm can avoid loss of sales, as in the massive consumption of goods, it is common for a product to be replaced by a similar one from another vendor if it fails to comply with the order according to customer expectations. This system also allows the saving of forms as the order is entered over the cell phone (although these savings are not significant in comparison to the amount of sales). In addition, the investment in the acquisition or implementation of the information system as well as the charges for Internet services via cell phone, information system maintenance and long life battery must be considered in the calculations of the financial value generation.

The Information System for controlling Visits of Promoters allows the reduction of theft of product samples and promotional items that should have been delivered to customers by the promoters. It should take into account that some promoters commonly do not return the product samples and promotional items because they want to avoid evidence that they were not working, and due to that, they give away or consume them, or, in some cases, use them for illegal sale. When a better control of the delivery of product samples and promotional items is established, the firm can save on these concepts and more deliveries occur with a consequent increase in sales, because this delivery directly affects the purchases made by the clients or consumers.

In the acquisition and implementation of an online store or virtual shop, the managers should consider an additional contribution margin which will result from the increase of sales of the firm, although it is likely that no savings arise, but investments and expenses increase, because it is an additional sales channel. In this case, in addition to the technological aspects, the managers must take into account various aspects, processes or areas of management (marketing, sales, production, distribution, etc.), which will directly influence the investments and expenses. The investments and expenses that can be generated by a project of acquisition and implementation of an Enterprise Resources Planning (ERP) information system—especially World Class ERP—can be very high. The financial benefits of an ERP information system, according to Alfaro (2012), could be associated with the following: (a) additional contribution margin due to the increase of customer loyalty and of the number of customers as a result of a better quality of service (this increase of value takes the form of reductions in delivery times, faster elaboration of quotes for the clients, more available time for contacting more clients, etc.); (b) savings on the following concepts: penalties for failing to deliver orders on time, discounts which were given to customers for delays in the delivery of orders, avoidance of unnecessary purchases, discounts for purchases with larger volume, downsizing, reduction of inventories and reduction of financial costs; (c) additional investments: hardware for servers, hardware for end users, basic software licenses for servers, basic software licenses for users, ERP information system, information system upgrades of the ERP information systems, interfaces of the ERP information systems with the legacy software and so on; and (d) additional expenses: maintenance of the information system, additional technical personnel who know the new technologies which came with the new ERP information system, additional users who know the use of the new ERP information system or other similar information system and so on.

As shown, the financial benefits of innovations in IT in firms can be diverse only if we know how to identify and calculate the financial value generation; otherwise, good results would depend only on luck. The lack of an adequate analysis of the value generation would bring unnecessary and significant costs that would be borne by the firms.

Some Cases of Nonprofit Organizations

Following are some innovative IT projects for nonprofit organizations in some South American countries:

1. Peru

   BMI Research (2015a) indicates the following:

   a. Digital Inclusion Programme Targets Coca Growing Region: "In March 2013, the government of Peru launched a programme to promote digital inclusion in the coca growing south east of the country" (p. 56). This is a pilot project, which includes 150 people across the Pichari and Kimbiri districts, who received basic training in IT hardware, software, Internet and the manners of the community so they could apply these technologies for entrepreneurial projects, considering a total of eight telecentres in the south-east region.
   b. Tablets for Schools: "In March 2015, it was announced that public schools in four regions in Peru—namely Lambayeque, Huancavelica, Apurímac and Ayacucho—would receive a total of 410,570 tablets as part of a concession contract to operate a fibre optic network" (p. 58). In such cases, it is necessary to consider the need of digital contents for the equipment, as the equipment by itself is not sufficient to educate the population.

Some additional innovative projects which were developed in Soluciones Prácticas and ONGEI are presented:

a. In Soluciones Prácticas, a nongovernmental and development organization, the following innovative IT were developed: (i) implementation of communication networks in rural zones, (ii) installation of informatics equipment in rural zones without electric energy, (iii) installation of Internet access in rural zones without electric energy,

(iv) digital literacy (project for teaching IT to people in rural zones), and (v) modules for improving the governability of municipalities through the improvement of internal management, participation of citizens and transparency in accountability (Soluciones Prácticas 2015). Soluciones Prácticas is focused on investments in technologies for improving the social conditions of the populations who worked with these projects.

b. In the National Office of Electronic Government and Informatics (ONGEI) in Peru, the following innovations in IT were developed:

    i. Peruvian State Portal, a portal with the maximum hierarchy in Internet for Peru in which all the entities of the Peruvian State must appear, and which currently has 1112 entities publishing their information.
    ii. Citizenship Service Portal, a portal with 42,001 governmental procedures (821 governmental procedures of 62 entities are online) and with publications of 1042 governmental entities of the three governmental levels.
    iii. Transparency Portal, a portal with publications about the planning, the organization, the procedures and so on, which contributed to the transparency of the Peruvian State.
    iv. Public Software Portal, a portal with 112 software applications which were developed and published by 30 governmental entities for sharing their benefits.
    v. Municipal Portals, 559 free portals which are administrated by municipalities in the diverse parts of Peru.
    vi. Catalog of Mobile Applications of diverse governmental entities of Peru, with access to the information of 31 mobile applications.
    vii. Portal for creating firms in 72 hours, with more than 60,000 created firms and more than US$5 million of savings for the citizens of the cities of Lima, Callao, San Martín and Lambayeque, which was transferred to the National Superintendency of Public Registers of Peru (SUNARP) on September 13, 2014.
    viii. Portal against Discrimination, with processes which relate 11 ministers against discrimination.

ix. Interoperability platform of the Peruvian State, with 24 web services which are used by 54 government entities.
x. System of Electronic Notifications of the Poder Judicial del Perú (Judicial Power of Peru).
xi. System of Online Medical Appointments for Ministerio de Salud del Perú (Health Ministry of Peru) (ONGEI 2015).

The measurements of the benefits of ONGEI's IT projects are focused on the improvement of governmental processes and of the defence of the rights of people. It is important to consider that the investments in IT processing capacity must be compared with other similar solutions which obtain similar technological benefits; however, it is possible that the government could invest money without sufficient benefits for justifying the project.

2. Chile:

BMI Research (2015b) indicates the following:

> "Start-Up Chile is a prominent start-up accelerator based in Santiago, Chile, that provides equity-free investment for start-ups. The programme was launched by the government via the InnovaChile programme and receives financial input from the Ministry of the Economy, Ministry of Foreign Relations and Ministry of the Interior. Start-Up Chile held its first English language weekend, with 11 businesses created in a 54-hour period of pitches and meetings" (p. 55).

Ariel and Fundación Telefónica (2011) explain as follows:

> "In 2005, Raúl Rivera created ForoInnovación with a group of Chilean universities, think tanks, trade and business associations. ForoInnovación is a non-profit 'action tank' aimed at creating in Chile a more entrepreneurial and innovative society. Most ForoInnovación projects are joint public-private efforts and involve a number of services for entrepreneurs, such as assistance on idea generation, networking, mentoring, diagnosis of business risks, advice on developing a back-up plan, and helping failed entrepreneurs get back on their feet. It also supports programs to enhance innovation and growth in Chile on a macro level, helping, for instance, to position Chile as a

nearshore hub for global service exports. One of its main initiatives is 'Avonni', the main national innovation award that recognizes the innovative capability of Chilean entrepreneurs. In 2010, over 500 projects applied for this award. Another major initiative is 'Innovacien', a network of innovative schools, which are piloting Information Technology supported approaches to learning" (p. 104).

3. Brazil:

BMI Research (2015c) indicates the following:

a. Digital City Network Expanding

"In March 2015, Brazil's Minister of Communications Ricardo Berzoini opened a digital city in Toledo in the state of Paraná. The digital city, which is the second in the state, comprises a fibre-optic ring of 14 km, connecting 18 agencies and four public access sites. The project forms part of a BRL680,000 (USD192,046) investment that will benefit 128,000 residents. The country has 43 digital cities across all regions. The programme seeks to modernise local management, boost access to public services and promote the development of municipalities in the country using technology.

In January 2015, the Brazilian Ministry of Communications announced BRL7mn (USD2.71mn) to establish a new digital content development centre in São Paulo, Brazil. The facility will be operated with the cultural department of the city and will provide workshops, studios and labs for small businesses to create videos, music, games and apps. The centre will be set up with the Casa de Cultura at a site managed by SPCine, a São Paulo-based finance investment initiative." (p. 71)

b. Big Data Adopted for Urban Mobility Challenges

"In August 2014, Brazil's São Paulo state transport agency Artesp, in collaboration with IBM, opened an information control centre (CCI) to oversee its 6000 km of highways. Artesp is investing BRL28mn in the centre, which will offer data management and mobility technologies provided by IBM and implemented by IT integrator and consulting firm

Magna Systems. The CCI will collect data from 19 control centres operating on 30 roads in São Paulo, according to Artesp.

The CCI will rely on Big Data systems to collect and monitor traffic volume, toll data and information captured by cameras, sensors and weather stations to assess the quality of roads and safety for users of the highways. Information is centralised in the CCI and analysed in real time, generating rapid responses and insights for decision-making. IBM already has experience with intelligent transport management through its traffic control centre in Vietnam, where it looks to prevent congestion and coordinate responses to accidents and adverse weather." (p. 73)

c. Smart Cities Initiatives Cater to Urbanization:
"Microsoft announced its first smart city deal in Brazil, as part of its CityNext initiative. The first contracts have been agreed with the Minas Gerais state government, with 23 other contracts signed with government institutions" (p. 74). "The deal with Minas Gerais marks Microsoft's first smart city contract in Brazil, although it has been providing other services to government entities for over 20 years. Its first contracts include providing the state government with Microsoft's SharePoint, SQL server, Hyper-V and Windows 8 solutions, among others. Microsoft has built 'Big Data' applications for each of these systems in order to improve the management of information generated in 28 public services centres across the state" (p. 74).

Ariel and Fundación Telefónica (2011) explain as follows:

a. "A popular genre of user-generated innovations is open-source software—software that is developed by users (who often happen to be professional software developers) and meets a specific set of criteria, such as its licence must allow for free redistribution, access to the source code, modifications and derived works; the licence must not discriminate against any person or group, it must not restrict anyone from making use of the programme in a specific field of endeavour, and the software must be software independent and technology-neutral (Open

Source Initiative 2009). Since 2003, when Sergio Amadeu was appointed by President Silva to head Brazil's National Institute of Information Technology, the Brazilian government has promoted the adoption of open source software, accelerating its use by universities, business and government agencies—from the national, to state, to regional level. The government has promoted the use of open-source by a series of policy initiatives, such as stating preference for open-source software and mandating its use in a programme that helps subsidise financing for low-cost personal computers. It has cited several reasons for promoting the use and development of free open-source software: the costs of use are significantly less than commercially developed alternatives and thus it is more accessible to a broader segment of the population; discarded old computers can be reused by replacing their out-of-date operating systems with open-source operating systems; it provides opportunities for more people to develop valuable ICT-related skills; and it gives people more software options to choose from.

In February 2009, Brazil's Ministry of Education announced it would be supplying 356,000 Linux-based virtualised desktops in each of the country's 5560 municipalities. At the time, this was the largest such deployment in the world. The government estimated that the cost of the PCs, with the PC sharing hardware and software, would be less than USD50 per seat and that Brazil would save roughly USD47 million in up-front costs with this switch, and thanks to the 1–10 model, about USD9 million in energy costs annually." (p. 11)

b. "In 1995, Rodrigo Baggio founded the Center for Digital Inclusion (CDI) in Rio de Janeiro, based on the concept of helping people to help themselves. CDI Community Centers have three principal objectives: they are self-managed, self-sustaining, and they implement the CDI pedagogy. This unique pedagogy requires that by the end of each 4-month course, students will have used technology as the main tool to initiate, plan, implement and complete a 'social advocacy project' aimed at changing an aspect of their existence. At the same time, CDI provides training on the use of computers and pays teachers higher-than-average salaries (US$200 per month, more than twice the average salary of a teacher in the public school system). Currently, there are CDI franchises in 753 schools in Brazil and 100 abroad, with

1036 volunteers, 1726 educators, and 600,000 people from low-income communities certified. CDI mobilized five internal working groups from different disciplines to innovate new solutions for efficient growth. The result was the creation of a new multimedia learning environment, new courses, new services with business plans, revised performance indicators, a new monitoring process, and an online platform for communication and collaboration. With the support of James Wolfensohn, former President of the World Bank and the Wolfensohn Institute, CDI is in the process of expanding to the Middle East and North Africa, to be followed by India and other parts of Africa. In 2000 Time Magazine named Baggio as one of 50 'Latin American Leaders of the new Millennium'." (p. 103)

4. Venezuela

   BMI Research (2015e) indicates the following:

   a. State Production of Computers

      "Former president Hugo Chávez's government's focus on economic autonomy underpinned major efforts to encourage domestic production of computers. In October 2009, Empreven, an organisation of Venezuelan entrepreneurs, launched plans to build a new PC manufacturing plant in Corozo, in the state of Zulia. The project received an initial investment of USD12.5mn, with production initially on a small scale. The money came from social funds generated by Venezuela's state oil company Petróleos de Venezuela, in line with the science, technology and innovation law known as Locti, and from Petrolera Sino Venezolana.

      In November 2007, production started at a new IT facility set up by Venezuela's national IT guiding body CENIT, with the capacity to produce 5000 computers a month. The government earmarked USD2.3mn to spend on the new facility, which complements the production capacity of state-owned IT company Venezolana de Industria Tecnológica (VIT).

      In June 2013, President Nicolás Maduro presented one of three tablets produced by VIT, with prices ranging from VEF2950 (USD470) to VEF4233. The Vergatario tablet follows on from the production of the Vergatario phone, which was aimed at making handsets affordable to the mass market in Venezuela. However, with the price listed on the VIT website, the tablets are unlikely to make an immediate impact on the market." (p. 55)

b. All Government Services to Be Digitized By 2016

"In March 2014, Science, Technology and Innovation Minister Manuel Fernández announced that the government was planning to digitise all its services by 2016. He reported that of the 805 separate government services offered in March 2014, 158 were available online. The ministry expects a further 250 services to be made available online in 2014, with around 400 expected to be added in 2015. The announcement follows e-government legislation passed in 2013 that obligated public sector institutions to use information technology in their internal management processes, as well as in relations with other state entities and citizens." (p. 56)

c. Venezuela and Argentina Cooperate on Open Source Software

"In February 2014, Venezuela's ICT ministry announced it was cooperating on the development of open source software with Argentina. The cooperation includes the meeting of the development teams of Argentina's Huayra and Venezuela's Canaima GNU/Linux operating systems to exchange knowledge and experience. Argentina launched the Huayra project in March 2014, based on Linux and used on the notebooks provided to schools and students as part of its digital inclusion programme Conectar Igualdad. Meanwhile, Venezuela's Canaima GNU/Linux is used in 51 % of the government's workstations as well as part of the Canaima Educativo programme." (p. 56)

An open-source project is important for saving unnecessary costs in the investment on licensed software, and, in many cases, the open source and free software demonstrate better performance than the licensed software. The governments must seriously consider the implementations of similar projects in diverse countries.

d. Automation of Canaima Production Lines Boosts Output

"In May 2015, it was reported that a delegation was working with the Canaima production facility in La Carlota, Caracas, to automate the production process and enable increased output. The Chinese delegation will stay for three months, according to local press reports, and will enable production to be boosted to 500,000 PC units. The refit will create three to four production lines and capacity for another 100 employees, unlocking greater flexibility. Production will diversify and the facility will increase its capacity to 500,000 notebooks as well as 600,000 tablets and 100,000 decoders for the Open Digital Television standard.

The Canaima programme began in January 2011 with the aim of increasing access to technology for the majority of Venezuelans and in 2013 was ranked as the 14th largest PC vendor globally by unit shipments. By 2012, it had delivered around 2mn PCs, with the aim of distributing a further 2.5mn by 2015 to ensure all school students in the country had access to a notebook. In earlier phases of the project, the government was reliant on imported hardware, but since the creation of a production facility in 2012 in Miranda state the government has been aiming to increase output and by 2015 operated three production facilities." (p. 55)

5. Colombia

BMI Research (2015b) indicates the following:

a. New Smart Cities Push

"Medellín, Colombia's second largest city, has won awards for its smart city initiatives, a trend the ICT ministry MinTIC intends to extend. Colombia's increasingly urbanised population creates greater need for IT-driven management tools to aid in policies such as the smooth running of public transport and local government initiatives. Government support of smart cities is clear in Colombia where MinTIC has set up a portal to encourage companies to invest in smart cities. With the urban population accounting for three quarters of Colombia's inhabitants, a proportion forecast to rise to 84 % in 2050, there is a definite demand for smarter cities.

The seven cities selected for smart city development are predominantly located in areas that already have high internet penetration, making them prime candidates for investment. The cities are: Manizales, Armenia, Pereira, Montería, Bucaramanga, Cali and Barranquilla, the next largest cities in Colombia after capital Bogotá and Medellín.

The greatest opportunities for smart cities lie in the larger urban areas where high population density causes a myriad of problems. Managing traffic is one practical application as well as installing sensors to show demand and make more efficient use of electricity. Other applications such as rubbish bins alerting when they are nearly full, water leaks being identified quickly or generating noise maps have implications for the development of cities. Colombia's increasing urbanisation, as well as its growing population create the need for different city management strategies that will rely on technologies and connections." (p. 57)

b. Computers for Education
"The government programme Computadores para Educar (Computers for Education), begun in 2000, continues as part of the Vive Digital strategy. The programme is administered by MinTIC in conjunction with the international One Laptop Per Child (OPLC) initiative, helping to supply affordable computers for public schools. The programme aimed to achieve 100 % connectivity in schools and public access terminals and to reach an average ratio of 12 children per computer by 2014.
In April 2014, Deputy ICT Minister Carolina Hoyos Turbay announced that the Colombian government had made investments of COP645bn in ICT since 2010. The bulk of the spending was directed towards computers for education. More than COP207bn was for the delivery of 202,126 computers, with 188,533 PCs (127,558 contributed by MinTIC and 60,975 by local authorities) and 13,593 tablets (9510 contributed by MinTIC, 4083 by local authorities).
In June 2014, MinTIC held a public auction for the supply of 101,771 notebooks to be distributed to children in Colombia. The government was given a budget of COP53.5bn, but acquired the notebooks for 46.4 % less than market prices. The winning tenders were received from Compumax and Heritage Group." (p. 58)

As mentioned in a similar case, the development of contents is critical for the success of such a project. It is necessary to develop material for introducing into computers.

Ariel and Fundación Telefónica (2011) explain as follows:

> Founded in 1995, Colciencias is a public entity that promotes science, technology and innovation activities in Colombia. With a US$200 million budget, it funds initiatives such as research groups, scholarships for doctoral students, corporate research activities, the establishment of technical development centers, and the promotion of regional technological projects. The entity is focused on creating an attractive research environment for scientists in Colombia and has been very active in fostering collaborations with research institutions in Europe and the United States. Since 2006, 22 technological development centers have been established, 1161 research groups have received funding from the program, 1045 doctoral students have received scholarships, and 203 companies have received funding for scientific innovation activities, most of them cofunded by the firms. The challenge for Colciencias is to coordinate the National System of Science, Technology and Innovation (SNCTI), with the goal of fostering a scientific, technological and innovative culture in Colombia. (p. 107)

In the diverse cases mentioned in this section, the value generation must be measured through the benefits to the target population, which would be the benefits to people, firms in an economic sector, governmental entities or firms or people in a country. The IT can't generate benefits by itself, and it is necessary to develop conditions for generating benefits, which are commonly related to non-IT characteristics.

It is necessary that the investments of the governments must be evaluated considering the financial and the nonfinancial benefits; however, the nonfinancial benefits, as described, must be the main benefits, because of the nature of nonprofit organizations. The investments too must not be so high as not to compensate the benefits to the population, in comparison with other solutions for justifying the project. The improvement of processes, the saving of time and money and other benefits could be calculated in terms of generation of the gross domestic product for the country.

6.3 How Can Organizations Calculate the Value Generation of Innovations in Information Technologies?

In the previous sections, the concepts of how organizations create value and how innovations in IT create value were presented. Now, the question is how organizations can calculate the value generation of innovations in IT. The theory of this concept has been previously developed; however, the components of that theory are not integrated. In this respect, the Global Status Report on the Governance of Enterprise IT (GEIT) of 2011 mentions that the "difficulty [in] demonstrating value and benefits" is one of the challenges in implementing GEIT mechanisms, according to the 30.3 % of the 834 executives who were interviewed in 21 countries across the globe (IT Governance Institute and PriceWaterhouseCoopers 2011). Also, after a research in which more than 250 executives were interviewed in 22 countries, about the evaluation of the value generation of IT, the IT Governance Institute and PriceWaterhouseCoopers (2009) indicated that

> The survey indicated that a surprising number of enterprises do not measure the value of their IT investments after the fact. Just slightly more than half of the respondents—56 percent—indicated that their enterprise does measure the value of IT investments, and 43 percent said no such measurement is made. Although executive management is generally convinced of the value of IT investments, it is unclear how 43 percent determine whether the expected value has been achieved. Those who do measure the value of IT investments rely primarily on profit and loss calculation (42 percent). (p. 12)

In practice, the majority of organizations don't evaluate the value generation of innovations in IT because managers do not have an integrated methodology for evaluating the IT operations and the IT projects before beginning new IT operations and new IT projects. MEVGIT is a proposed methodology for avoiding the pitfalls related to the value generation of IT innovative projects or IT innovative operations. The theoretical framework for evaluating the value generation of IT contained in MEVGIT includes the following: (a) free cash flow (Chih-Chang 2013; Kousenidis

2006), (b) direct costing (Klychova et al. 2015; Iotti and Bonazzi, 2014), (c) total cost of ownership (Bibo 2014; Laudon and Laudon 2012), and (d) procedure 59 of the MAIGTI methodology (Alfaro 2011), which is a methodology for integral auditing of the management of IT.

Free Cash Flow

Alfaro (2015) cites Chih-Chang (2013) and Kousenidis (2006), who explain the concept of free cash flow. In this respect, Alfaro (2015) mentions that

> Chih-Chang (2013) indicated that free cash flow is “the balance of cash inflows and outflows” (p. 1). Also, Chih-Chang (2013) explained that free cash flow indicates “the ability of corporations to expand, and is commonly known by stock market analysts as capital expenditures” (p. 1). (p. 21)

Also, citing Kousenidis (2006), Alfaro (2015) writes:

> Kousenidis (2006) explained that the majority of finance text books defined free cash flow as follows: “the after tax operating earnings of a company plus non-cash charges less investment in working capital, property, plant and equipment, and other assets” (p. 649); also, indicated that free cash flow “requires that cash flow does not incorporate any financing-related cash flows, such as interest expense or dividends” (p. 649). (p. 21)

Direct Costing

Alfaro (2015) cites Klychova et al. (2015), and Iotti and Bonazzi (2014), who explain the concept of direct costing. In this respect, Alfaro (2015) mentions that

> Klychova et al. (2015) indicated that [direct costing] “is intended to include in the cost of production and ending stocks estimate only variable production costs and allocation on financial result of the total amount of fixed costs without distribution by product types” (p. 308). Also, Klychova

> et al. (2015) explained that: "The purpose of this method is increasing the speed of decision-making on pricing and possibility of analyzing the relationship of the costs, volume of production (sales) of products and profit (CVP-analysis) as well as analysis of break-even point" (p. 308). (p. 21)

Also citing Iotti and Bonazzi (2014), Alfaro (2015) writes:

> Iotti and Bonazzi (2014) explained that "The direct costing assigns only the costs directly attributable to the individual productions, while overhead costs are not allocated and are briefly summarized at the close of the reclassified income statement" (p. 1492). (p. 21)

Total Cost of Ownership

Alfaro (2015) cites Bibo (2014) and Laudon and Laudon (2012), who explain the concept of Total Cost of Ownership. In this respect, Alfaro (2015) indicates that "Bibo (2014) explained that the Total Cost of Ownership (TCO) is 'a technique which can be used to make sure that all associated costs over a given time period are considered' (p. 89)" (p. 21). Again citing Laudon and Laudon (2012), Alfaro (2015) writes:

> Laudon and Laudon (2012) indicated that the total cost of ownership of technology assets, must include:
>
> 1. Hardware acquisition: purchase price of computer hardware equipment, including computers, terminals, storage, and printers
> 2. Software acquisition: Purchase or license of software for each user
> 3. Installation: Cost to install computers and software
> 4. Training: Cost to provide training for information systems specialists and end users
> 5. Support: Cost to provide ongoing technical support, help desks, and so forth
> 6. Maintenance: Cost to upgrade the hardware and software
> 7. Infrastructure: Cost to acquire, maintain, and support related infrastructure, such as networks and specialized equipment (including storage backup units)

8. Downtime: Cost of lost productivity if hardware or software failures cause the system to be unavailable for processing and user tasks
9. Space and energy: Real estate and utility costs for housing and providing power for the technology (p. 196). (p. 21)

MAIGTI's Procedure 59: Procedure for Auditing the Value Generation of IT Projects

Alfaro (2011) explains the steps of Procedure 59 of the MAIGTI methodology which were developed for auditing the financial value generation of IT projects. Applying an adaptation of MAIGTI's Procedure 59, Sosa and Alfaro (2011) evaluated the value generation of the implementation of a module of an information system for the sales of the delivery of packages, and found that with an investment of US$ 24,620.71, the net present value after three years was US$ 413,683 with a discount rate of 25 %. According to Alfaro (2011), the original steps of MAIGTI's Procedure 59 were the following: (a) to review the methodology for the calculation of the value generation of the IT projects, and the calculations of the value generation of all IT projects (b) to review the definition of the period of evaluation (it should be a board decision based on any of the following ways: lifetime of the IT project, strategic planning period of the organization or a specially assigned time by the board); (c) to revise the definition of the discount rate or the minimum attractive rate of return on investment, which will be applied to the calculation of the net present value of the IT project (this rate shall be determined by the board; but considering that must be greater than the minimum risk-free rates—rates for deposits with fixed time, e.g.); (d) to check the identification of additional inflows due to which the project has been completed (to check that the additional inflows will be generated by an increase in the contribution margin—sales value minus variable costs—and by the savings which are generated not only due to the improvement in a process, but also savings from penalties that would arise if the firm failed to deliver an order, or the margins that would be forgone by the nonconformity and retirement of customers of the firm); (e) to review the identification of additional outflows for the project (to remember that additional outflows are caused by additional investments and additional expenses generated by the project); (f) to check the calculation of net flow as the difference between the additional inflows (additional contribution margin and savings) and additional outflows; (g) to review the calculation of the value generation of the project (for firms, the value generation is determined by the calculation of the net present value of the net flows during the indicated period of time, applying the discount rate or the minimum attractive rate of return); and (h) to check whether the project generated or didn't generate value (if the project has a negative net present value or a positive net present value which is not attractive—a few dollars, e.g.—it makes no sense to run the project).

Defining MEVGIT

Based on the proposal of Alfaro (2015), the concepts which are associated with the calculation of the financial value of the innovative project (Table 10: FR-MIM3-010-001 Financial Evaluation of the Project) are the following: "additional inflows (additional contribution margins and savings), additional outflows (additional investments and additional expenses), the evaluation period and the discount rate (minimum attractive return rate) which was determined by the Finance Area of the organization" (p. 27).

The additional inflows could be the additional contribution margin and savings. The additional contribution margin could come through the sales or the reduction of the variable costs. The increase of the contribution margin through the sales could come in three manners: (a) the increase of sales to the current clients through the increase of the loyalty of clients after the improvement of the quality of the goods or services or the improvement of the delivery time, (b) the increase of sales to new clients, and (c) to avoid the loss of sales due to the improvement of the processes or the business model as a whole.

The additional outflows could be additional investments or additional expenses. Additional investments could include (a) hardware acquisition, (b) software acquisition, (c) installation, (d) infrastructure, and (e) furniture and equipment. It is also important to consider that if the previous items are hired as services and not acquired as goods, the inclusion of these items must be as additional expenses. Additional expenses could include (a) personnel, (b) advertising, (c) training, (d) support, (e) maintenance, (f) inactivated time, and (g) space and energy. It is also important to consider the accounting norms when personnel work directly for the elaboration of the product or to achieve a result of the project, then the cost of the personnel must be considered as part of the cost of this product or result, and in cases where the products are long-term goods, the cost of the personnel must be considered as part of the investment and not as an expense. Depending on the project, the total cost of ownership can include (a) hardware acquisition: computing equipment (computing equipment for the main data centre, computing equipment for the alternate data centre, equipment for the servers, and computing equipment for final users—desktops, laptops, all-in-one computers, etc.), storage equipment, printing equipment (network printers and user printers), network equipment (routers, firewalls, switches, access points, network wiring, etc.), communications equipment (mobile phones, tablets, personal digital assistants, portable data terminals, etc.); (b) software acquisition: base software (operating systems for servers, operating systems for final users, proxy servers, mail servers, database management systems, web servers, Internet explorers, programming languages, programming tools, Computer-Aided Software Engineering (CASE) tools, office software, project management software, etc.), and information systems (Transaction Processing Systems, Customer Integrated Systems, Management Information Systems, Workgroup Support Systems, Decision Support Systems and Artificial Intelligence, Executive Information Systems, Interorganizational Systems and Planning Systems); (c) installation (the installation of all the related equipment, hardware and software and the uninstallation of all the related equipment, hardware and software); (d) infrastructure (cooling equipment for the whole data centre, racks with cooling system, equipment against fire, electrical equipment—board power with thermo-magnetic switches, voltage stabilizers and uninterrupted power supply equipment, electrical wiring, technical floor, and technical ceiling; (e) furniture and equipment (desks, shelves and related equipment).

Considering these concepts, the steps of the Methodology for Evaluating the Value Generation of Information Technology (MEVGIT) are the following:

1. To calculate the additional inflow, which will be collected by the product or result of the project:

    a. To calculate the additional contribution margin (in the case of firms) or the additional gross domestic product (in the case of nonprofit governmental entities) due to the product or result of the project.

        For firms:

        i. To calculate the additional contribution margin from the increase of sales to the current clients.
        ii. To calculate the additional contribution margin from the increase of sales to new clients.
        iii. To calculate the additional contribution margin when the organization avoids loss of sales.
        iv. To calculate the additional contribution margin from the reduction of variable cost of sales.

        For nonprofit governmental organizations:

        i. To analyze how to convert the nonfinancial benefits with the goods or services of the nonprofit governmental entities to amounts of gross domestic product.
        ii. To calculate the amount of gross domestic product, which will be increased through the product or result of the project.

    b. To calculate the savings due to the product or result of the project

        i. To calculate the savings due to the reduction of investments.
        ii. To calculate the savings due to the reduction of expenses.

2. To calculate the additional outflows, which will be collected by the product or result of the project:

    a. To calculate the additional investments: hardware acquisition, software acquisition, installation, infrastructure, furniture and equipment, and others

   b. To calculate the additional expenses: personnel, advertising, training, support, maintenance, inactivated time, space and energy, and others

3. To calculate the net flow. The calculation of the net flow is the difference of the additional inflows and the additional outflows.
4. To estimate the discount rate. The discount rate must consider the following criteria: (a) to be higher than the risk-free rate, (b) to be higher than the average return on investment of the firms of the economic sector of the country or region, (c) to be higher than the weighted average cost of capital, and (d) to be equal or greater than a minimum discount rate that the board of directors has determined.
5. To calculate the net present value. For calculating the net present value, the discount rate and the net flow must be considered. Each net flow at the end of each period must be discounted dividing $(1 + \text{discount rate})^i$, where "i" is each one of the periods. The sum of the discounted net flows of each period will be the net present value.

6.4 Conclusions

Based on the literature review, the main conclusion is the urgent learning need of the managers about how to evaluate the value generation of IT for avoiding pitfalls related to that concern in profit and nonprofit organizations. It is important to note that many managers don't understand how their organizations generate value; IT can't generate benefits by itself, and it is necessary to develop conditions for generating benefits, which are commonly related to non-IT characteristics.

It is also necessary to review and possibly correct the management indicators for evaluating the value generation in organizations, with the right selection of indicators that will influence the analysis of the value generation of IT. In the case of profit organizations, the value generation can be measured by the generation of money according to the goals of the firm, as this is easier than calculating the satisfaction of customers and of workers, although this is the most important and unique way for evaluating the value generation of firms.

In the case of nonprofit organizations, the value generation can be measured by the generation of benefits according to the final purpose of benefits of the nonprofit organization (health benefits, educational benefits, income benefits, etc.) for the target population. The evaluation of the value generation of innovations in IT can be realized through MEVGIT, a formal methodology which includes a theoretical framework based on free cash flow, direct costing, total cost of ownership and MAIGTI's Procedure 59 (procedure for evaluating the value generation of IT projects).

6.5 Recommendations for Future Researches

Future researches need to establish a baseline of the practices of evaluation of the value generation of IT, not only by determining the state of accomplishment with the evaluation, but by evaluating the causes and consequences of the accomplishment and the lack of accomplishment with that evaluation. It is also recommended to evaluate the value generation of the innovation of diverse types of IT, such as hardware, base software and information systems, in diverse economic sectors, considering the diverse characteristics of the organizations and the countries. For this purpose, the most important operations and projects in the organizations must be considered, taking into account a period of evaluation of at least 10 years, considering a range of three or five years after the beginning of production of IT. It is also important to analyze whether diverse groups of operations or projects that the managers of the organizations will decide for their beginnings will really generate value to the organizations, with a transversal study which would consider the diverse characteristics of the organizations, operations, projects and economic sectors in diverse countries. Additionally, the improvement of MEVGIT will be necessary considering the results of similar researches that were mentioned.

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7

Future Revolution in Innovation: Digitalization Reflections in the Brazilian Perspective

Hugo Ferreira Braga Tadeu
and Jersone Tasso Moreira Silva

7.1 Introduction

In 2008 the world economy faced its most dangerous crisis since the Great Depression of the 1930s (Bonelli and Fontes 2013). The contagion, which began in 2007 when sky-high home prices in the USA finally turned decisively downward, spread quickly, first to the entire US financial sector and then to financial markets overseas. The casualties in the USA included (a) the entire investment banking industry, (b) the biggest insurance company, (c) the two enterprises chartered by the government to facilitate mortgage lending, (d) the largest mortgage lender, (e) the largest savings and loan and (f) two of the largest commercial

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banks. The carnage was not limited to the financial sector, however, as companies that normally rely on credit suffered heavily.

The financial crisis dragged down the entire global economy where many economies around the world are struggling to ensure that economic growth is equitable and provides benefits for their entire populations. Advanced economies have not yet reached their full potential and they struggle with persistently high unemployment, rising inequalities and fiscal challenges (Fernald and Jones 2014). Emerging markets and developing economies are facing stronger headwinds than before and need to adjust their development models to ensure economic growth and a more broad-based distribution of gains (Grazzi and Jung 2015).

Emerging countries such as Brazil, Russia and South Africa are facing decreases in gross domestic product (GDP), high interest rates and mainly a drastic reduction in firms' productivity. Grant (1991), Day (1997), Cusumano and Mardikes (2001), Paunov (2012) and Tadeu and Silva (2014) appropriately show that innovation strategy and innovative business models have to be considered as a way to improve productivity and reduce operational limitations. In this sense, it is observed that technologies, such as digitalization, are altering the structure of competition, the conduct of business and, ultimately, performance across industries (Friedrich et al. 2011).

The overall benefits of digitalization in emerging economies, which are 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 (Katz and Koutroumpis 2012).

Indeed, emerging economies enjoy greater reductions in unemployment from digitalization than developed economies (Perez 2014). Generally speaking, this job creation differential is linked to the application of digitization and new technologies (Harrison et al. 2008). In emerging economies, digitization supports the continued acquisition of tradable, often labor-intensive jobs in sectors such as manufacturing from developed economies. In developed economies, digitization enhances productivity in nontradable jobs, such as service jobs, which yields fewer new positions but has a greater effect on GDP (Katz and Koutroumpis 2012).

In terms of Brazilian companies, they can still improve their productivity by implementing new technologies or performing incremental improvements in their current industrial structure, but this requires an environment that is conducive to innovative activity, supported by both the public and the private sectors (De Negri et al. 2007). Private sectors are facing a growing fiscal pressure by the world economies and it is important that private sectors resist the pressures to cut back on the R&D spending on digitalization, which is considered a critical theme for sustainable growth and competitiveness going into the future.

From the onset, our goal is to provide insight and stimulate discussion among all stakeholders about the best strategies and policies to help countries to overcome the obstacles to improve competitiveness.

7.2 Competitiveness and Its Relevance in the Digitalization Context

Competitiveness is defined as the set of institutions, policies and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the level of prosperity that can be reached by an economy. The productivity level also determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates. In other words, a more competitive economy is one that is likely to grow faster over time (WEF 2014).

Although the productivity of a country determines its ability to sustain a high level of income, it is also one of the central determinants of its returns on investment, which is one of the key factors explaining an economy's growth potential (Duguet 2006). Many determinants drive productivity and competitiveness, such as education and training, technological progress, macroeconomic stability, good governance, firm sophistication and market efficiency, among others (Griffith et al. 2006).

While all of these factors are likely to be important for competitiveness and growth, they are not mutually exclusive—two or more of them can be significant at the same time, and in fact that is what has been shown in the economic literature (WEF 2014).

The World Economic Forum (WEF) is an international institution for public–private cooperation and committed to improving the state of the world by engaging business, academic and leaders of society to shape global, regional and industry agendas. The WEF is funded by its 1000 member companies, typically global enterprises with more than $5 billion in turnover (varying by industry and region). These enterprises rank among the top companies within their industry and/or country and play a leading role in shaping the future of their industry and/or region. Membership is stratified by the level of engagement with forum activities, with the level of membership fees increasing as participation in meetings, projects and initiatives rises.

With regard to competitiveness, the WEF annually provides a report entitled Global Competitiveness Report (GCR) that studies and benchmarks the many factors underpinning national competitiveness. In other words, GCR is a comprehensive database, measuring microeconomic and macroeconomic foundations of countries' competitiveness. The GCR considers 12 pillars, presented in Fig. 7.1, which compose the Global Competitiveness Index (GCI). The GCI is a weighted average based on rates varying from a scale of 1 to 7 of many different components measuring different aspects of countries' competitiveness.

For the purpose of this chapter, we considered three pillars that specifically contribute to competitiveness, innovation and technology analyses observing digitalization opportunities in Brazil, aligning with (Grazzi et al. 2015). The three chosen pillars are Pillar 9 (Technological Readiness), Pillar 11 (Business Sophistication) and Pillar 12 (Innovation). The GCI data from these pillars were used in the PICAM method (Tadeu and Silva 2013a), which estimates the influences of these pillars in the Brazilian digitalization investment decision.

Global Competitiveness Pillars

For a better understanding as to why we chose the pillars presented here we initially considered the relevance of Pillar 9 (Technological Readiness). The pillar assesses the opportunities for digitalization once it measures the agility with which the economy applies existing technologies to enhance the productivity of its industries (Huergo and Jaumandreu 2004), with

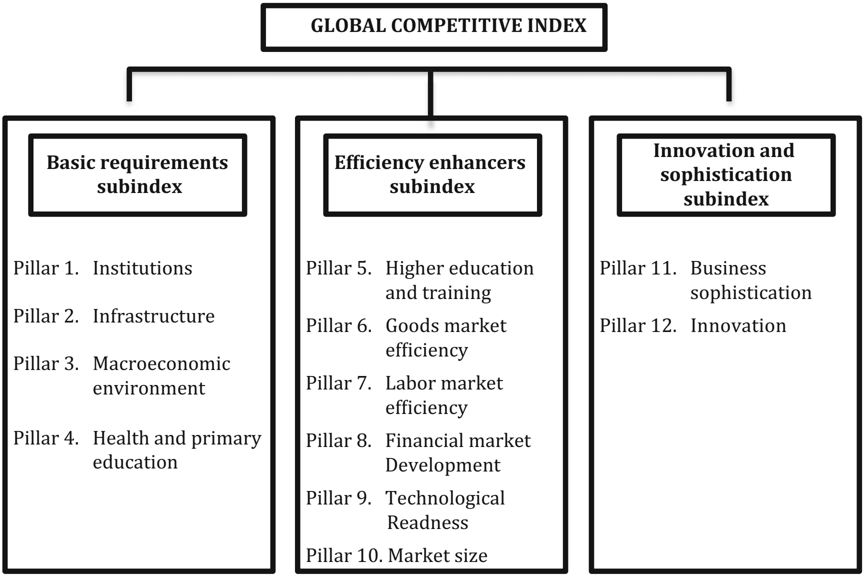
GLOBAL COMPETITIVE INDEX
Basic requirements subindex
Pillar 1. Institutions
Pillar 2. Infrastructure
Pillar 3. Macroeconomic environment
Pillar 4. Health and primary education
Efficiency enhancers subindex
Pillar 5. Higher education and training
Pillar 6. Goods market efficiency
Pillar 7. Labor market efficiency
Pillar 8. Financial market Development
Pillar 9. Technological Readness
Pillar 10. Market size
Innovation and sophistication subindex
Pillar 11. Business sophistication
Pillar 12. Innovation

Fig. 7.1 The GCR 12 pillars
Source: WEF (2014)

specific emphasis on its capacity to fully leverage digitalization, information and communication technologies (DICT) in daily activities and production processes for increasing efficiency and competitiveness. DICT has given the critical spillovers to the other economic sectors and their role as industrywide enabling infrastructure (Jorgenson 2011). Therefore, DICT access and usage are key enablers of countries' overall technological readiness. A country's most notable strengths are related to innovation, technological readiness and business sophistication, where it tops GCI rankings. It is important to notice that the acronym DICT was created in this chapter.

Pillar 11 (Business Sophistication) was chosen because of its direct effect in the digitalization investment decision (Katz and Koutroumpis 2012). It measures the quality of overall business networks and also of individual firms' operations and strategies in order to increase investments in digitalization. These factors are measured by the quantity and quality of local suppliers and the extent of their interaction. When companies and suppliers from a particular sector are interconnected in geographically proximate groups, called clusters, efficiency is heightened, greater opportunities for innovation in processes and products are created and barriers to entry for new firms are reduced (Mairesse and Robin 2009). Individual firms' advanced operations and strategies (branding, marketing, distribution, advanced production processes and the production of unique and sophisticated products) spill over into the economy and lead to sophisticated and modern business processes across the country's business sectors. Therefore, sophisticated business practices are conducive to higher efficiency in the production of goods and services, but that will not be possible if the firms' don't improve and increase digitalization.

Finally, Pillar 12 (Innovation) was chosen because it measures the capacity for innovation taking as estimation variables such as quality of scientific research institutions, company spending on R&D, university–industry collaboration in R&D, government procurement of advanced technology products, availability of scientists and engineers, and patent and intellectual property protection (Mairesse et al. 2012). The objective is to measure the conditions for innovation reinforcing the business efficiency spillovers as well as the opportunities for innovation in processes and products creation.

For a better understanding of the Brazilian competitive behavior, it was decided to conduct an analysis with comparisons to other large emerging countries called BRICS (Brazil, Russia, India, China and South Africa). In addition, it was decided to compare Brazil with respect to two technological leaders that are Germany and the USA. These countries were chosen due to their lead in developing and adopting new technologies which are transforming the manufacturing industries (Germany – Industry 4.0 (Acatech 2013); USA (White House 2011). The results will facilitate the overview and determine the investment opportunities in the Brazilian digitization manufacturing and service sectors.

The Characteristics of Digitalization Decision Making

Considering the importance of the three pillars presented previously and their effects on BRICS development we applied a mathematical method called PICAM in order to understand the pillars' variables behavior and the factors' impacts on digitalization investment decision making along the 2005–2014 period. Thus, this section presents the description of the pillars' variables and the PICAM method used.

Variables Description

The consolidated variables for the BRICS, Germany and USA analyses were the ones that measure the levels of the countries' competitiveness used in the World Economic Forum database. The considered variables are the GCI, Sophistication Business (BS) and Innovation (INN).

Specifically, for a better understanding of the digitalization investment decision process, it was decided to broaden the pillars' definition as the variables that will be used in the PICAM method. These are presented as follows:

- Pillar 9 (Technological Readiness):

    - Availability of Latest Technologies (ALT)
    - Firm-level Technology Absorption (FTA)
    - Technology Transfer (TT)

- Pillar 11 (Business Sophistication):

    - Local Supplier Quantity (LSQuan)
    - Local Supplier Quality (LSQual)
    - State of Cluster Development (SCD)
    - Nature of Competitive Advantage (NCA)
    - Value Chain Breadth (VCB)
    - Control of International Distribution (CID)
    - Production Process Sophistication (PPS)
    - Extent of Marketing (EM)
    - Willingness to Delegate Authority (WDA)
    - Reliance on Professional Management (RPM)

- Pillar 12 (Innovation):

    - Capacity for Innovation (CI)
    - Quality of Scientific Research Institutions (QSRI)
    - Company Spending on R&D (CSRD)
    - University–Industry Collaboration in R&D (UICRD)
    - Government Procurement of Advanced Technology Products (GPATP)
    - Availability of Scientists and Engineers (ASE)
    - PCT Patents, Applications/million pop (PCT)
    - Intellectual Property Protection (IPP)

The analyses to be considered in this chapter, which will be presented as follows, involve initially the analysis for the consolidated variables such as Technological Readiness, Business Sophistication and Innovation and, secondly, the analysis of the variables that compound the consolidated pillars.

The PICAM Method

In order to explain the effects of the competitiveness variables on BRICS, Germany and the USA on digitalization investment, we applied the PICAM method (Tadeu and Silva 2013a, 2013b, 2014a, 2014b, 2015a, 2015b). The method consists of a quantitative analysis to evaluate the variables' behavior and their influence on Pillars 9, 11 and 12, respectively. The method also generates information on the rate of growth for variables for BRICS, Germany and the USA. Detailed quantitative equations are presented below:

- Pillar 9 (Technological Readiness):

    - Equation 1: TR = f (ALT, FTA, TT).
    - Equation 1: $\mathrm{LogTR}_t = \beta_0 + \beta_1\mathrm{LogALT}_{it} + \beta_2\mathrm{LogFTA}_{it} + \beta_3\mathrm{LogTT}_{it} + \varepsilon_t$.

- Pillar 11 (Business Sophistication):

    - Equation 2: BS = f (LSQuan, LSQual, SCD, NCA, VCB, CID, PPS, EM, WDA, RPM).

  - Equation 2: $LogBS_t = \beta_0 + \beta_1 LogLSQuan_{it} + \beta_2 LogLSQual_{it} + \beta_3 LogSCD_{it} + \beta_4 NCA_{it} + \beta_5 LogVCB_{it} + \beta_6 LogCID_{it} + \beta_7 LogPPS_{it} + Log_8 EM + Log_9 WDA + Log_{10} RPM + \varepsilon_{t.}$

- Pillar 12 (Innovation):

  - Equation 3: INN = f (CI, QSRI, CSRD, UICRD, GPATP, ASE, PCT, IPP).
  - Equation 3: $LogBS_t = \beta_0 + \beta_1 LogCI_{it} + \beta_2 LogQSRI_{it} + \beta_3 LogCSRD_{it} + \beta_4 UICRD_{it} + \beta_5 LogGPATP_{it} + \beta_6 LogASE_{it} + \beta_7 LogPCT_{it} + Log_8 IPP + \varepsilon_t$.

The following section presents the growth rate and PICAM model results applied on BRICS, Germany and the USA.

7.3 Innovation and Digitalization Results

This section presents the growth rate analysis for BRICS with the purpose of analyzing the behavior, through time, of the following consolidated variables: Business Sophistication (BS), Global Competitive Index (GCI), Innovation (INN) and Technological Readiness (TR). The variables are expressed by growth rates calculated from the competitive index used by WEF.

Figure 7.2 shows the results for BRICS's BS growth rate. In terms of BS Brazil has shown to be better off compared to China and India throughout the 2006–2014 period.

As for the period 2009–2013, Brazil overcame the group members indicating that the country has higher efficiency in production and a better-quality business network compared to the other countries in the bloc. However, macroeconomic policies affect Brazil's BS drastically.

Figure 7.3 shows the results for BRICS's Global Competitive Index (GCI) growth rate. As for the GCI consolidated variable the results suggest that Brazil and China have shown the same path of increase starting from 2007 and in the case of Brazil extending to 2012–2013. The Brazilian GCI has shown a considerable improvement compared to the other countries.

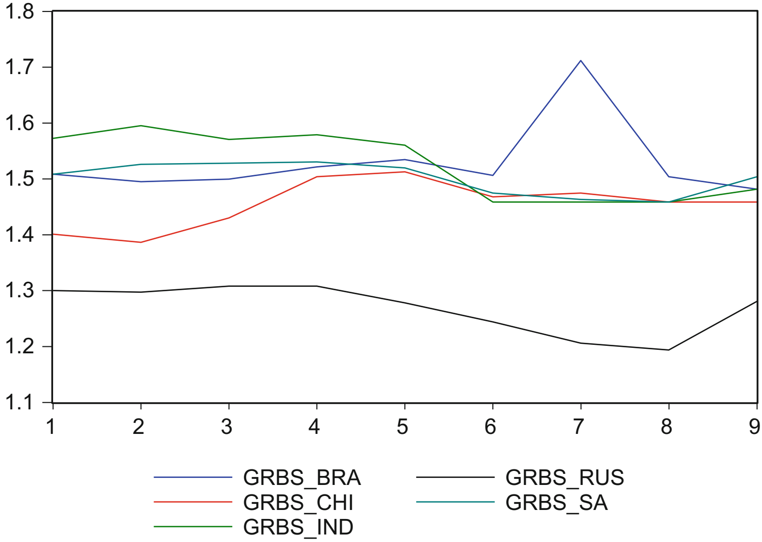

Fig. 7.2 BRICS Business Sophistication growth rate. The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

Figure 7.4 shows the results for BRICS's Innovation (INN) growth rate. The INN results suggest that Brazil has a constant level of innovation with an increase in investments from 2010 to 2014. However, within BRICS, Brazil is better off only than Russia.

As for Russia we observed a significant decrease through time, especially after the 2008–2009 period, compared to the other countries' behaviors. In terms of innovation, it seems as though Russia considerably reduced its investments in innovation during the analyzed time period.

Figure 7.5 shows the results for BRICS's Technological Readiness (TR) growth rate. The TR results suggest that Brazil has improved starting from 2006, overcoming the other countries from 2008 to 2014. This means that although Brazil reduced investment in innovation, it has, on the other hand, improved technological readiness.

As for TR it is observed that most of the countries have improved with the exception of India, which has shown to have the least improvement throughout time.

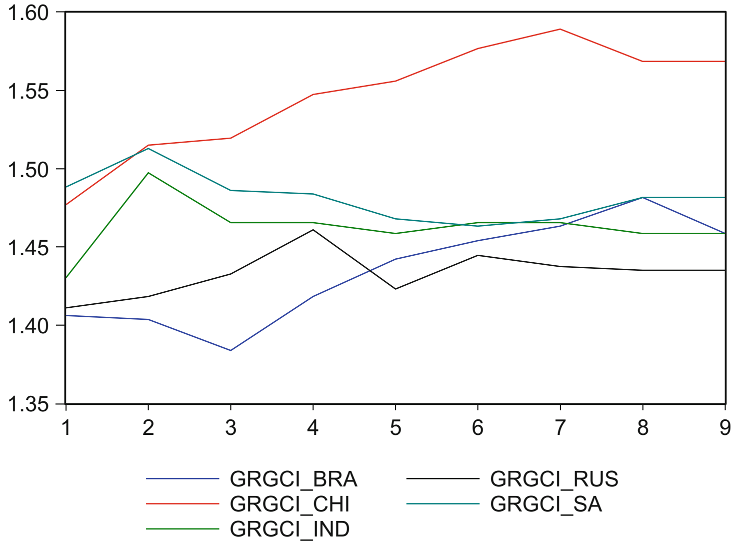

Fig. 7.3 BRICS Global Competitive Index growth rate. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

BRICS in the PICAM Competitive Context: 2006–2014

Policymakers are struggling to find ways to manage the present economic challenges while preparing their economies to perform well in an increasingly complex global landscape. Technology is increasingly essential for firms to compete and prosper. Thus, the following section presents the results of the PICAM model on BRICS in the technological competitive context.

BRICS—Technological Readiness (Pillar 9)

The PICAM method was used to test the technological readiness (TR) that measures the agility with which BRICS adopts existing technologies to enhance the productivity of its industries. The results provided in Table 7.1 suggest that availability of latest technology (ALT) and technological transfer (TT) positively influence the TR of BRICS.

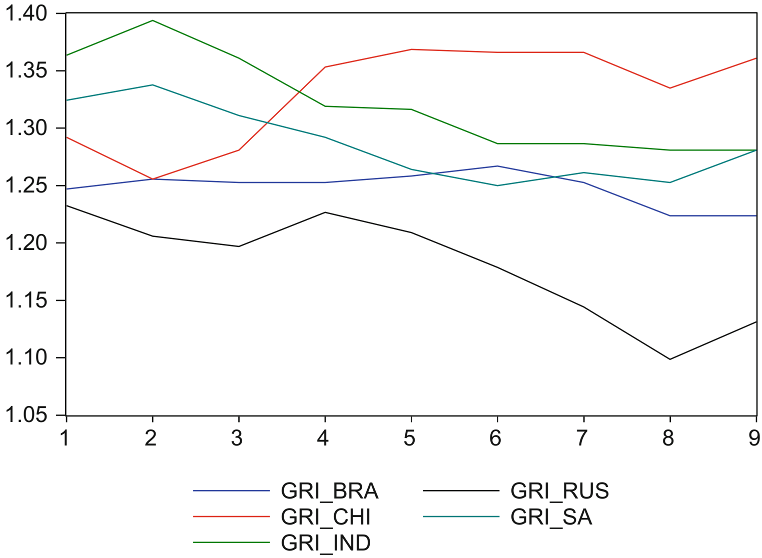

Fig. 7.4 BRICS Innovation growth rate. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

However, these countries will need to improve the level of performance of their firm's technology adoption (FTA). The same equation was tested for Brazil individually and the FTA showed negative sign as well. This can be understood as an opportunity to invest in digitalization once the firms do not have or do not know the usage of the available technology.

The results have also shown that the Brazilian's firms have invested less in TR (availability of latest technology, firm level of technological absorption and technology transfer) compared to the others countries. However, Brazil has been the country that invested the most if one considers just the availability of latest technology and FTA. Therefore, Brazil shows better opportunities for digitalization improvement compared to the other members of the bloc.

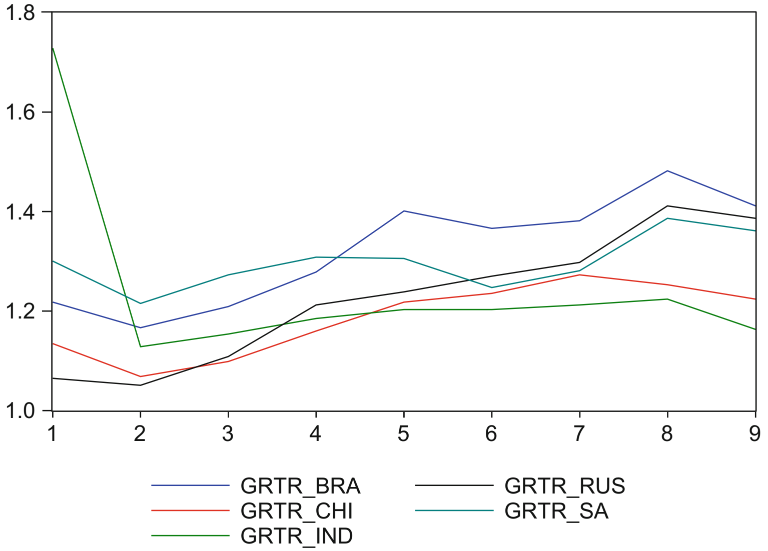

Fig. 7.5 BRICS Technological Readiness (TR) growth rate. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (I7) 2011/2012; (8) 2012/2013; (9) 2013/2014

BRICS—Business Sophistication (Pillar 11)

The PICAM method was used to test the business sophistication of BRICS with the objective of measuring the quality of overall business networks and the quality of individual firms' operations and strategies in order to increase investments in digitalization. The results provided in Table 7.2 suggest that all the analyzed variables positively influence BRICS's business sophistication with the exception of production process sophistication (PPS), which presented a negative sign. Important to notice is that PPS needs a high level of investment in digitalization to improve efficiency in order to reduce operation costs of production. In this case, BRICS lacks such investments, which can be considered as an opportunity to create a digitalization agenda for the firms in this economic bloc.

Table 7.1 Pillar 9 (Technological Readiness)

Variables[a]	EQ1	EQ2	EQ3
C	0.6100 (6.2297)	1.1613 (9.4522)	1.0936 (8.3022)
GRALT	0.4210 (6.6951)	0.6486 (11.0381)	0.6142 (10.326)
GRFTA		−0.5562 (−5.8853)	−0.8132 (−4.5352)
GRTT			0.3429 (1.7387)
R-squared	0.9861	0.9911	0.9927
S.E. of Reg.	0.1093	0.1021	0.1025
SSR	0.5140	0.4385	0.4313
DW stat	0.8356	1.0696	1.0847

[a] Statistics-t in parentheses

The same estimation was made for Brazil separately and the results show that PPS and quality of local suppliers (LSQUAL) need improvement and investment in digitalization. The results also show that all the countries in the bloc have invested less than necessary in order to have an adequate sophisticated business practice to achieve higher efficiency in the production of goods and services.

BRICS—Innovation (Pillar 12)

The PICAM method was used to test BRICS's capacity for innovation (CI) taking as estimation variables of quality of scientific research institutions (QSRI), company spending on R&D (CSRD), university–industry collaboration in R&D (UICRD), government procurement of advanced technology products (GPATP), availability of scientists and engineers (ASE), patent (PCT) and intellectual property protection (IPP).

The objective is to measure the conditions for innovation reinforcing the business efficiency spillovers as well as the opportunities for innovation in the creation of processes and products. The results provided in Table 7.3 suggest that all the analyzed variables positively influence BRICS's capacity for innovation. Important to notice is that CI and CSRD presented the highest coefficients, representing the importance of these variables to guarantee a proper innovation environment.

Table 7.2 Pillar 11 (Business Sophistication)

Fixed effects estimation—dependent variable: business sophistication 2005–2014

Variables[a]	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7	EQ8	EQ9	EQ10
C	−0.4940	−0.3295	−0.3414	−0.2102	−0.1909	−0.1939	−0.2226	−0.0346	−0.0736	−0.0695
	(−4.3507)	(−2.2185)	(−2.3449)	(−3.1320)	(−3.0555)	(−3.1478)	(−3.0549)	(−0.4229)	(−0.9616)	(−0.9061)
GRCID	1.3560	1.0311	0.8491	0.2325	0.1384	0.1465	0.1861	−0.0266	0.0082	0.0556
	(16.928)	(5.1043)	(3.3106)	(1.9147)	(1.0324)	(1.0850)	(1.3024)	(−0.2136)	(0.0688)	(0.4676)
GREM		0.1955	0.1011	0.3364	0.3199	0.3329	0.2892	0.2822	0.1147	0.1052
		(2.0122)	(0.7067)	(4.7662)	(4.6521)	(4.9056)	(3.3126)	(3.7468)	(1.1920)	(1.2883)
GRLSQUAL			0.2752	−0.0649	0.0076	0.0199	0.0723	0.0406	0.2438	0.1895
			(1.1417)	(−0.5774)	(0.0607)	(0.1654)	(0.5245)	(0.3467)	(1.8089)	(1.8367)
GRLSQUAN				0.5560	0.5291	0.5421	0.5386	0.4085	0.3413	0.3204
				(12.1543)	(9.8397)	(9.7031)	(9.5529)	(6.7701)	(5.5398)	(6.1152)
GRNCA					0.0629	0.0627	0.0621	0.0106	0.0073	0.0283
					(1.2555)	(1.2238)	(1.0933)	(0.1913)	(0.1431)	(0.6318)
GRPPS						−0.0508	−0.0772	−0.0555	−0.0778	−0.0513
						(−0.8510)	(−1.2331)	(−1.0077)	(−1.5134)	(−1.0696)
GRRPM							0.0234	0.1080	0.1577	0.0649
							(0.4113)	(1.6867)	(2.5389)	(0.9740)
GRSCD								0.1681	0.0976	0.0986
								(3.3570)	(1.8115)	(2.0785)
GRVCB									0.0870	0.0651
									(2.4956)	(1.9492)
GRWDA										0.1270
										(2.0465)
R-squared	0.9916	0.9867	0.9882	0.9990	0.9990	0.9990	0.9988	0.9992	0.9993	0.9994
S.E. of Reg.	0.0486	0.0465	0.0464	0.0324	0.0324	0.0317	0.0320	0.0307	0.0385	0.0275
SSR	0.0898	0.0800	0.0776	0.0369	0.0357	0.0333	0.0327	0.0292	0.0446	0.0258
DW stat	1.0416	0.9505	0.8902	1.6200	1.5851	1.6848	1.6565	2.0483	2.2040	1.9551

[a] Statistics-t in parentheses

Table 7.3 Pillar 12 (Innovation)

Fixed effects estimation – dependent variable: innovation 2005–2014								
Variables[a]	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7	EQ8
C	1.0142	0.2094	0.2820	0.2816	0.3104	0.2947	0.1115	–0.0248
	(20.7841)	(2.6278)	(4.1465)	(4.1598)	(11.0250)	(8.6997)	(2.9300)	(–1.9114)
GRASE	0.1761	0.11565	0.1175	0.1289	0.1847	0.1892	0.1407	0.1669
	(5.3705)	(3.2847)	(4.6485)	(5.0104)	19.7000	(14.7969)	(9.0444)	(30.996)
GRCI		0.6788	0.0692	0.0583	0.0946	0.0960	0.1805	0.2083
		(12.1386)	(0.8158)	(0.6830)	(1.8051)	(1.7758)	(4.5378)	(11.0893)
GRCSRD			0.7028	0.6900	0.1164	0.1220	0.0488	0.1913
			(8.5405)	(8.1353)	(2.5288)	(2.5649)	(1.0610)	(8.6285)
GRGPATP				–0.0015	0.1455	0.1464	0.1921	0.1423
				(–0.0433)	(6.5384)	(6.4492)	8.4114	(20.8230)
GRIPP					0.1746	0.1733	0.1416	0.0870
					(14.6371)	(14.1137)	(11.0412)	(19.6131)
RPCT						0.0018	0.0013	0.007
						(0.6484)	(0.5347)	(0.1120)
GRQSRI							0.1487	0.1792
							(5.7165)	(15.7249)
GRUICRD								0.1475
								(28.7734)
R-squared	0.9969	0.9994	0.9933	0.9954	0.9998	0.9998	0.9997	0.9999
S.E. of Reg.	0.0591	0.0406	0.0244	0.0243	0.0119	0.0121	0.0101	0.0031
SSR	0.1331	0.0610	0.0214	0.0208	0.0048	0.0048	0.0033	0.0003
DW stat	0.2122	0.2079	0.8408	0.7765	1.0112	1.0405	0.8525	1.4363

[a] Statistics-t in parentheses

By guaranteeing investments in digitalization R&D the private sector will improve industrial efficiency in order to reduce operation costs of production. The results have shown that all the countries, with the exception of Russia, have invested more than necessary in order to improve innovation. One may note that most of the countries have presented similar levels of investment that is comprehensive since they are countries that need to improve their TR. Therefore, they need to increase investments in digitalization.

Brazil, Germany and the USA Context Within the Global Competitive Index

The results in Fig. 7.6 show that Germany has the best Business Sophistication index behavior compared to the USA and Brazil. This means that Germany tends to have higher levels of efficiency in production, network quality, strategic quality and operations within its firms compared to the USA and Brazil.

The results in Fig. 7.7 show that as for the Global Competitiveness Index, Germany has improved its competitiveness through the analyzed period reaching an equilibrium with the USA from 2011 onward.

As for Innovation, the results in Fig. 7.8 show that Germany has improved from 2009 to 2014, overcoming the USA in 2012. The results show a change in levels of innovation sophistication factors throughout the analyzed period. Germany surpassed the USA in 2007 and 2010.

In terms of Technological Readiness, it is observed that Germany has considerably improved its level compared with the USA, which was negatively affected by the global economic financial crisis (Fig. 7.9).

The impact of DICTs extends well beyond productivity gains. Investment in DICTs positively affects economic and social transformation by improving access to services, enhancing connectivity, creating business and employment opportunities, and changing the ways people communicate, interact and engage among themselves and with their governments.

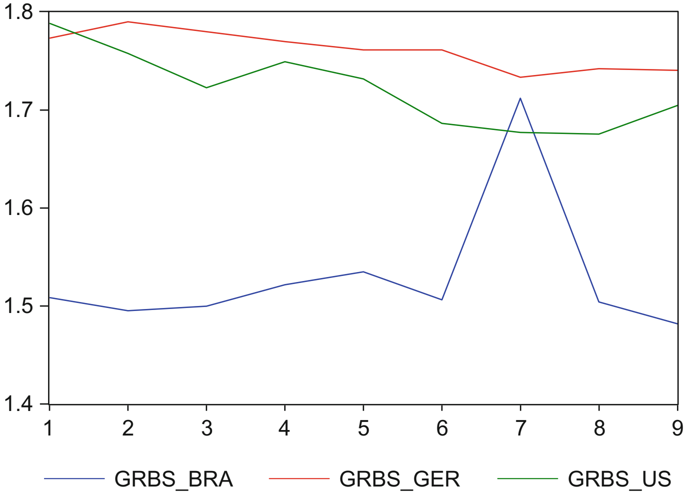

Fig. 7.6 Business sophistication growth rate for Brazil, Germany and the USA. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

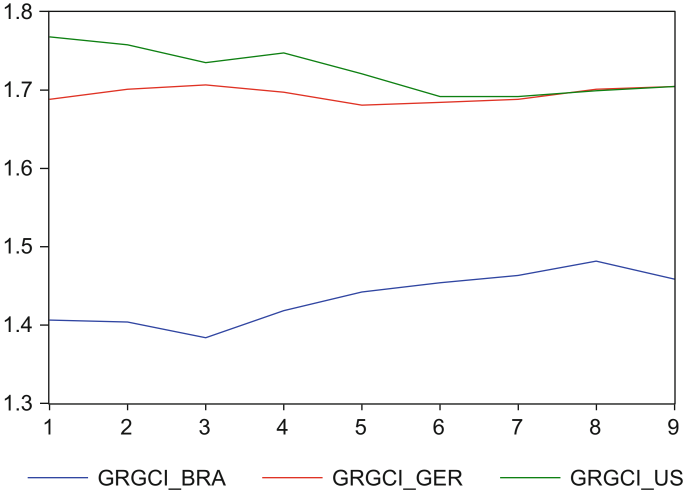

Fig. 7.7 Global Competitiveness Index growth rate for Brazil, Germany and the USA. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

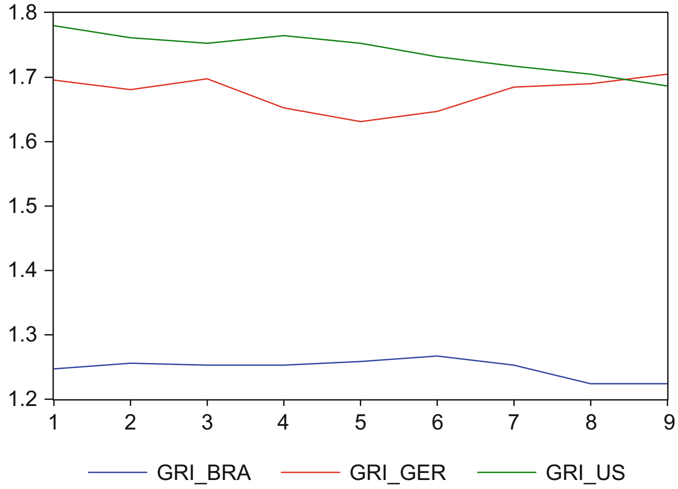

Fig. 7.8 Innovation growth rate for Brazil, Germany and the USA. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

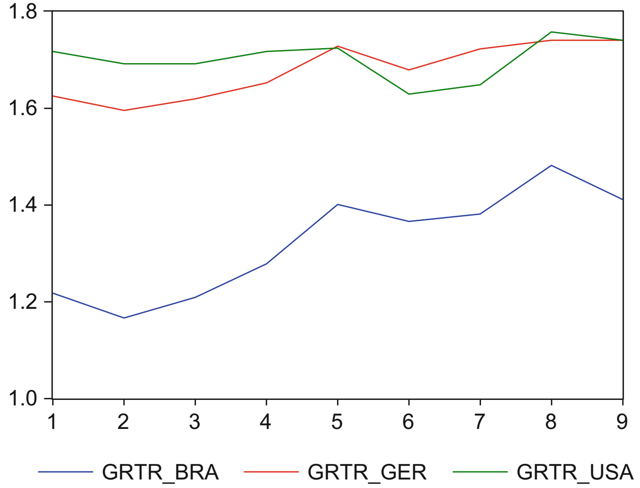

Fig. 7.9 Technological Readiness growth rate for Brazil, Germany and the USA. Obs: The time period is represented as follows: (1) 2005/2006; (2) 2006/2007; (3) 2007/2008; (4) 2008/2009; (5) 2009/2010; (6) 2010/2011; (7) 2011/2012; (8) 2012/2013; (9) 2013/2014

7.4 Conclusions

The development of digitalization in countries' manufacturing industry will firmly need to establish the idea of innovation spurring development. Firms would need to connect ideas and undertake innovation in relation to organization, integration and synergy. The government should make overall plans and efforts should be made in measured steps to secure key breakthroughs even while promotion is carried out across the board.

It is also necessary to quicken the pace for in-depth integration of digitalization and industrialization. Information technology with digitalization at its core should be applied to transform and upgrade traditional manufacturing industry to achieve integration innovation.

The overall results suggest that the Networked Readiness Index impact of technology on productivity is not uniform in Brazil compared to Germany and the USA. Brazil has a great opportunity for investing in digitalization based on the lack of government usage, affordability, skills and mainly the technology infrastructure that need to be improved or even installed. Investments in digitalization and connectivity will yield higher economic impact in specific sectors, such as industry, commerce and information services. Furthermore, the government has failed to make DICTs a core driver of its development strategy. Consequently, the economic and social benefits from DICTs remain very limited instead of driving growth in productivity.

Finally, an innovative system should be established, taking enterprises as the main body, staging market-oriented and attaching great importance to the integration of enterprises, institutions of higher learning and research institutes.

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8

Social Media Innovations and Creativity

Vanessa Ratten

8.1 Introduction

Creativity is often a procedure that takes place on social media based on complex social system dynamic behavior that involves both innovation and entrepreneurship. The increased role of creativity in social media innovations is due to its ability to yield work that is unusual and useful (Lee et al. 2015). Despite the increased importance of social media technological innovations, there is a scarcity of research linking innovation and creativity to social media and management practices (Wang and Miao 2015). This is despite the emergence of new social media including crowdsourcing and open innovation changing the way we look at creativity in a management perspective (Ranaweera and Sigala 2015). The increase in creativity on social media is linked to the personal characteristics of individuals and situational factors affecting the development of

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a creative mindset (Amabile et al. 1996). Individual creativity is usually associated with the work environment or activities in daily life as problems are solved (Lubart 1994). This is different from creativity at the social level, which involves inventions and programs aimed at exploring new activities (Lee et al. 2015). This interactional working environment on social media using both individual and social levels of creativity is important for team creativity to evolve and be utilized in a productive manner.

Runco (2004, 685) refers to creativity as “the capacity to cope with the advances, opportunities, technologies and changes”, which highlights how creativity is helpful in integrating social media innovations with everyday lifestyles. Another definition proposed by Yeh (2015, 397) defines creativity more broadly in terms of abilities rather than capacities: “ideas, products, creative individual’s abilities and thinking processes, which contribute to both originality and usefulness”. Both definitions refer to creativity as a process that results in innovative outcomes but the latter definition is adopted in this chapter as it integrates ideas with thought processes. This means that the chapter adopts the view that creativity involves thinking outside the box and looking at things differently (Mayer 1999). This ability to produce innovative results that have original and useful content is important to entrepreneurial firms, particularly those involved in social media. Social media is being consistently updated based on new ideas that add to the technological innovations taking place on the Internet.

The ability to transform a technological innovation into reality often needs a creative approach because it has not been done before. Innovations are being used more widely as a way to tap into market potential, especially in new technology applications such as social media (Fuller et al. 2008). Incorporating creativity in social media can occur in a variety of different ways but is often the result of customer engagement with the development of service innovations (Andreassen et al. 2015). This means that managing the innovation process in a social media setting differs because of the use of online communities, which act as entrepreneurs in the development of new processes. When organizations actively involve customers with the innovation process this enriches the evolution of service development, particularly for emerging technological applications.

Therefore, the creative performance of products and services is enhanced when integrated into innovation management systems (Sigala and Chalkiti 2015).

Social media incorporates technological innovation into services in a different way than the traditional processes used in the past by organizations. Moreover, with the advanced service innovations occurring in social media there has been a rethink about our conceptualization of innovation management. This is due to a link between creative activity and innovation because of the increased number of new ventures enabled by changing technological innovation. Part of this linkage is because innovation and creativity have a symbiotic relationship, which has been recognized in the management literature as being important (Sigala and Kyriakidou 2015). This has meant creativity is often seen as an antecedent of innovation because of its ability to induce change (Amabile et al. 1996). In addition, innovation involves the implementation of ideas while creativity is about producing the ideas (Shalley et al. 2004).

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 on an online context. More recently creativity has been seen as having more of a complementary function to innovation management in the competitive global economy (Sigala and Kyriakidou 2015). This complementary function is due to more online collaborative activities integrating teamwork as a core component (Tseng and Yeh 2013). 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 to occur.

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 is an important strategy for overall performance and helps increase further social media applications. This is due to creativity being affected by an individual's interaction with their social and physical environments, which are impacted by timing concerns (Woodman and Schoenfeldt 1990). Timing is crucial for social media as it affects the way individuals use their experience to complete tasks in a new way that is based on their knowledge of a certain behavior. Creativity often occurs at the start of the innovation process as it involves an individual or team coming up with a good idea. After an idea is developed, it is incubated beyond its initial state (Baer 2010). A challenge in the management of innovation is converting ideas into actual new products that have social media applications. This process can take time depending on how quickly social media innovations are adopted in the marketplace.

This chapter attempts to fill the gap in the current innovation management research by focusing on the linkage between creativity and innovation from an entrepreneurial perspective in social media practices and applications. This chapter is conceptual in nature as it develops a set of research propositions from the literature review. In this chapter, I use a cognitive style of creativity as the theoretical framework to explain innovation management in social media. The next section will further discuss the literature about creativity management.

8.2 Literature Review

Creativity Management

The environmental contexts influencing the creativity process are related to administrative services that are often developed from incremental innovations. This makes the understanding of creativity in terms of business practices linked to the performance outcomes associated with social media. The majority of studies about innovation management focus on innovation as a two-stage process involving creativity (idea generation) and implementation (George 2007). This means there is a gap in the literature incorporating both the idea generation and implementation process in terms of linking them to the environment fostering creativity (Wang and Miao 2015).

An individual's creativity is driven by personal traits, environmental features and social networks (Aubke 2014). These social networks incorporate the relationships an individual operates in, which impacts the level of creativity embedded in a society. This means that increasingly creativity is being viewed as a social process as collaboration is part of the development process (Sigala and Chalkiti 2015). This is due to creativity involving communication, which enables the emergence and development of new ideas and ways of doing things. The way individuals and organizations develop their creativity is based on the accessibility to knowledge within a certain environment. Often an individual's work environment plays a part in developing the cognitive processes that lead creativity to become innovation (Baer 2010). A key issue in innovation management is the ability to organize creativity so that new streams of products, services and technologies are developed (Sigala and Kyriakidou 2015). One way organizations are managing the creativity process is by evaluating the flow of resources that support mechanisms designed to improve social media performance.

Performance can be evaluated by examining the behavior of creative individuals and their usage of social media. Creative individuals are sometimes referred to as having a cognitive style that fosters innovative behavior (Chen et al. 2015). This means that an individual's cognitive-style creativity refers to how their mental models develop ideas. Creative individuals usually integrate divergent thinking about possible future activities, which they can incorporate into social media. A way to look at creativity in individuals is by evaluating their psychological traits, which are linked to entrepreneurial outcomes (Chen et al. 2015). Therefore, the cognitive style of an individual is part of their psychology as it affects behavior in the workplace. Cognitive style refers to the way individuals make decisions, how they behave and their ability to relate to others. The individual differences in cognitive style are important in understanding perceptions of new ideas and ways to solve current problems with existing management practices associated with social media. This creativity is often linked to entrepreneurship as it fosters the creation of new business ventures associated with social media technological innovations. The next section will further discuss the linkage between creativity and innovation.

Creativity and Innovation

In creativity research there has been a suggested link between the quantity in terms of flexibility and productivity with the quality of ideas (Rietzschel et al. 2007). In some cases, the quality may be the elaboration and originality of new ideas that result from the creative process (Yeh 2015). This is due to creativity being a complex process with productivity sometimes predicting more original ideas than performance (Diehl and Stroebe 1987). Productivity can be measured in different ways depending on the evaluation of the idea generation process in novel social media applications.

Im et al. (2015, 166) define new product creativity as "the degree to which a new product is perceived to be uniquely different from competitor's products in a manner that it is meaningful to target customers". The key aspects of creativity that are important to innovation management are novelty and meaningfulness (Im and Workman 2004). This is because consumers view novelty and meaningfulness differently depending on the interaction with a product or service. This means that consumer knowledge about creativity from the perspective of whether it creates value for them influences their intention to engage in social media innovations.

The time needed to come up with creative ideas is important in understanding the thinking processes associated with innovative outcomes (Howard-Jones and Murray 2003). Sometimes creative ideation is a long process that involves many different types of input that can include risk and financial resources. Biasutti (2015) suggests that a sociocultural approach to creativity helps further the individualistic analysis of cognition to incorporate cultural context and social interactions. The sociocultural perspective is important to understanding the role of the social context in creativity and the interaction individuals have as part of their collective knowledge (Fischer 2014).

Innovation is generally defined as the introduction of new and useful ideas, process, products or technologies (George 2007). This means that the management of innovation includes generating and implementing creative ideas that potentially lead to market success (Wang and Miao 2015). Innovation focuses on the implementation while creativity involves generating ideas that can then potentially lead to further innovations. In comparison to innovation, creativity involves the generation of novel and useful ideas (West 2002). The implementation of ideas can include creating, introducing, selling and gathering responses about the innovation in the marketplace (Axtell et al. 2000).

The process of creativity and innovation do not always follow a linear path due to their complex attributes (Anderson et al. 2004). Creative ideas are turned into innovative offerings by their dynamic and uncertain outcomes. This means that there are tensions and dilemmas which characterize the innovation process when novel ideas are converted into practices (Lewis et al. 2002). The paradoxes being idea generation, implementation and outcomes are based on the linkage of creativity with innovation (Miron et al. 2004). Idea generation involves experimenting with different thoughts and courses of action that challenge current innovation management thinking. By disrupting current management practices, idea generation changes the routines associated with innovation (Rosing et al. 2011).

Creativity is associated with explorative activities and innovation with exploitative behavior. This linkage to explorative and exploitative behavior is linked with March's (1991) idea that learning involves a number of different types of action. The learning can occur in both product and process innovations, which are the main types of innovation referred to in the management literature and are revolutionizing industry practices. Product innovation refers to novel tangible goods introduced into the market (Cooper 2008). Most types of product innovations involve meeting unmet customer demands that are lacking in the current marketplace (Gopalakrishnan et al. 1999). Product innovation is implemented slower than process innovations due to the easiness of integrating new mechanisms into the marketplace. The focus on product innovations is the customer who thereby improves upon current usage patterns, and this is part of the collaboration process in social media innovations.

Process innovations involve the changing of service applications to make things more efficient (Ettlie and Reza 1992). The systemic nature of process innovations means they usually are the outcome of idea generation and implementation that has been tested over a time period. The integration of knowledge for process innovations is based on coordinating mutual needs within a service context. The exchanging of information can be internally sourced within an organizational context or based on external environmental factors (Gopalakrishnan and Bierly 2001). The integration of mechanisms needed for process improvements to be adopted in the market is challenging due to the communication required. Sometimes the coordinating of innovations requires trust between parties as part of the process improvement (Aiman-Smith and Green 2002). Product innovation involves integrating the needs of customers with the requirements of distributors and suppliers. The conceptualization of innovation in a product context can involve alterations to the design process (Ettlie et al. 1984). The next section will further discuss the role of product and process innovations in technological innovation occurring in social media by suggesting a conceptual framework.

8.3 Conceptual Framework

Social Media Innovations and Creativity

The challenge for innovation management research is linking the individual and social dimensions of creativity to enhance learning processes. The sociocultural theory of creativity focuses on collective learning as part of the more systems-orientated and constructivist approach (Glaveanu 2010). The practice of creativity incorporates a multiplicity of processes that are simultaneously occurring in the social environment (Burnard 2012). This means that instead of creativity having a linear approach it is the result of multiple interactions between systems, relationships and individuals (Biasutti 2015).

Both innovation and creativity are important in fostering an organization's competitive position in the marketplace. In order to generate innovative ideas creative approaches are developed to unlock potentially good ideas. This helps to revolutionize the market by responding to technological change. One of the main ways organizations have been revolutionizing innovation management practices is through social media, which has different creative approaches to utilizing technological innovations (Sigala 2012). This means that innovation and creativity are becoming more recognized for their role in fostering the development of social media (Sigala and Chalkiti 2015). An individual's creativity depends on their accessibility and availability of information (Hemsley and Mason 2012). Social media has changed organizations' innovation management systems by enabling them to access knowledge in formal and informal manners (Sigala 2012). Social media, particularly from online social networks, has altered the way organizations manage their knowledge systems. This is due to social media synthesizing knowledge from a range of sources in order to facilitate creative development of new innovations.

Social media enables individuals to participate in collective knowledge processes by sharing thoughts and ideas. This enables the formation of online communities that often operate informally and without the same type of structure as other organizations. The interconnections made possible by social media are enhanced when information is easier to retrieve and alter based on technology innovations. As more individuals utilize social media as part of their daily lives it is changing the way innovation is managed both privately and in professional circumstances.

Little is understood about how social media has changed the innovation and creativity management processes (Sigala and Chalkiti 2015). This is due to the new trends and technological developments that have impacted innovation management. There is an urgent need to understand how social media as a technology tool has impacted innovation management (Raneweera and Sigala 2015). By understanding the creativity and innovation processes embedded in social media it will help to further research about innovation management.

There is growing acknowledgment about the flexible nature of social media in terms of how it is creative and innovative. This is due to research focusing on the multidisciplinary nature of creativity and innovation based on design thinking, which is integrated with business practices. Increasingly knowledge management approaches are utilizing a creative perspective to inform management thinking. Part of this is due to the source of innovation often being the creativity context (Sigala and Chalkiti 2015). The next section will further discuss the role of creativity in the revolution of innovation management by focusing on social media applications and suggest a set of research propositions.

8.4 Research Propositions

Creativity and Entrepreneurial Cognition

The ability to be a successful entrepreneur is sometimes based on entrepreneurial cognition. Individuals that have an entrepreneurial cognitive style focus on intuition and informality as a way to make decisions. This means that creative entrepreneurs have a management style based on feelings they perceive as being trustworthy and indicators of future behavior. The unique features of creative entrepreneurs' affect innovation management processes as they can speed up the time businesses take to get new ideas into the marketplace. The success of an entrepreneur can be based on the positive psychological outcomes that they accumulate from new venture creation. These outcomes can be work-related depending on the type of entrepreneurial behavior.

Individuals within the creative or technology industry may evaluate their entrepreneurial success of the management of innovations that have revolutionized the industry. This means that the context of entrepreneurial behavior impacts new venture success rates (Chen et al. 2015). Sometimes social media companies often evaluate their business success based on innovation rather than purely financial gain. This means that self-actualization of creativity in the design of products and services can be more important than profit maximization (Chen et al. 2015).

Increasing creativity in new products and services is crucial to the survival of organizations (Im et al. 2015). Products with higher levels of creativity embedded in them have been found to have increased profitability levels for the organizations involved. The superior value that creative products offer customers means that organizations can charge higher rates and this influences their competitive ability in the global arena. The creativity stream of innovation management and entrepreneurship research has been lacking due to the previous focus on supply chain and logistic needs of organizations. However, as more technological innovation has occurred in the past decade, particularly in terms of social media, there has been increasing interest in creativity.

The main ways creativity affects firm performance are by differentiating products and services from competitors in order to create an advantage (Amabile 1988). There has been an emphasis on meaningfulness within creativity as it is perceived as being more important to consumers in terms of new product adoption (Im and Workman 2004). This is due to the meaningfulness of new ideas or ways of doing things being easier to ascertain for consumers of social media. The benefits of new social media products and processes for consumers enable them to meaningfully interact with them. New technologies that are novel may not be adopted at the same rate as those that consumers think have more meaning in their life. This can occur when novel technologies are too different from current practices and take time to understand their usefulness. Sometimes consumers are unwilling to change due to their comfort with current practices and the cost of changing (Im et al. 2015). This inertia may mean that timing is the most important issue when introducing a new product or service into the market.

Novelty can include a degree of hedonic value, which incorporates the perception of coolness or doing things more for selfish rather than useful reasons (Im et al. 2015). Novel features include those considered outrageous or weird at the time as they use new approaches not previously used in the market. With time, however, these novel features are accepted as the norm by consumers as they become more comfortable. An example of a novel feature in social media is swiping yes or no on the screen with your hand to interact with mobile applications. Such innovations in social media were initially new but are now considered positive additions to website experiences. Other examples of novel innovations in social media are crowdfunding campaigns such as those on Kickstarter that create virtual communities around a new product or service. This leads to the first research proposition:

Research proposition 1 Increased creativity and entrepreneurial cognition will lead to better social media innovations.

Collective Flow and Creativity

There are a variety of different forms of flow but one of the most important in creativity studies is the collective one. Collective flow involves creative activities that incorporate groups or teams of individuals and this is important in social media innovations. Collective or group flow means that members are focusing on the same aim or objective related to the topic of discussion (Biasutti 2015). The flow occurring during a collective session means that emotions and feelings are attuned to the same topic. During the collective flow process, group members challenge each other's opinions in order to come up with a mutually beneficial objective. Group members experience flow when the dynamics of the discussion are timed to produce a good outcome. Risk taking is a key ingredient in collective flow as group members may share thoughts that can be divergent to others. The interactions as part of collective flow are referred to as optimal psychophysical states that inspire good overall outcomes (Biasutti 2015).

Collective flow is important for sustaining and improving creativity as members constantly strive for better outcomes (Kenny 2014). As group members increase their interest in the creative process, collective flow enables creativity to become a reality. The production of spontaneous ideas occurs in collective flow and these are important by-products of innovation management. It is crucial for innovation practices that collective flow be incorporated into management discussion about ways to increase creativity, particularly for social media applications. Group members can interact and often synchronize their ideas, leading to more creativity and innovation.

Collective creativity can be viewed from a socio-cognitive approach where the creativity is embedded in the mind as a result of certain behavior occurring (Glaveanu 2010). This contrasts with the sociocultural perspective of creativity, which focuses on the creativity embedded in social aspects of cultural activities (Biasutti 2015). The sociocultural way of looking at creativity enables the application of more learning and knowledge in order to maximize innovation. The creativity process involves a cyclical design that incorporates collective work and interactions (Fischer 2014). This means that creativity incorporates the mutual engagement and reflection of different ideas in order to come up with an innovative possibility (Sharples 1996).

The creativity process is guided by the individuals involved in developing knowledge, which is a by-product of the social environment. This can include reviewing and reflecting upon certain ways of doing things to build on the creativity process. Biusutti (2015, 118) suggests that as a part of reflection there is contemplation defined as generating "new ideas which are explored and transformed, producing plans and constraints that drive a further period of engaged writing". The engagement in the creativity process can support better innovation strategies depending on the effectiveness of the contemplation phase.

Communication is important during the collaborative creation process as it helps knowledge to be acquired and disseminated. There are different forms of communication that can be involved from verbal dialogue to online discussions in social media contexts. Collaborative creativity is expressed in different ways including through empathetic behavior and the inclusion of flow (Croom 2015). Empathetic attunement with other stimuli is a mechanism used to encourage collaborative creativity (Seddon and Biasutti 2009). This is helpful in supporting collective flow, which is a specific state of consciousness commonly referred to in studies about creativity. Flow involves a state of mind, which combines affective, cognitive and physiological factors (Csikszentmihalyi 1990). In social media, there are individuals from different geographic locations communicating together on media platforms. Therefore, this leads to the second research proposition:

Research proposition 2 Increased collective flow and creativity will lead to better social media innovations.

Team Creativity

Team creativity involves utilizing different types of resources as part of the decision-making process (Brand 1998). Knowledge and innovation management are ways that team creativity can be enhanced when coupled with shared leadership (Lee et al. 2015). Sometimes there is more comfort in sharing ideas in a team setting when individuals have the same demographic features. However, diversity in an innovation setting has also been shown to affect achievement (Tsui et al. 2002). This is due to the competitive pressure of a team setting, which helps members outperform and add to each other's innovation suggestions.

Jehn (1997) suggested that functional diversity influences team creativity because of the generation of different points of views about new ideas. This diversity is important in increasing the level of information sharing based on novel ideas and thoughts. Creative behavior is likely to increase when there is more functional diversity among team members (Lee et al. 2015). Creativity is often approached using intrinsic motivation theory that suggests that individuals are likely to be more innovative when this is embedded in their social system (Amabile 1996). Often leadership of creative pursuits can influence creativity when partnered with situational factors (Zhou 1998). This means that transformational leaders change the way innovation is viewed and this affects follower creativity (Shin and Zhou 2003). Ideas that are shared in a team setting are enhanced when creativity is facilitated as part of the process (Oldham 2003). This means that effective knowledge exchange among team members is related to the progression of creative behavior. Sometimes the knowledge needs to be managed properly so that the technical and practical aspects are matched. For this reason, knowledge sharing is seen as a key antecedent of successful creative collaboration.

Woodman et al. (1993) proposed the interactionist model of creativity that incorporates personality, knowledge, motivation, abilities and style. These attributes of the creativity model are influenced by social environmental factors that can help or discourage innovation. West (1990) proposed a model for innovation that incorporated team activity with participation, which can result in creative outcomes. This team approach means that group creativity is affected by the personal characteristics of individuals in a group, which influence the way members freely share ideas.

Creative thinking involves broadening the attention span to look at things in a refreshed manner (Kasof 1997). Sometimes this kind of thinking can involve having more cognitive flexibility in altering an individual's mindset to keep up to date with changing circumstances (Hennessey and Amabile 2010). Friedman et al. (2003) suggested that a more defocused and broader attention span facilitates better creative ability that generates new ideas. This is particularly helpful in more entrepreneurial fields that need support rather than hindering of creative material. Creativity involves looking at a number of stimuli at the same time in order to synthesize possibilities (Yeh 2015). The hallmark of creativity is that it combines stimuli in previously unknown ways (Mendelsohn 1976).

Cognitive flexibility is crucial to creative thinking as it encourages the interrelationships of patterns to generate new associations (Hennessey and Amabile 2010). To do this it involves overcoming previously entrenched cognitive patterns to process creative idea generation (Yeh 2015). Creative thinking can be increased when diversifying previous experiences come together as a result of cognitive flexibility (Ritter et al. 2012). Research by Goldschmidt (2015) suggests that visual stimuli can help increase creative design performances. This means that varying kinds of visual stimuli influence future creative behavior. The visual stimuli associated with positive emotions are more likely to enhance cognitive flexibility as they help individuals see things in a new way (Davis 2009).

Creative problem-solving performances are enhanced by the recognition of positive emotions with specific stimuli (Ashby et al. 1999). Friedman and Forster (2010) suggest that more positive emotional states benefit creative cognition as they broaden the attention span of individuals. Gillebaart et al. (2013) found that novelty in imagining novel events leads to better creativity in the form of increased information processing. In addition, Jackson et al. (2012) found that playing video games can enhance the creative performance of individuals because of their experience in coming up with different courses of action.

In social media, online communities can listen and evaluate different ideas through a trial-and-error approach to come up with the best outcome. This means that the creativity involved in social media enables participants to reflect on suggestions and then develop innovative practices. This process for social media is also helped by the volunteers and unpaid work of online communities interested more in a topic than in profitability. New social media applications such as Snapchat have evolved due to the collective flow from online users. Therefore, the third research proposition is:

Research proposition 3 Increased team creativity will lead to better social media innovations.

Managerial Implications

The three research propositions developed from the theoretical framework have important implications for managers. This is due to the revolution in innovation management that has occurred as a result of technological advances in social media. First, the findings suggest that innovation managers should help increase knowledge sharing about social media to enhance creativity. By sharing leadership, then, this will encourage employees to be part of the creativity process in building social media innovations. Second, in order to increase creativity and innovation, managers should consider personality traits of individuals that can be linked to creating an online community interested in social media advancements. They should encourage creativity in their organizations that is reflected in measurable innovation improvements as evaluated by customers. Finally, given the competitive pressures placed on organizations to be more innovative, managers should ensure there is a clear vision about group creativity. When managers promote creativity in team activities, more innovation is likely to result from knowledge sharing.

8.5 Future Research Suggestions

The current research about creativity and innovation is limited in the social media arena due to the fast-changing technological innovations occurring. Future studies need to focus on the types of social media, which may require different ways of looking at creativity in order to maximize innovation performance. It may be worthwhile for researchers to investigate the effect of group creativity on social media innovations to understand the distinction between thought and action involving technology. Creativity in current innovation management research is limited due to its psychology and organizational behavior origins that stress group dynamics rather than innovation outcomes. As creativity is complex and can involve a group or an individual it would be helpful for future research to improve our understanding of the concept in an innovation management perspective. Future research can link the previous organizational behavior literature about creativity to the entrepreneurship field by utilizing more longitudinal case studies to show how the concept is changing.

Conclusion

This chapter discussed the revolution of innovation management in terms of how creativity and innovation are affecting social media. It analyzed how social media has changed the way creativity is utilized through technological innovation. Social media is rapidly changing according to the creative approaches individuals have employed based on their usage behavior. The use of social media has revolutionized innovation management because of its innovative approach to technology services. The innovations in social media are highly contextual and depend on customers' interaction with the technology.

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9

The Revolution in Innovation Management: The Challenge for Legacy Firms

Jerry Wind and Kelly Rhodes

9.1 Introduction

In today's rapidly changing world, ongoing innovation is more critical to the long-term success of any business—start-up, twenty-first-century, or legacy—than ever before. Specifically, we see five major interrelated forces of change: advances in science and technology; skeptical and empowered people; an exploding media landscape; disruptive cultural, social, and geopolitical environments; and new business and revenue models. Consider the following:

- Advances in Science and Technology

Imagine that your customers and competitors each have access to an IBM Watson cognitive computer, which, through the use of

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natural language processing and machine learning can process all data (structured or unstructured) on any topic and in any language and, for any decision, produce a list of options and corresponding probability of success. Imagine the future "Internet of Everything" where everything and everyone is connected digitally. Imagine being able to offer products/services personalized to an individual down to the genetic level.

- Skeptical and Empowered people

Imagine your customers don't trust you or anything you say. Imagine your every move is scrutinized by a network of individuals all of whom have the ability to broadcast their opinion to the world. Imagine all people alive are "digital natives" who grew up with 24/7 access to the Internet and social media via a mobile phone and the ability to block unwanted ads using ad-blockers and on-demand movie/TV/music services.

- An Exploding Media Landscape

Imagine a world where consumers use upward of five (or even ten) different social media sites in any given day. Imagine there are an infinite number of media outlets and content producers such that the idea of a "mainstream" disappears and every micro-niche group is catered to. Imagine every individual has access to the same content production tools as professional studios (thanks to the sharing economy and crowd funding) such that the lines between producer and consumer become even more blurred than they are today.

- Disruptive Cultural, Social, and Geopolitical Environments

Imagine a world characterized by widespread famine, water scarcity, global warming, and antibiotic-resistant superbugs. Imagine terrorism is pervasive and unpredictable. Imagine even more extreme income disparity where only 0.1 % of the world's population owns 99 % of the world's wealth.

- New Business and Revenue Models

Imagine a business that is effective and efficient but owns no physical assets. Imagine a world where pricing for every good and service is dynamic. Imagine engaging with customers to cocreate every aspect of the consumer purchase journey—the marketing, the store design, the product/service itself, and more.

Given how rapidly the world is changing—as evident by how close many of the above-listed scenarios are to being realized—no company can afford to keep doing what they are doing today if they want to be successful in the future. They must innovate. Therefore, it is more important than ever that firms utilize effective approaches for facilitating breakthrough innovation. Furthermore, as innovation management goes through a revolution itself—with the emergence of open innovation, 24/7 development, globalization, and so on—businesses must look to innovate not only in the products and services they provide but in all aspects of the company, including their business models, organizational architecture, and, most critically, their approach to innovation management.

While the leaders of legacy companies recognize their organizations are behind and aggressively pursue innovation, they consistently fail to create breakthrough innovations. Instead, we see over and over again in history that truly revolutionary innovations come from new, young companies outside the industry. Clayton Christensen, in his HBR article "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail," finds that "despite the established firms' technological prowess in leading sustaining innovations, from the simplest to the most radical, the firms that led the industry in every instance of developing and adopting disruptive technologies were entrants to the industry, not its incumbent leaders" (Christensen 1997).

The objective of this chapter is twofold: (1) to explore why so many legacy firms struggle to develop breakthrough products and services and (2) to provide practitioners with ten interrelated guidelines for what they could and should do to address this challenge. While our guidelines are designed primarily for legacy firms, they have relevance to all firms, including start-ups and twenty-first-century firms (e.g. Google, Facebook, and Amazon). We end the chapter with a call to action for all readers to start experimenting with some of our proposed approaches.

It is important to note that while this chapter was designed for practitioners, it also provides a research agenda for academics or, ideally, for the collaboration between academics and practitioners.

9.2 The Shackles on the Innovation Engines of Legacy Firms

In this section, we will explore the forces that hinder innovation at legacy firms. We start by looking at ten industries for which breakthrough innovation in recent decades has come from outsiders. Then we look at the trend for legacy firms to acquire or partner with start-ups before addressing the issue of Mental Models, which we see as the fundamental obstacle preventing legacy firms from producing breakthrough innovation organically.

Breakthrough Innovation Comes from Outsiders

In theory, industry leaders are the best poised to come up with breakthrough innovations. These companies, by dominating if not having a complete monopoly on an industry, have everything one might imagine would be needed to innovate, including billions of dollars in revenue, large R&D budgets, strong brand reputations, ability to hire top talent, an understanding of the current industry, customer distribution channels, and access to customer data. Yet, in reality, very few are able to produce the breakthrough innovations necessary for the company's long-term success, as evident by the fact that only 12 % of the companies found on the Fortune 500 list in 1955 are still on the list in 2015 ("Fortune 500 firms" 2015). In fact, not only do legacy companies often fail to innovate themselves, they have been found to hold innovation back across an industry (e.g. the attack of major record labels on Internet innovations) (Masnick 2013). Instead, most of the breakthrough innovations of recent decades have come from outsiders.

There are certainly exceptions to this rule (e.g. General Electric, 3M, IBM, and others), but there are a significant number of industry leaders (many of whom were once the industry revolutionaries) who missed out on a breakthrough innovation and soon found themselves competing with a company that wasn't even part of the market just a few years earlier. Below, we take a look at just ten of the more notable examples from a range of industries. Rather than attempting to provide a comprehensive overview of the evolution of all legacy companies, the goal of this section is to analyze notable examples to demonstrate the vulnerability of even the most seemingly dominant firms.

Industry	
1. Cell phones	Old: Nokia, Motorola, Palm, Blackberry, etc. New: Apple iPhone By the numbers: Blackberry's stock reached a peak market value of $83 billion in 2008, just after the arrival of the Apple iPhone in 2007. By June 2015, Blackberry was worth only $5 billion and Apple made $32.2 billion from iPhone sales in Q4 2015 alone (Rodriguez 2015; Buhr 2015). Similarly, Nokia's share of the smartphone market, which had been as high as 50.9 % in Q4 2007, had plummeted to just 3.5 % by Q2 2012, leading Nokia to sell its mobile device division to Microsoft for $7.9 billion (an acquisition since deemed a "monumental mistake" on Microsoft's part). ("Global market share" 2016; Keizer 2015). What happened: Before the Apple iPhone, the mental model of a cell phone was that of a device whose function was almost exclusively phone calls and texts, with a few additional features built in for business phones, but all designed with physical buttons/keyboard and stylus as the primary means by which people operated their phones. While Nokia, Motorola, and Blackberry were making billions of dollars from this type of phone, Apple, an outsider to the cell phone industry at the time, was reconceptualizing the role a "cellular phone" could play in people's lives, and correspondingly rethinking the design of a "phone" to fit this role. The result: the Apple iPhone, characterized by the absence of a traditional physical keyboard and stylus, a multitouch interface with physics-based interactivity, and multitasking that let a user move seamlessly from one function to another and back (Ritchie 2015). From that point on, the other phone companies were rushing to compete, launching unsuccessful touch-screen device after unsuccessful device. For example, BlackBerry's response, the BlackBerry Storm, was so bad it had a 100 % return rate, leading Verizon to fire BlackBerry as a result (Rodriguez 2015). By focusing on incremental changes to the design and functionalities of their current devices, the major players in the cell phone industry completely missed the opportunity to redesign the "phone" given the other technologies that had evolved at the same time.
2. Hotel	Old: Traditional hotel (Hilton, Marriot, etc.) New: Airbnb By the numbers: In September 2014, Hilton hotels and Marriot hotels had market capitalizations of $24.35 billion and $21.05 billion, respectively ("Hilton (HLT) vs. Marriot (MAR)" 2014). As of January 2016, just under a year and a half later, their valuations had dropped to $17.07 billion and $15.3 billion (Yahoo! Finance 2016). In the meantime, Airbnb, a company started in 2007 by two San Francisco residents who could not afford to pay their rent, has taken the industry by storm. As of 2015, the start-up is valued at $25.5 billion, with approximately $900 million in revenue for 2015 and the conventional lodging industry estimating around $450 million in lost revenue in 2015 as a result of the introduction of Airbnb (Alba 2015; "Airbnb's $2 Billion Negative Impact" 2015). What happened: How did two guys with no experience in hospitality shake up the entire industry? The answer: they capitalized on the emergence of new technology platforms and the increasingly empowered consumer to bring the sharing economy to the hospitality industry. While the major hotel companies continued with business as usual, focusing on owning more properties and rooms and finding people to fill those rooms, the founders of Airbnb flipped the model. Rather than engaging in the capital-intensive work of building physical assets, Airbnb built a software platform that directly connected people who had empty rooms they were looking to rent out with people who were looking for a room to rent. This approach has proved incredibly successful and Airbnb's growth shows no signs of slowing down.
3. Photography	Old: Kodak New: Nikon/Canon/Sony New 2.0: Smartphones (Apple iPhone, etc.) and Photo sharing (Flickr, Instagram, etc.) By the numbers: Kodak, by 1997, was worth over $31 billion, with revenues of nearly $16 billion and consistently ranked as one of the five most valuable brands in the world (Crutchfield 2011; "The last Kodak" 2012). Just five years later, the Eastman Kodak company filed for bankruptcy (De la Merced 2012). What happened: Having dominated the camera industry since the company's founding in 1880, the Kodak company failed not because they lacked ingenuity (Kodak actually invented the first digital camera in 1975) but because they had become complacent and their executives "suffered from a mentality of perfect products," which was incompatible with a new, high-tech world characterized by a mindset of "make it, launch it, fix it" ("The last Kodak" 2012). Kodak hesitated to develop digital photography for fear of cannibalizing its film business, which the company had come to see as its golden goose after a century of near-monopoly and high-profit margins. Sony, Canon, and Nikon were not so short-sighted and charged ahead with digital photography such that by the time Kodak realized digital was the future it was too late (Dan 2012). Even after this failure, Kodak continued to cling to the physical property it already had, missing opportunity after opportunity. Had they gone back to the original mission of George Eastman—to give the consumer a camera that fit their life and thus make photography a core element of people's daily lives—it might have been Kodak who would have come up with the idea of developing a photography-centered phone, instead of outsider Apple, or, of developing a photo-sharing platform, rather than new companies like Flickr and Instagram.
4. Grocery stores	Old: Traditional grocery stores and chains New: Walmart New 2.0: Amazon, Alibaba, and Ocado By the numbers: From one store in 1962 to domination of the American retail sector in the late twentieth century, Walmart drastically changed the landscape of grocery stores and, in doing so, changed American culture (Matthew 2012). As of 2014, Walmart was the largest company in the world, with $485.7 billion revenue, operating approximately 11,000 stores in 27 countries and employing 2.2 million employees (Snyder 2015). However, in July 2015, Amazon, founded in 1995, just passed WalMart as the world's biggest retailer by market value with a market capitalization of $247.6 billion (compared to WalMart's $230.5 billion) (Pettypiece 2015). What happened: The mental model of grocery store chains had long been frequent sales (whereby the majority of products are overpriced and a rotating selection of products is "on sale" for lower). From his very first store in 1962, Sam Walton challenged conventions of the retail industry by offering "always low prices" (Walmart n.d.). In his pursuit of offering the greatest value and convenience, he reimagined the grocery store—large retail footprints, barely put together (no fancy fixtures, lights, or presentations), and "highly promotional, truly ugly, and heavy with merchandise," as described by Walton himself, thus pioneering the first "big box" stores (Planes 2013). However, in spite of this dominance, Walmart is not safe from being out-innovated, specifically because of the complacency such dominance encourages. Already well outpacing Walmart's online sales ($89 billion compared to Walmart's $12.2 billion), Amazon threatens to dethrone Walmart as the number one US grocery business with its Amazon Fresh program (first beta-tested in 2007), an achievement other new food delivery companies (e.g. Fresh Direct, UK's Ocado) are fighting for as well (Peterson 2015; Weiser 2015).
5. Shopping	Old: Department stores (Sears, Macy's, JC Penney's), Bookstores (Borders, Barnes & Noble) New: Amazon, Zappos, eBay, and Alibaba By the numbers: According to census figures, department store sales hit their peak in January 2001, with sales totaling more than $19.9 billion. Since then, they have been on a steady decline. As of January 2014, sales were down to $14.2 billion. The bookstore chain, Borders, which "pioneered an innovative inventory tracking system that improved the company's product management and sales projections," peaked in 1998 with shares hitting an all-time high of $41.75 (Osnos 2011). Soon after, the retailer began losing millions of dollars every quarter such that in 2011, after 40 years in business, the company announced bankruptcy and liquidated shortly after (Borney, 2011). Even as the now "undisputed king of…Huge Chain Bookstores," Barnes & Noble has still had to downsize and, as of January 2016, its stocks are valued at only $8.79 per share, less than a fifth of their peak value ($46.25 in March 2006) (Yahoo! Finance 2016). In contrast, Amazon, an e-commerce-first company founded in a garage in 1995 on the basis of becoming the "world's biggest bookstore," has become one of the cornerstones of the web worth $247.6 billion (see 4. *Grocery stores*); 20-year-old online marketplace eBay is valued at $28.17 billion; and Zappos (a wholly owned subsidiary of Amazon having been acquired for $1.2 billion in 2009) does $2 billion in revenues annually (Yahoo! Finance 2016; Pontefract 2015). What happened: Conventional department stores and bookstores were too invested in their brick-and-mortar sales and operations to do the kind of breakthrough innovating that Amazon was able to do. Founders Jeff Bezos (Amazon), Tony Hsieh (Zappos), and Pierre Omidyar (eBay), with no investments in any retail space and unhindered by the need to protect current revenue streams, were able to conceive of e-commerce-first businesses that maximized the possibilities of current technology and consumer attitudes and built organizations designed to continuously innovate as these conditions change. For example, Alibaba and Amazon have moved into selling TV shows, movies, games, and other entertainment. As e-commerce players (including Warby Parker and Amazon) open physical stores, department stores are falling further and further behind in the race toward developing an omnichannel approach that can deliver the seamless experience consumers expect.
6. Movie rental	Old: Blockbuster New: Netflix, Redbox, Hulu By the numbers: Once an industry revolutionary itself, Blockbuster Video came to dominate movie and video game rentals, peaking in 2004 with 60,000 employees, 9000 stores, a market value of $5 billion, and revenues of $5.9 billion (Harress 2013). Around the same time, DVD rental-by-mail company Netflix turned its first profit and Redbox launched a kiosk rental service (Carr 2010). By the end of 2010, Blockbuster had filed for bankruptcy (Harress 2013). Today, Netflix has a marketing capitalization of $44.2 billion (Google Finance 2016). What happened: Reed Hastings, after receiving a $40 late fee to Blockbuster, decided he could create a better experience and founded Netflix, forever changing the future of video rental (Carr 2010). Embracing the growing sophistication of computers and the pervasiveness of home computers, Hastings created a DVD-by-Mail company built on the basis of warehouses of DVDs, a website, and a recommendation algorithm, as opposed to constructing a network of conveniently located stores as was the industry model. With sales booming and late fees bringing in a staggering $800 million in 2000 alone, Blockbuster did not see the changes in customers' expectations or customers' growing frustration with usury late fees. They were so blinded by their own success that when presented with the opportunity to buy Netflix for $50 million, they passed. By the time Blockbuster launched an online DVD subscription service in 2004, they were already seven years behind Netflix. As the industry landscape continued to change with the growth of Redbox and Netflix followed by the emergence of streaming in 2007 (Hulu was founded and Netflix introduced streaming on its site), Blockbuster was never able to regain a foothold in the video rental business ("Hulu" n.d.; "Company Overview" n.d.)
7. Car service	Old: Taxi companies New: Uber By the numbers: Started just over five years ago in San Francisco as "UberCab," Uber now operates in 58 countries and is the most valuable start-up in the world, valued at $50 billion (McAlone 2015). The term "ubering" has become a part of the lexicon. What happened: Despite rapid technological changes in the last decade, the experience of hailing a taxi cab has remained essentially unchanged and unpleasant. The passenger is, for the most part, without information or power. In an industry as regulated as taxis, there's little incentive or ability to innovate. Enter Uber. Embracing the pervasiveness of GPS-capable smartphones and the emergence of the sharing economy (à la Airbnb), Uber redesigned every element of the experience—allowing basically anyone with a car to become a driver and designing a technology platform through which riders and drivers are matched, directions are determined, payment is exchanged, and ratings (of both passenger and driver) are collected—and, in doing so, reimagined what it means to be a "car service." Rather than accepting the conventions of the taxi industry, Uber owns no cars and employs no drivers, considering themselves a ride-sharing app rather than a taxi service (Frerickson 2015). They defy the industry standards and regulations of cab companies, allowing anyone to become a driver and taking a percentage of each fare, as opposed to the medallion system of taxis which has cab companies fighting for control of scarce medallions and then charging drivers a fee to rent the medallion, that is a fee to work. Taxi companies and car services fighting to protect the business they have are trying to regulate ride-sharing companies into the ground, rather than embracing new technologies and trying to compete, thus threatening to trap car services in the twentieth century. However, with a business model suited to today's world and customers, Uber has been able to fight back—mobilizing its customers to defeat New York City mayor Bill de Blasio's attempt to cap the growth of Uber in the city—growing its business and changing the way people travel and, consequently, the way they live their lives (Griswold 2015). But even Uber cannot stop innovating as it competes with other companies operating in the same market, including Lyft and, one day, an ad-powered free taxi service offered by Google's self-driving cars (Woollaston 2014).
8. Cars	Old: Traditional auto manufacturers New: Tesla New 2.0: Google's self-driving car By the numbers: Founded in 2003 on the idea that electric cars could be better than gasoline-powered cars, Tesla has grown to a $25.04 billion company with a network of over 500 supercharger stations across the country as of the end of 2015 and receiving over 325,000 preorders for its low-cost Model 3 in the first week after its unveiling (Tesla n.d.; Richard 2015; Niedermeyer 2016). What happened: The auto industry has remained almost stagnant for decades. Traditional car manufacturers have made no attempts to radically change cars for fear of cannibalizing the profits of their existing lines (Quora 2015). While it has been clear for years that battery electric vehicles are the future for cars, it took the founding of a new car company (the first American car company to go public since Ford Motors in 1956) to have the courage to reinvent the automobile industry, building completely electric cars and fighting to sell directly to consumers (rather than distributing via the traditional model of dealerships). Even more radical than Tesla's electric car is Google's self-driving car—an innovation which is expected to revolutionize the entire economy as countless jobs are eliminated (truck driver, bus driver, taxi driver, train operator, etc.) and, at the same time, people can use the time they normally spend commuting or waiting for a train to do productive work (Davies 2015). Despite the enormous impact of this innovation, traditional car companies were making no serious investments in this area knowing that driverless cars, in combination with the notion of the sharing economy (already BMW has plans to launch a peer-to-peer car-sharing service that lets BMW owners earn extra cash by renting out their cars), would mean fewer cars on the road and thus fewer car sales (McGee 2016). Rather than pursue an innovation that would hurt their current business even though it would benefit society, they sat idly by until Google, a tech company, began making serious headway. Only then did other car companies begin to pursue this research. While auto manufacturers including Audi and Mercedes-Benz have made great progress, Google still has the greatest head start in this space, both from a hardware and software IP perspective (Hamed 2015). In a few years, the most popular brand of car could be Google.
9. Music	Old: Record labels, CD manufacturers, Music stores, and so on New: Apple iTunes New 2.0: Spotify, Pandora, YouTube By the numbers: In the early 2000s, For Your Entertainment (FYE) had sales topping $1 billion with a network of more than 1100 stores. Attempts by record labels to create digital music services in the early 2000s, such as MusicNet and Pressplay, failed. But in April 2003, Apple, a computer company with no experience in the music industry at the time, opened its iTunes Store. By 2010, iTunes was the "largest music retailer on the planet" and by April 2014 there were 800 million accounts (and 800 million credit card numbers) (Griggs and Leopold 2013; Ulloa 2014). Following the emergence of iTunes, FYE closed more than 600 stores and changed their inventory mix. Despite these changes, sales continued to fall and, as of April 2016, the stock value of parent company Trans World Entertainment was only $3.85 per share, about a quarter of what it was worth a decade earlier (a peak of $14.82 in April 2005) ("Update: Trans World CEO" 2014; Google Finance 2016). What happened: The ravaging of the music sector by Napster in the early 2000s made it glaringly obvious that the music industry was in need of a serious rethinking. Burdened by a bias toward the conventional mental model of how music was sold and distributed, none of the players in the music industry at the time was able to conceive of a legitimate way to earn money from the sale of digital music that would stick. It took a computer company Apple to pick up the gauntlet of digital music, reimagining the way music should be sold, distributed, and consumed in a way that resonated with the modern consumer. By selling single songs, sacrificing quality for convenience (challenging the convention of the music industry that innovations should consistently improve sound quality), and starting from scratch to design a device to play digital music, and launching a brilliant marketing campaign, Apple was able to lead the conversation around digital music (Griggs and Leopold 2013). Now, in 2016, Apple finds itself the legacy company. Spotify, a music streaming company with a freemium model, and Google-owned video platform YouTube threaten iTunes' music dominance. Spotify, which originated in 2005 with two guys in an apartment in Sweden, is now valued at over $8.4 billion, with 75 million users (20 million paying) and $3 billion paid to music artists (Macmillan and Demos 2015; Crook and Tepper 2015). Apple, with the wisdom to see streaming as the future of music, launched Apple Music, a subscription-only service designed to compete with Spotify, in the Summer of 2015 (Crook and Tepper 2015). A decade after Napster's takedown, the three biggest music labels are poised for a showdown with YouTube as each is due to negotiate new licensing deals with the platform, which draws more regular listeners and viewers than Spotify and Apple Music combined and is valued at up to $40 billion (Garrahan 2016; Sloane 2014). Music industry executives are concerned by "the disparity between the amount of music listened to for free on the site and the revenues those tracks generate from advertising" (Garrahan 2016).
10. Energy	Old: Oil and nuclear Energy (e.g. Germany's E.On) New: Renewable and distributed energy By the numbers: As one source put it, "ten years ago, Germany's biggest utility E.On AG appeared to have it all: dominance in Europe's largest energy market, a stranglehold over domestic and European regulators, a foothold in the U.S. and a unique lever over Russia's Gazprom" but fast forwarding to 2015, the company is reporting a €7.25 billion quarterly loss (Smith 2015). Today, the company's shares are worth just €9.43, a tiny fraction of the €148 price they commanded at their peak in 2008. And E.On is not alone in this. Across the energy industry, companies built on old forms of energy are losing out to renewable energy. What happened: Author, economic theorist, and sustainability activist Jeremy Rifkin has predicted that a third industrial revolution is approaching and it will be based on a new energy regime: distributed renewable energy. Distributed energy sources are energies that can be "found everywhere and are, for the most part, free," such as sun, wind, hydro, geothermal heat, biomass, and ocean waves (Zeller Jr. 2011). This is in contrast to traditional energy sources (e.g. coal, oil, gas, and uranium) which can only be found in a few places and require massive concentrations of capital and centralized command and control systems to get the energy from the source to the end user (Rifkin 2011). According to Rifkin, these distributed energies can "provide more power than we will ever need for our species until the end of time." Working in collaboration with Rifkin, the European Union made a formal commitment to "create a matrix for a new economic paradigm" based upon distributed energy. In an effort to fulfill this commitment, Germany has stated that it hopes to increase the percentage of electricity in the country powered by renewable energies from 25 to 35 by 2020 (Rifkin 2015). Consequently, Germany has begun providing generous subsidies for renewable energies. Only now, in response to these subsidies, is E.On making any attempt to salvage some of its business, spinning out the business that has a chance in the new regulatory environment (grids, renewables, and services) into one company and the rest (gas trading and conventional power generation) into another (Rifkin 2015). This situation thus demonstrates what happens when a company's current success creates a mentality of invulnerability that blinds them to the need to prepare for future scenarios where their core business does not exist.

These ten examples are meant to be parables that illustrate what can happen if a legacy firm relies on current mental models—of their industry, their business model, and their customer—to guide their business strategy, thus demonstrating how, in today's rapidly changing world, a short-term focus essentially guarantees a firm's eventual demise.

The Current Solution: Acquisitions and Alliances

In recognition of the threat posed by start-ups and the limitations of their internal abilities to develop breakthrough products and services, legacy companies have begun to invest or acquire promising start-ups, a strategy long-pioneered by pharmaceutical companies with their investments in biotech companies.

For example, in the area of big data and analytics, IBM has been making strategic acquisitions of cloud, big data, and data analytics companies, including a “spree” of cloud acquisitions in 2015 (StrongLoop, AlchemyAPI, Blekko, Blue Box, and Compose as well as a $2 billion acquisition of SoftLayer). Their intent is to boost growth in these areas as a way of compensating for the decreasing strength of their IT, software, and hardware businesses (Shields 2015). Even newer companies are finding the need to augment internal capabilities with acquisitions. Take, for example, Google’s $500 million acquisition of DeepMind, an artificial intelligence start-up, followed by its “acqui-hiring” of the two academic teams behind deep learning start-ups Dark Blue Labs and Vision Factory (Lunden 2014).

We see Microsoft attempting to corner the market on innovation in augmented and virtual reality by supplementing their development of HoloLens through a $2.5 billion acquisition of Minecraft creator Mojang, a $150 million spent on IP assets from the Osterhout Design Group, and acquisition of Havok (the leading provider of 3D physics) from Intel (Knight 2015; Batchelor 2015; Lunden 2014; Kaelin 2015). Also trying to establish itself as a leader in this field, Facebook paid $2 billion to acquire Oculus VR (Luckerson 2014). In the background of these acquisitions is the failure of Google’s internal R&D-based foray into virtual reality that was known as Google Glass, heralded by *Time Magazine* in 2012 as one of the best inventions of the year but brought to an abrupt end in early 2015 (Montgomery 2015).

And it is not just self-identified tech companies that are trying to do this. Major legacy players in some of the most conventional industries, such as banking and automobiles, are acquiring tech start-ups. BlackRock Inc., one of the world’s largest asset managers, recently acquired robo-advisor company FutureAdvisor to complement the expansion of their “big data” team (Toonkel 2015). In the case of automobiles, General Motors has been laying the groundwork for a self-driving network of cars by introducing the Chevy Volt (“the first mass-market electric car”), purchasing the remains of Sidecar (a defunct Uber competitor), investing $500 million in Lyft (another Uber competitor), and partnering with Mobileye to develop maps for robo-cars (Fitzpatrick 2016; Davies 2016). Additionally, Ford has considered partnering with Google to make self-driving cars, combining Ford’s car-building expertise with Google’s first-mover advantage on self-driving car technology (Ziegler 2016).

Legacy companies are also starting to establish new operational centers (occasionally around an acquisition) in a tech center, in recognition of the importance that technology—specifically digital technology—is transforming every area of our society. For example, in January 2015, Ford opened a new Silicon Valley research center for the purpose of driving "innovation in connectivity, mobility, and autonomous vehicles" ("Ford Opens New" 2015).

While these efforts to augment internal capabilities through acquisition or strategic alliances are good solutions in the short term, it only helps to mask how much legacy companies struggle to organically create breakthrough innovation.

The Reason for the Lack of Organic Innovation

So what is the cause of this? Why, with all their advantages, do legacy companies find themselves out-innovated by start-ups or companies from outside the industry? For many, the answer is fundamentally this: Mental Models. Breakthrough innovation requires challenging and changing the mental model of the firm and industry with respect to the product/service offering, business and revenue models, and operations.

In *The Power of Impossible Thinking*, authors Jerry Wind and Colin Crook define "mental models" as "mindsets" or "the brain processes we use to make sense of our world" (Wind and Crook 2005). Citing research by University of California neurologist Walter Freeman, Wind and Crook explain that the human brain discards most of the information it takes in about the world through the senses and "uses what remains to evoke a 'parallel world' of its own…which is internally consistent and complete" (Wind and Crook 2009). In other words, there is no such thing as objective reality. What each of us sees as reality is inherently a reflection of our internal biases and our beliefs, attitudes, feelings, and behaviors are driven by these mental models, not reality. Take, for example, the story of Roger Bannister. Until 1954, the four-minute mile was considered a natural limit for runners. Within three years of Roger Bannister shattering this barrier on an Oxford Track in May 1954, 16 other runners had also surpassed this limit (Wind and Crook 2005).

Where do these mental models come from? Mental models are shaped by past experiences. If the environment is static, these models can be useful, helping us become more efficient on a day-to-day basis by reducing the amount of information we need to process decision making. However, if the environment is changing, skipping over the environment sensing and processing stage can do more harm than good. By relying on mental models to guide our decisions (as opposed to reality) we might not notice the environment is changing. Even if one does notice, the convenience of mental models and the feeling of security we associate with them make it tempting to resist the change. Thus, in a changing environment, mental models become obstacles to creativity, change, and innovation. Given the unprecedented speed and magnitude of change affecting the business environment today—thanks to the interrelated five forces of change—it is then clear that all firms must become acutely cognizant of their own mental models in order to avoid being blindsided by environmental changes.

Legacy companies, as industry leaders, are particularly burdened by mental models due to their history of past success and current revenue. A history of success is dangerous as we develop a mental model where we see the way of doing things that achieved success in the past as the best—or even only possible—way of doing things. From our ten examples, we see in the cases, from cell phone companies to grocery stores, how past success caused them to become complacent and slow-moving with no sense of urgency regarding pursuing breakthrough innovation. A firm that has never experienced success (e.g. outsiders like Apple or newcomers such as Walmart) does not have this problem. As discussed earlier, this would be fine if the environment weren't changing but, in today's world, the environment for every firm is changing. Any firm that wants to be in business in 20 or even 10 years cannot afford to unquestioningly continue doing things today as they have always been done.

Additionally, current success makes legacy firms vulnerable as they become narrowly focused on protecting the cash flow of existing products, rather than making investments in potentially breakthrough ideas, viewing innovation as a threat that will cannibalize existing business, rather than as an opportunity. This bias is acutely evident in the cases of Kodak and its failure to develop digital photography and that of the record industries and digital music. Since companies do not measure or report lost opportunities, the risks of innovating are ambiguous while the benefits of maintaining the current situation—immediate revenue—are acutely tangible. Passing over opportunities for innovation continuing with one's current business therefore seems less risky than investing in the unknown. The company becomes so preoccupied defending their current market share that they fail to invest in the type of breakthrough innovation that is needed for the long term. In short, the comfort of the status quo blinds organizations to the need for change and the fear of abandoning what has worked in the past inhibits courage.

In contrast, new and outsider companies have nothing to lose. They have no investments in the current way of doing things or any current revenue to bias them. In fact, they are by nature trying to change the status quo in the market and gain their share of wallet. Unlike legacy firms, which have a bias for control and internal reliance, start-up companies are unable to control anything at the outset, thus making them more inclined to leverage open innovation or other external sources of talent or ideas. Additionally, they are able to take a longer-term view on their investments as they are not burdened by the pressure of quarterly stock reports. Consequently, they are able to invest the time and resources required to develop a new major ecosystem, such as the Apple App Developer ecosystem or Tesla's ecosystem of charging stations.

The ability of "mental models" to inhibit innovation in legacy companies has been noted by others studying innovation in legacy firms. The authors of "Leading the Startup Corporation: The Pursuit of Breakthrough Innovation in Established Companies" assert that "the danger lies in focusing excessively on what has always worked" (Davila and Epstein 2015). In accordance with the section above, McLaughlin et al. (2008) argue that "established companies often lose the propensity to be innovative, as some of the cultural enablers of previous incremental changes become the current cultural inhibitors of radical innovation" and Stringer (2000) finds that "most large firms are poorly equipped to implement a growth strategy based on radical innovation, because most large firms are 'genetically' programmed to preserve the status quo" (Chang et al. 2012).

And it is not just the mental models of the executives that handicap legacy companies. The mental models of entry-level employees and middle managers can stifle the efforts of even the most forward-thinking CEO as employees focus on accomplishing short-term objectives, sometimes knowingly to the detriment of the company's long-term strategy, in an effort to protect the status quo and current way of life. Thus, breakthrough innovation requires challenging the mental models of employees at all levels of the organization (through strong company culture, a change in physical space, new hiring practices, etc.). Further compounding this already daunting challenge is the fact that the longer an employee works for a company or in an industry and/or the closer an employee gets to the end of their career, often the more difficult it is to get said employee to change his/her mental model as the employee is increasingly vested in the current way of doing things (as this is where their expertise lies) and less concerned about the company's long-term success. It thus comes as no surprise that the larger, more established, and more successful the organization has been, the less likely the company will produce real innovation.

9.3 Challenging Mental Models—Six Approaches

Breakthrough innovation requires challenging the mental model of the industry, as demonstrated by the previous sections. However, most people find this difficult to do. To help overcome this, we outline here six approaches to challenging mental models.

1. Look for customer insights and engage consumers

Most companies today hold the mental model that they alone should be in control of conceiving, designing, making, and marketing their firm's products/services they offer. By focusing more on consumer insights and, better yet, engaging the consumer in the creation and development of the offering, a company is necessarily pushed outside their comfort zone.

A great example of codevelopment with consumers is Vans shoes, a legacy company that has managed to stay relevant for half a century. Founded by Paul Van Doren and three partners, the company has believed in "giv[ing] the customers what they want" since their 1966 beginning in Southern

California, such that their shoes quickly became known for the range of color combinations and were embraced by skateboarders everywhere. A recent book on the company recounts the origins of the Vans custom shoe program. As the story goes, a woman came into the store but couldn't find a color she liked so Van Doren told her to go to the fabric store down the street, pick up the fabric she wanted, and he would make the shoes for her (Tschorn 2009). In 2004, the company brought this philosophy into the twenty-first century, launching Vans Customs at www.vans.com, which allows "would-be fashion designers to create their own Classic Slip-ons utilizing hundreds of different color and pattern combinations" ("The Vans Story" n.d.). The shoes are also sold with the canvas fabric left plain, allowing customers to hand-draw/paint whatever design they want. In addition to enabling consumers to codesign the product, the company has empowered customers to cocreate the brand story by "backing early skate films to creating OffTheWall.TV, a media channel dedicated to the stories of the people who wear their shoes" (Vogl 2015).

Other companies that give customers the power to cocreate the product include Build-a-Bear and Shoes of Prey, which allow women to design customized, handmade women's shoes. In addition to product cocreation, we see companies increasingly incorporating user-generated content into their marketing, from sponsoring videos by YouTube stars to Dorito's "Crash the Super Bowl" competition. Such initiatives go a step beyond focus groups and surveys. Rather than simply asking people what they want and trying to interpret it, give the people the power to codesign the products, services, and campaigns they want.

2. Set stretch objectives

A stretch objective approach challenges businesses to set objectives that are unattainable under their current way of doing things, forcing them to look for new approaches. For example, in a paper published in 2008, Wind, Capozzi, and Buchwald outlined how Manning Selvage & Lee (MS&L), a leading public relations firm with $33 million in revenues, used a stretch objective approach to reach its ambitious goal of tripling revenues to $100 million in just three years, instead of the five years they originally thought it would take (Wind et al. 2008).

3. Develop an idealized design

Most organizations, at any given time, are a combination of Band-Aids, short-term solutions slapped on to fix various problems. In order to break out of this, organizations should use idealized design. Popularized by Russell Ackoff, idealized design instructs organizations to imagine that their company is destroyed and they are starting from scratch (Ackoff 2006). It then tasks them with designing what the organization would ideally look like, given today's technology, and then move backward from this idealized design to where we are today to see what we need to do now to realize that ideal organization. In this way, idealized design suggests a backward planning approach.

4. Bring the radicals in

Conventional mindsets dictate that radical ideas be dismissed. From the perspective of one's current mental models, they are too risky. However, companies should be doing the exact opposite. Radical ideas, and the radical individuals behind them, are critical to breakthrough innovation. In *The Power of Impossible Thinking*, Wind and Crook tell the story of IBM and the open source movement. When Richard Stallman first put forth the idea that everyone should be able to obtain software for free, IBM chose to invest and adapt the open source movement, rather than trying to fight it and suing Stallman. By building proprietary products and services on top of open source software, IBM was able to continue to be successful as the open source movement picked up. Contrast this with the response of the recording studios and Napster. Rather than recognizing that digital music is the future and working to conceive of a business model that works with Napster, the studios instead applied their energy and resources to suing Napster. While Napster was eventually brought down, the recording studios missed the opportunity to own digital music, leaving the field open for Apple, an outsider, to step in and claim billions of dollars in revenue and brand value that could have gone to one of the recording studios.

5. Destroy your brand

Most employees are reluctant to challenge their employers. As a result, the people in charge and the people who work on designing new frameworks rarely get the complete honest feedback from their employees. In order to combat this issue, the "destroy your brand" approach suggests organizing a small group of people from the organization (excluding the brand manager), taking them out to dinner, asking them to select a company that is outside their industry (if they work for a retailer, they might look to a "sharing economy" company like Airbnb) and to imagine that company is going to enter their brand's industry. Then they are tasked with designing a strategy for the outsider company to destroy the brand (e.g. what should Uber do in retail to destroy their brand). It is the experience of Jerry Wind, from leading this exercise for over 15 companies, that these teams are very easily able to come up with ways to destroy the brand. Once these vulnerabilities (or opportunities) are identified, the organization can zero in on what are the mental models of the brand managers that are limiting the firm's ability to innovate and design strategies to prevent the brand's destruction.

6. Zooming in and out and lessons from winners and losers

In making decisions, executives must zoom in and out in order to avoid overlooking details and spot opportunities. For example, in response to the BP oil rig explosion in April 2010, the company's then CEO Tony Hayward overlooked the full impact of the crisis as he focused narrowly on the details of the crisis and how it would affect his company and his life (Kanter 2011). If he had challenged his mental models, seeing his customers and shareholders as human beings with lives outside buying oil, and zooming out to look at the big picture—the environmental damages, the human devastation, the impact on other industries—he wouldn't have angered so many Americans and been forced to resign.

To avoid this, firms should zoom out and look back on recent history to identify winning companies and failing companies from the past (as we did in section 2.1). Then, zooming in on these examples, they can identify lessons which can then be applied to their own business. This way, they don't find themselves repeating the past and winding up on someone else's list of failing companies.

Revolutionary Innovation: The Case of *Beyond Advertising*

An example of how to challenge the mental models of an industry comes from the Wharton Future of Advertising Program. In the book *Beyond Advertising: Creating Value Through All Customer Touchpoints*, Jerry Wind and Catharine Findiesen Hay's, in collaboration with the Wharton Future of Advertising Innovation Network, propose a new model for the advertising industry which they refer to as "*Beyond Advertising* Roadmap" (see Fig. 9.1) (Wind, Hays, and Wharton Future of Advertising Innovation Network 2016b). Based on the Program's Advertising 2020 project[1]—an exercise in cocreation and idealized design—the model challenges the current mental models of the industry, proposing an alternative model for advertising and marketing based on today's environment (as characterized by the five forces of change) with the hypothesis that this model will be more successful at creating value today than a model rooted in the past.

Key to this roadmap is that it starts with understanding the current environment (Part 1, Five Forces of Change). In Part 2, companies are tasked with challenging their mental models of "advertising" (refer to the approaches outlined in section 2.3). Then, they must design new strategies, implementing Part 3, The All Touchpoint Value Creation Model of aligned objectives, a compelling unifying brand purpose, all touchpoint orchestration, and the R.A.V.E.S. and M.A.D.E.S guidelines. The most important element of this model is the all touchpoint components. The only way to reach consumers in today's environment is to design a strategy which considers all potential touchpoints between the consumer and the company and then begin the process of identifying and experimenting with different portfolios of touchpoints. Putting this model into practice requires challenging how one approaches advertising, communication, marketing, and even business strategies, as all touchpoint orchestration requires a complete rethinking of a company's strategy. Specifically, companies must adopt adaptive experimentation, rethink their organizational

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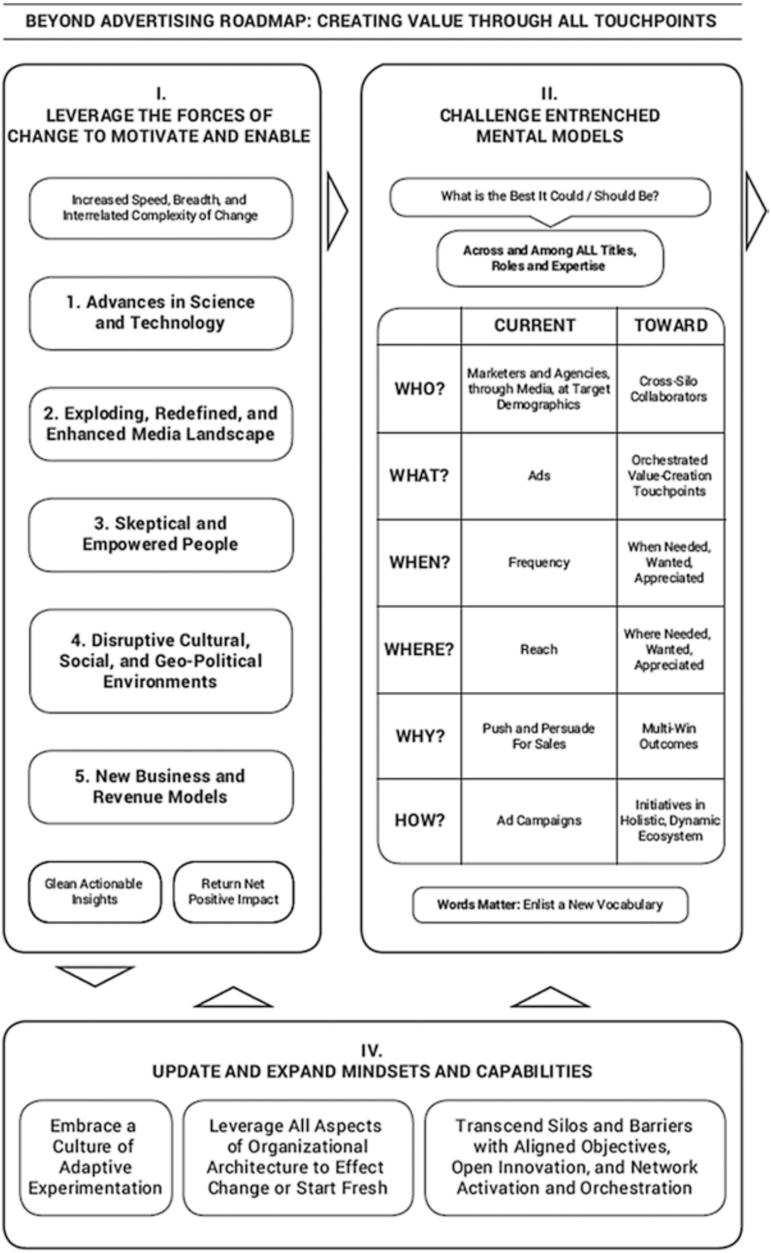
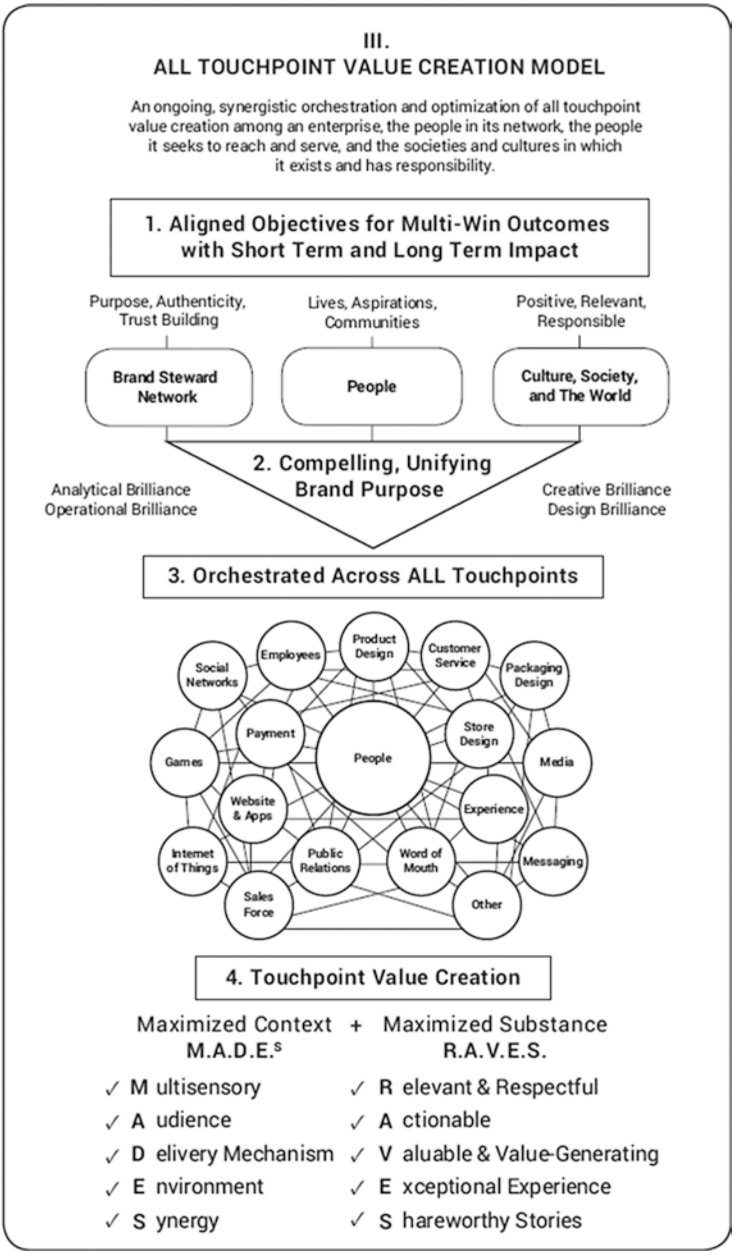
[1] Garnering over 200 responses from thought-leaders across and outside advertising and marketing, the project asked two questions: (1) What could/should advertising look like in 2020? and (2) What should we do now for that future?


BEYOND ADVERTISING ROADMAP: CREATING VALUE THROUGH ALL TOUCHPOINTS
I.
LEVERAGE THE FORCES OF CHANGE TO MOTIVATE AND ENABLE
Increased Speed, Breadth, and Interrelated Complexity of Change
1. Advances in Science and Technology
2. Exploding, Redefined, and Enhanced Media Landscape
3. Skeptical and Empowered People
4. Disruptive Cultural, Social, and Geo-Political Environments
5. New Business and Revenue Models
Glean Actionable Insights
Return Net Positive Impact
II.
CHALLENGE ENTRENCHED MENTAL MODELS
What is the Best It Could / Should Be?
Across and Among ALL Titles, Roles and Expertise
Words Matter: Enlist a New Vocabulary
IV.
UPDATE AND EXPAND MINDSETS AND CAPABILITIES
Embrace a Culture of Adaptive Experimentation
Leverage All Aspects of Organizational Architecture to Effect Change or Start Fresh
Transcend Silos and Barriers with Aligned Objectives, Open Innovation, and Network Activation and Orchestration

	CURRENT	TOWARD
WHO?	Marketers and Agencies, through Media, at Target Demographics	Cross-Silo Collaborators
WHAT?	Ads	Orchestrated Value-Creation Touchpoints
WHEN?	Frequency	When Needed, Wanted, Appreciated
WHERE?	Reach	Where Needed, Wanted, Appreciated
WHY?	Push and Persuade For Sales	Multi-Win Outcomes
HOW?	Ad Campaigns	Initiatives in Holistic, Dynamic Ecosystem

Fig. 9.1 The *beyond advertising* roadmap: creating value through all touchpoints (Wind, Hays, and Wharton Future of Advertising Innovation Network 2016b)



III.
ALL TOUCHPOINT VALUE CREATION MODEL
1. Aligned Objectives for Multi-Win Outcomes with Short Term and Long Term Impact
Purpose, Authenticity, Trust Building
Lives, Aspirations, Communities
Positive, Relevant, Responsible
Brand Steward Network
People
Culture, Society, and The World
2. Compelling, Unifying Brand Purpose
Analytical Brilliance
Operational Brilliance
Creative Brilliance
Design Brilliance
3. Orchestrated Across ALL Touchpoints
Product Design
Employees
Customer Service
Social Networks
Packaging Design
Payment
Store Design
Games
People
Media
Website & Apps
Experience
Internet of Things
Public Relations
Word of Mouth
Messaging
Sales Force
Other
4. Touchpoint Value Creation
Maximized Context + Maximized Substance
M.A.D.E.^{S}
R.A.V.E.S.
✓ M ultisensory
✓ A udience
✓ D elivery Mechanism
✓ E nvironment
✓ S ynergy
✓ R elevant & Respectful
✓ A ctionable
✓ V aluable & Value-Generating
✓ E xceptional Experience
✓ S hareworthy Stories

An ongoing, synergistic orchestration and optimization of all touchpoint value creation among an enterprise, the people in its network, the people it seeks to reach and serve, and the societies and cultures in which it exists and has responsibility.

Fig. 9.1 (continued)

architecture, and transcend silos and barriers (via aligned objectives, open innovation, and network activation and orchestration), as outlined in Part 4.

This new model requires bold, courageous experimentation in every element of the organization including the organization's business model, the language it uses, the architecture of the company, the characteristics of a leader, its relationships with external stakeholders, and its metrics for success. Such experimentation cannot be managed by traditional approaches. If one accepts this new model of advertising and marketing, then it is imperative to engage in a new approach to innovation management.

9.4 Guidelines for Shattering the Shackles

In this section, we outline ten interrelated guidelines that can be applied by legacy companies seeking to avoid the previously described "incumbent's curse" or by any organization looking to increase their likelihood of developing breakthrough innovations, including start-ups and twenty-first-century firms.

1. Manage innovation as a portfolio encompassing all three innovation horizons

One of the most helpful techniques for balancing short-term and long-term objectives in an organization is to manage innovation as a portfolio which encompasses the three innovation horizons (see Fig. 9.2). The *x*-axis in this chart represents the business model/offering/technology (historically, the framework focused just on technology but it is necessary today to look at the entire offering) and the *y*-axis represents the market. On each axis, there are three different levels: Current, Existing, and New, where "Current" means what the organization currently does, "Existing" means what is used by other organizations but not the company, and "New" means new to the world. Connecting the two axes creates three "horizons" of offerings.

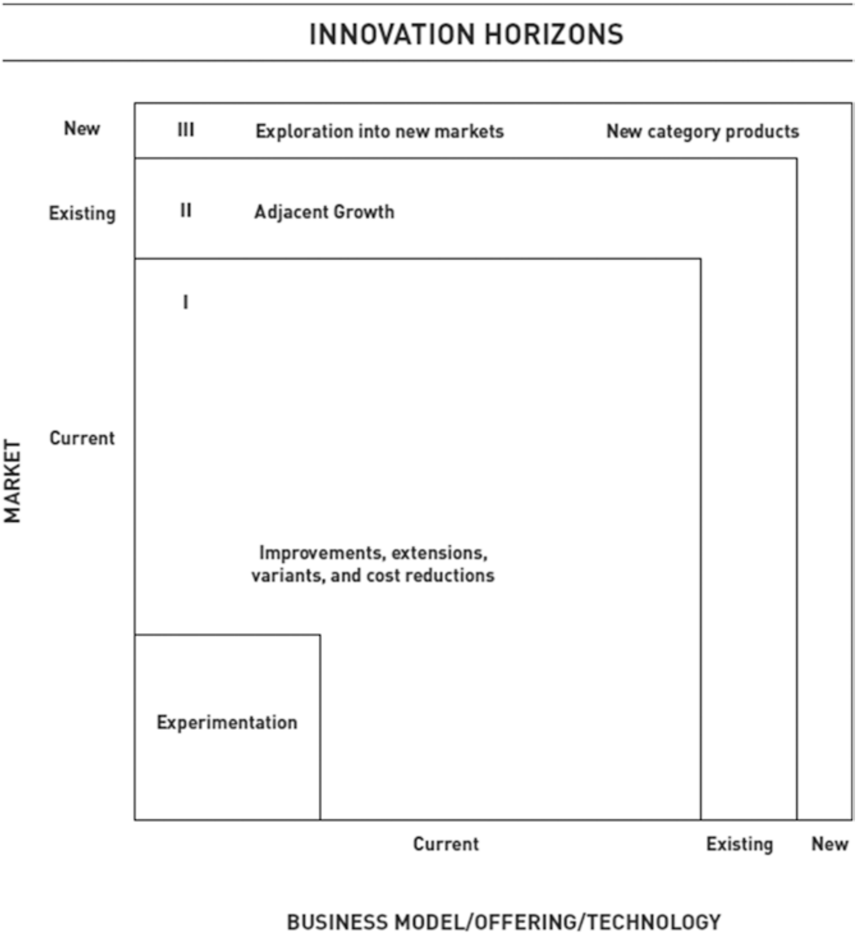

INNOVATION HORIZONS
New
Existing
Current
MARKET
III
Exploration into new markets
New category products
II
Adjacent Growth
I
Improvements, extensions, variants, and cost reductions
Experimentation
Current
Existing
New
BUSINESS MODEL/OFFERING/TECHNOLOGY

Fig. 9.2 Innovation horizons framework

This model allows for the management of innovation as a portfolio. Just as with a stock portfolio, the individual stocks that are picked matter less than the asset allocation. Furthermore, just as a company's strategy determines how assets are allocated between different types of assets, a company's strategy will determine the allocation of resources between the different innovation horizons, with different allocations between the horizons corresponding to different levels of risk and expected return.

It is our belief that no more than 80 % of a company's resources should be devoted to improvements to the current offering (and even then some of that 80 % should be dedicated to experimentation). In a portfolio where 80 % of the budget is dedicated to Horizon 1, 15 % might be dedicated to Horizon 2, and 5 % to Horizon 3. Even if an organization feels compelled to invest 90 % in Horizon 1, it should make sure at least 7–8 % is invested in Horizon 2 and 2–3 % in Horizon 3. Both these examples are merely illustrative guidelines for allocation. There are an infinite number of ways to distribute resources between these different areas and companies should experiment with different allocations. However, one thing that is certain is that any company that invests 100 % in Horizon 1 is likely not to have a future.

By framing the strategy as "maintaining a portfolio," people are less likely to fall prey to the mental model that innovation in Horizon 2 and Horizon 3 are in conflict with investments in Horizon 1 and that investing completely in the current business is the least risky strategy. It helps organizations see that diversity of innovation (and experimentation) is, in fact, the least risky strategy.

2. Challenge your business models and leverage networks

New research conducted by Libert, Wind, and Fenley find that there are four business models: asset builders, service providers, technology creators, and network orchestrators. Of the four business models, they further find that companies classified as Network Orchestrators "outperform companies with other business models on several key dimensions," including "higher valuations relative to their revenue, faster growth, and larger profit margins" (Wind et al. 2014; Wind et al. 2016b). Specifically, they find that the average multiplier (price-to-revenue ratio) for the S&P 500 companies in 2013 is 8.2 for network orchestrators, almost double the 4.8 for technology creators, and almost quadruple the 2.6 for service providers and the 2.0 for asset builders. The implications of this research to legacy companies—most of which would be classified as asset builders, service providers, or technology creators—is that they must add a network component to their business model if they want to avoid being left behind when their industry is "uberized." Most legacy firms have dormant networks employees, customers, distributors, suppliers, investors, and so on, and the challenge is to activate these networks.

3. Adopt a new leadership model

Challenging the mental models of the organization and its employees necessitates challenging the mental model of leadership. Research done by Libert, Wind, and Fenley as a corollary to their research on business models finds that “leaders need a broader range of style options to match the broader range of assets companies are creating today.” Specifically, breakthrough innovation in today’s world requires a leader who operates at the intersection of the leader as investor, cocreator, and network orchestrator (see Fig. 9.3).

The leader of an innovative organization must be an investor so they can look at innovation as a portfolio and understand how to distribute assets among the different innovation horizons in a way that is consistent with their company strategy, just as an investor would manage a stock portfolio. He or she must be a cocreator as it is no longer enough to try to innovate with just a company’s internal resources. A company must now cocreate with its customers and prospects as well as engage in open innovation. Executing these strategies requires a leader with a win-win mentality, as opposed to the conventional mentality of totalitarian control and narcissism. Thirdly, the leader must be able to function as a network orchestrator. Innovation often involves different disciplines, different approaches, and different expertise.

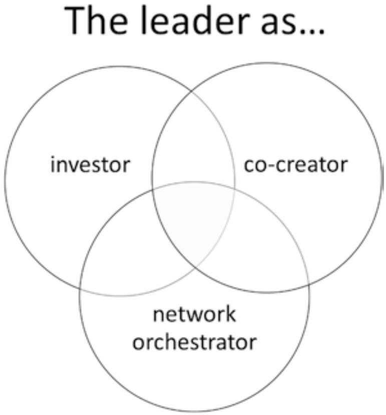


Fig 9.3 The skills required in a new model of leadership

In order to effectively lead this type of collaboration, the leader needs to have the orientation of a network orchestrator. It is at the intersection of these three leadership mentalities that we find the leadership approach best suited to managing innovation.

4. Adopt open innovation

In a competitive business environment, companies generally look internally to find solutions to any problems that arise, limiting themselves to the creativity and knowledge of their own employees. While internal talent is important, a study by leading open innovation company InnoCentive found that “the further the problem was from the Solver’s expertise, the more likely they were to solve it.” Consequently, no company will ever be able to hire all the talent in all the fields it would need to solve its biggest problems. An organization must supplement their internal capabilities by embracing open innovation. The benefit of “opening the innovation process to external knowledge flows” to a company’s ability to successfully innovate has been argued by many authors, including Chesbrough and Crowther (2006) and Rigby and Zook (2002).

In addition to using third-party platforms/accelerators such as InnoCentive, Amazon Mechanical Turk, and DreamIt, companies should establish their own initiatives designed for use by their internal teams in collaboration with outsiders. Companies can do this by sponsoring competitions (e.g. the Netflix Prize), crowdsourcing (e.g. Dorito’s “Crash the Super Bowl” campaign), founding accelerators (e.g. Samsung Accelerator), going open source, or creating online platforms/networks (e.g. Dell IdeaStorm). If focused on critical areas of the firm, these can create a magnet for outside talent to contribute to the selected area. Most of the successful, high-tech, multinational firms (such as IBM and Google) have established such accelerators.

5. Foster talent

Talent is essential for breakthrough innovation. No amount of leadership or use of frameworks can incubate breakthrough innovations if the talent simply isn’t there; the ingenuity of even one individual can make all the difference, as evident by the fact that many pharmaceutical firms have based much of their R&D on individual stars. At the same time, the ability to put together the right teams of people has never been more important. Building off of the findings from the previous section on Open Innovation, firms need not rely only on internal talent but should look toward external talent as well.

When it comes to innovation, ingenuity of employees is particularly important. When evaluating applicants for any department, companies should look for characteristics which have been correlated with ingenuity, including creativity and tolerance for ambiguity, as well as an interdisciplinary background and the ability to collaborate.

One example of a company trying to use talent as a means reinvigorating an established organization is Burger King. Having purchased the company for $4 billion in 2010, 3G Capital, a privately held company, began by firing all the company's traditional managers and hiring young talent (under the age of 30) who were then put through intense training programs (Leonard 2014). This type of shake-up and focus on talent, rather than experience or learned expertise, can help position a company for breakthrough innovation.

6. Create a creative culture

In order to foster innovation in employees and retain talent, a company must establish a creative culture, where culture is defined as the company's values, beliefs, and patterns of behavior (Tushman and Anderson 2004). Specifically, they should create a feeling of openness, freedom, and collaboration. Organizations can develop such a culture through the use of company lore (stories, special objects), visionary leadership, hiring the right people to cocreate this culture, training programs, and design of the workspace.

Ed Catmull, computer scientist and president of Pixar Animation Studios and Walt Disney Studios, outlined the following items as the studios' principles for creating a creative culture (Catmull 2008):

- Power to the creatives—creative power in a film resides with the film's creative leadership

- A peer culture—people at all levels support one another
- Technology + Art = Magic—getting people in different disciplines to treat one another as peers
  - Everyone must have the freedom to communicate with anyone
  - It must be safe for everyone to offer ideas
  - We must stay close to innovations happening in the academic community
- Staying on the rails—be introspective in order to systematically fight complacency and uncover problems

However, the heart of any culture is its values. Thus the most essential component of establishing a creative culture is ensuring innovation is valued and supported by the organization's operations. This includes sending the message that it's "okay to fail" by providing security for failure (guaranteed an old position) or simply by encouraging experimentation, which implicitly sends the message that it is okay to fail.

7. Follow best practices and get the needed buy-in

For any problems, it can be helpful to look to others who have been successful to get inspiration. The key to this strategy is being thoughtful when choosing at whom to look. You want to be conscious of how you define what constitutes "success." Additionally, while one should look at similar companies (same/related industry or region), some of the most valuable insights often come from studying best practices of companies very different from yours (a completely unrelated industry or geographic/cultural region). Three legacy companies that are generally considered to have been successful at breakthrough innovation are 3M, IBM, and Nike.

3M has outlined its innovation and growth strategy as follows:

> Changing the basis of competition requires:

  - Doing anything (legally and ethically) that…

- Upsets the status quo

- Changes the rules of the game
- Increases our value to the customer

- Thereby resulting in a novel and powerful competitive advantage that is difficult for competition to respond to

IBM identifies seven key steps to building an innovative environment. In the "setting the stage" phase, one must stamp out fear, paint the picture, and encourage diversity. Then, in the "taking action" phase, one must connect the dots, reach outside, make ideas visible, and motivate for results (IBM Global Business Services 2006). Nike's sustainable innovation pipeline also consists of two phases. In the first phase, "front-end innovation," one must explore (landscaping + analysis), scope (business case + strategy), and hunt (proof of concept). The second phase, "commercialization," consists of pilot (prototype + test), adopt (business transition), and scale (mobilize markets) (Vogel and Garcia 2012).

Additionally, as described in section 2.2, breakthrough innovation requires challenging the mental models of employees at all levels of the organization. Thus, transformation can only be accomplished by getting buy-in from all stakeholders in the company. John Kotter,[2] in his seminal work *Leading Change* (1996), outlines an eight-step process for change management based upon a ten-year study of more than 100 companies that attempted such a transformation. The eight steps are establishing a sense of urgency; creating a guiding coalition; developing a vision and strategy; communicating the vision; empowering employees for broad-based action; generating short-term wins; consolidating gains and producing more change; and anchoring new approaches in culture (Kotter 1996).

A recent presentation by Accenture presented the following steps for change management: prepare your people for change; maximize adoption of workday; generate positivity and excitement; open the lines of communication and engagement; limit resistance; drive commitment and ownership; elevate the quality of your solution; empower your people to make better decisions; proactive change management makes it possible.

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[2] John Kotter is the Konosuke Matsushita Professor of Leadership. Emeritus, at Harvard Business School, *New York Times* best-selling author, and founder of Kotter International (a management consulting firm), he is renowned for his work on leading organizational change.

The key to this process is engaging both internal and external stakeholders in the process of transformation. Specifically, engaging external stakeholders can help internal change. The engagement of customers, prospects, suppliers, and other developers helps to legitimize the move to more innovative management approaches, thus increasing the chances that the company can realize transformation internally.

Furthermore, this process requires a new leadership model focused on this notion of cocreation as well as properly designed incentives and culture (more details in next sections).

8. Incentives

Key to any initiative is providing sufficient incentives—both recognition and rewards—to motivate participants to engage. This is true in the case of getting employees and other stakeholders to innovate. In addition to direct bonuses for successful innovation or successful selling of innovative products, companies can offer the opportunity to be promoted to the head of a new business unit as a recognition-based incentive (the promotion could come with a raise or not). Firms can also emphasize the intrinsic rewards of working on innovative initiatives, which include working with interdisciplinary teams, doing technically difficult work, and developing pioneering solutions.

Regardless of the form of the incentive, it is critical that all performance measures and incentives are linked to the stretch objectives of the firm.

9. Align the organizational architecture

Finally, in order for all of the above components to work together, one must align the organizational architecture—the creative configuration of strategy, structure, work, people, and culture—for innovation (Nadler and Tushman 1997). Tushman and Anderson argue that “other things being equal, the greater the total degree of congruence or fit among the various components, the more effective the organization.” Figure 9.4, reproduced from *Beyond Advertising: Creating Value Through All Customer Touchpoints*, outlines the levers of organizational change one must orchestrate.

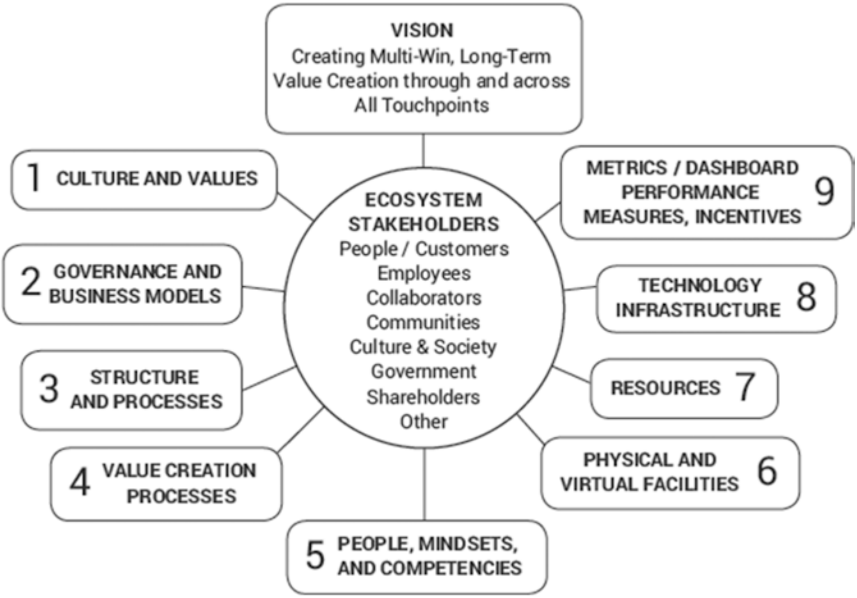
VISION
Creating Multi-Win, Long-Term Value Creation through and across All Touchpoints
ECOSYSTEM STAKEHOLDERS
People / Customers
Employees
Collaborators
Communities
Culture & Society
Government
Shareholders
Other
1 CULTURE AND VALUES
2 GOVERNANCE AND BUSINESS MODELS
3 STRUCTURE AND PROCESSES
4 VALUE CREATION PROCESSES
5 PEOPLE, MINDSETS, AND COMPETENCIES
PHYSICAL AND VIRTUAL FACILITIES 6
RESOURCES 7
TECHNOLOGY INFRASTRUCTURE 8
METRICS / DASHBOARD PERFORMANCE MEASURES, INCENTIVES 9

Fig. 9.4 Levers of organizational change

For example, for a company to successfully innovate, all the levers of organizational architecture must be aligned for speed. This means having a culture of urgency (e.g. Facebook's motto of "done is better than perfect") where one is compelled to run with an idea, even if it isn't perfect. The company's structures and processes must be designed to enable fast prototyping and rapid, adaptive experimentation, and performance measures must include speed and time.

10. Adopt adaptive experimentation

The only way to learn is to experiment. Therefore, companies should adopt adaptive experimentation in all areas of their organization. That means designing and implementing continuous and ongoing real-world experiments to learn and improve business decisions and strategies over time. The key distinction between adaptive experimentation and conventional notions of experimentation is that adaptive experimentation is not a one-time strategy or investment, but rather a continuous improvement philosophy.

In practical execution, adaptive experimentation means rather than taking a single action and accepting whatever result that action may generate, a company should experiment with different variations, measuring the effect each action had and using the findings of each experiment to inform the design of the next. For example, a company might experiment by launching three new approaches for fostering innovation: (1) internal development, (2) an accelerator open to the public, and (3) partnering with an open innovation firm. Based on the results of the first phase, the company might choose to continue with all three initiatives (experimenting with the budget or structure), kill one or more of the initiatives, merge one or more of the initiatives, or add a new initiative, such as an open competition.

This strategy has positive implications for both immediate business practices and the development of an innovative organizational culture. In the immediate, adaptive experimentation allows an organization to identify the causal relationships between actions and results; to learn to make better, more effective, and more efficient decisions; to force measurement and accountability; and to achieve a competitive advantage (as only you know the design of the experiment). Additionally, adopting a philosophy of adaptive experimentation also has the key benefit that it helps to foster a creative and innovative culture (see section 4.6) since people know that not every experiment will be a success, sending the message that it is okay to fail. This gives people permission and an obligation to initiate bold and innovative actions. Adaptive experimentation is also a useful approach for challenging current mental models, as one must necessarily consider other ways of doing things in order to experiment with them.

9.5 Combining the Guidelines—A Morphological Analysis-Inspired Approach

Applying a modified morphological analysis[3] approach, we suggest the development and use of an "Idea Generation Framework" (Fig. 9.5)—such as the one we illustrate below based on the guidelines outlined

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[3] For background on morphological analysis, see Kwanyoung Im and Hyunbo Cho, "A systematic approach for developing a new business model using morphological analysis and integrated fuzzy

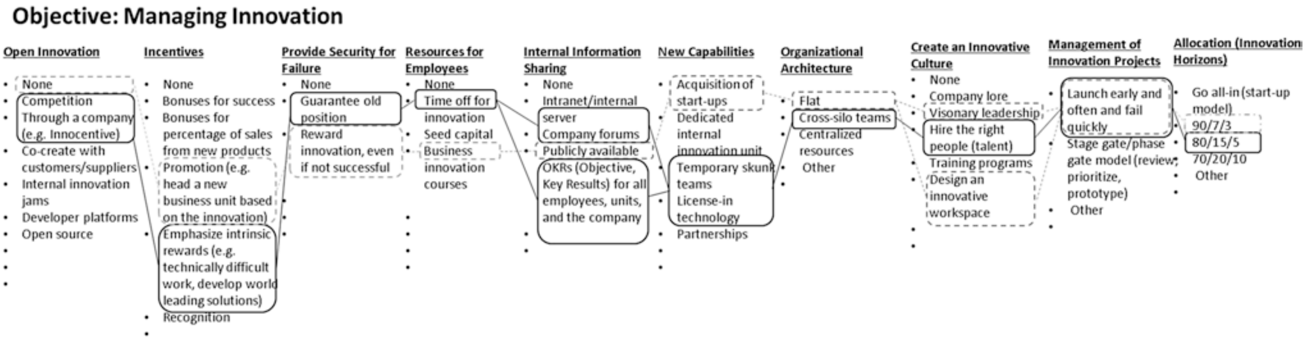
Objective: Managing Innovation
Open Innovation
None
Competition
Through a company (e.g. Innocentive)
Co-create with customers/suppliers
Internal innovation jams
Developer platforms
Open source
Incentives
None
Bonuses for success
Bonuses for percentage of sales from new products
Promotion (e.g. head a new business unit based on the innovation)
Emphasize intrinsic rewards (e.g. technically difficult work, develop world leading solutions)
Recognition
Provide Security for Failure
None
Guarantee old position
Reward innovation, even if not successful
Resources for Employees
None
Time off for innovation
Seed capital
Business innovation courses
Internal Information Sharing
None
Intranet/internal server
Company forums
Publicly available
OKRs (Objective, Key Results) for all employees, units, and the company
New Capabilities
Acquisition of start-ups
Dedicated internal innovation unit
Temporary skunk teams
License-in technology
Partnerships
Organizational Architecture
Flat
Cross-silo teams
Centralized resources
Other
Create an Innovative Culture
None
Company lore
Visonary leadership
Hire the right people (talent)
Training programs
Design an innovative workspace
Management of Innovation Projects
Launch early and often and fail quickly
Stage gate/phase gate model (review, prioritize, prototype)
Other
Allocation (Innovation Horizons)
Go all-in (start-up model)
90/7/3
80/15/5
70/20/10
Other

Fig. 9.5 Illustrative idea generation framework

above—to help companies generate new ideas for managing innovation. It should be noted that, while similar to morphological analysis in design, this framework differs from pure morphological analysis in that in our approach, we can accommodate options which do not use elements from all columns (hence the "none" option in some of the columns) or options which use multiple elements. Consequently, possible approaches to innovation management could include an item from a column/columns or even include groups of options from columns (e.g. engaging in two different open innovation initiatives).

The framework was populated based in part on the ten guidelines above as well as an extensive review of the practices, philosophies, and architecture of some of today's most innovative companies, including Google, Apple, 3M, Amazon, and more. We found that, across these companies, there were a few common "elements" to managing innovation, each of which had several different possible executions. The elements are as follows:

- Open Innovation
- Incentives
- Provide Security for Failure
- Resources for Employees
- Internal Information Sharing
- New Capabilities
- Organizational Architecture
- Create an Innovative Culture
- Management of Innovation Projects
- Allocation (Innovation Horizons)

To use this framework, companies should first review the framework to make sure all elements have been captured with the underlined headings and then that each possible approach to that element has been listed underneath. It is important that each firm design the framework to fit its idiosyncratic conditions and preferences. While our framework can be used as a reference, firms should customize it to their needs—adding columns and entries for columns as suits them. Then, once the

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approach," *Expert Systems with Applications*, Vol. 40, Issue 11, September 2013, Pages 4463–4477.

framework has been verified with all known approaches, one can begin designing potential strategies to innovation management by connecting at least one item from each of the elements below.

The solid black and dashed grey "lines" in Fig. 9.5 are illustrative of how one can use this structure to design an approach to innovation management, with each line representing a possible strategy for approaching innovation management generated from this framework. Looking at the dashed grey line, the strategy proposed does not incorporate open innovation, incentivizes employees to innovate with the potential for promotion, rewards innovation even if not successful so as to provide security for failure, gives employees seed capital to get potential innovations off the ground, shares information internally using company forums, acquires start-ups so as to bring new capabilities into the company, has a flat organizational structure, creates an innovative culture through visionary leadership and an innovative workspace, manages innovation projects with the philosophy of launch early and often and fail quickly, and, using the Innovation Horizons concept (see section 4.1), invests 90 % of its resources in Horizon 1 innovations, 7 % in Horizon 2 innovations, and 3 % in Horizon 3 innovations.

The "dashed grey line" strategy we believe can lead to innovation in legacy companies as it would force the company to look toward Horizon 2 and Horizon 3 innovations, even while supporting current revenue. A fail-fast approach will break the company out of the tendency to "perfect" any new product, thus reinforcing the message of the visionary leadership that it is okay to fail. The flat organizational culture, open office design, and internal information-sharing forums will encourage idea sharing across the corporation, including between employees and managers and between teams. The acquisition of start-ups will bring new capabilities (and potential new talent) into the firm, empowering existing ideas and/or sparking new ideas as the addition of new capabilities gets people out of routine and encourages them to think outside their mental model while one new person could provide the needed perspective to get past a roadblock. The potential for promotion and knowing they will be rewarded even if they fail encourages employees to innovate and seed capital gives them the means to do so.

Once one has identified a line that outlines an innovation management approach that seems to make the most sense for their firm, the company should begin implementing and experimenting with this approach.

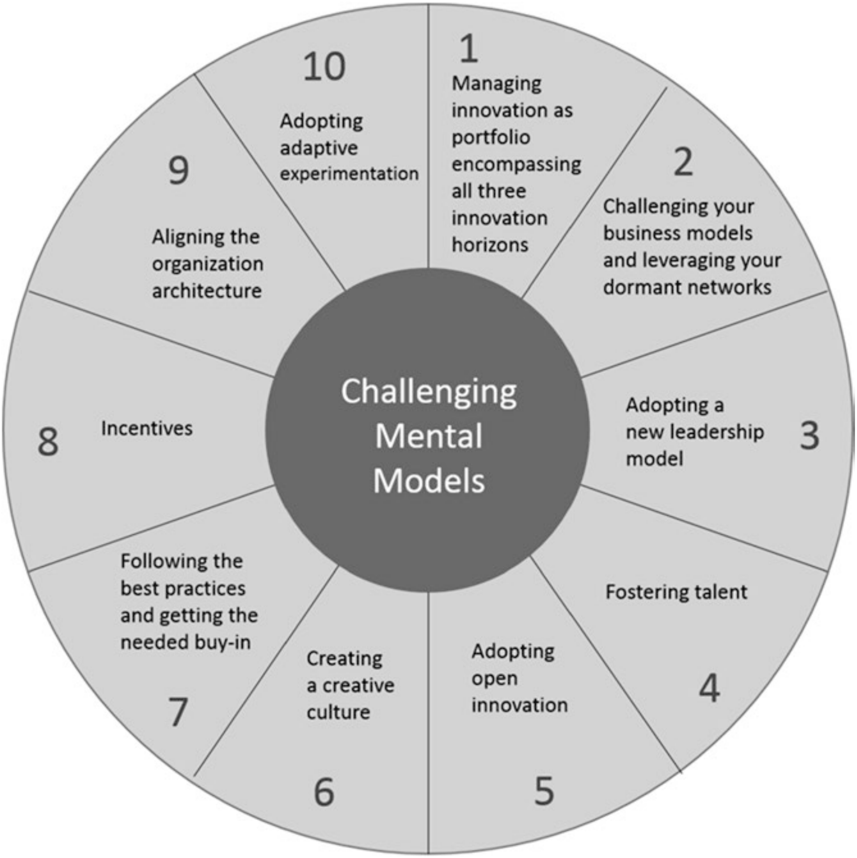
Challenging Mental Models
1
Managing innovation as portfolio encompassing all three innovation horizons
2
Challenging your business models and leveraging your dormant networks
3
Adopting a new leadership model
4
Fostering talent
5
Adopting open innovation
6
Creating a creative culture
7
Following the best practices and getting the needed buy-in
8
Incentives
9
Aligning the organization architecture
10
Adopting adaptive experimentation

Fig. 9.6 Summary of guidelines for innovation

Conclusion

In conclusion, we suggest that legacy organizations begin their journey to becoming a more innovative organization by first challenging (and potentially changing) their mental models, then reviewing the ten guidelines we cover in Part 4 (see Fig. 9.6 for a summary), assessing how successful they currently are in each of these areas.

Then, based on this assessment, they can apply a morphological analysis–inspired approach in order to generate new ways of managing innovation. Finally, they should start to design and execute experiments in every aspect of the organization.

While no strategy can guarantee breakthrough innovation—history has shown a certain amount of luck and serendipity is needed—what we can say with confidence is that not following these guidelines makes any organization vulnerable to being relegated to history books and museums, no matter how successful or seemingly dominant they are today. If companies want to continue growing or succeeding, the last thing they can do is become complacent and continue with business as usual, ignoring the fact that the world around them is changing. Instead, they must embrace the idea of a moving target, constantly reflecting on and reevaluating current practices and mental models, and always experimenting with new approaches. It is only through ongoing, adaptive experimentation that companies can hope to keep their finger on the pulse of opportunity and, if they are lucky, stay one step ahead of their competitors.

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