Alexander Brem · Éric Viardot *Editors*

Adoption of Innovation

Balancing Internal and External Stakeholders in the Marketing of Innovation

Springer

Adoption of Innovation

Alexander Brem • Éric Viardot
Editors

Adoption of Innovation

Balancing Internal and External Stakeholders in the Marketing of Innovation

Springer

Editors
Alexander Brem
The Mads Clausen Institute
University of Southern Denmark
Sønderborg
Denmark

Éric Viardot
Business Policy Department
EADA Business School
Barcelona
Spain

ISBN 978-3-319-14522-8 ISBN 978-3-319-14523-5 (eBook)
DOI 10.1007/978-3-319-14523-5

Library of Congress Control Number: 2015936277

Springer Cham Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Contents

Adoption of Innovation: Balancing Internal and External Stakeholders in the Marketing of Innovation

Alexander Brem and Éric Viardot

Abstract

In recent years, innovation management has shown to be a very important topic for academics and professionals. However, the emphasis has mostly been on the upstream activities of the innovation management process and specifically about how to obtain as well as to integrate new sources of innovation beyond the traditional and internal R&D function. Conversely, the downstream activities of the innovation process, specifically marketing and commercialization, have attracted little research. But the situation is changing now due to governments and companies that have realized that in order for an innovation to be successful, it is not enough to have good new ideas: it must foremost be adopted by the market. As a consequence, there is currently a shift in priorities and a renewed interest in the marketing of innovation and especially in the adoption of original products or services, because one important function of marketing is to contribute to the adoption of innovative solutions by potential customers. This book aims to contribute to this advancement and to provide fresh conceptual insights and thinking about the manners to stimulate and to facilitate the adoption of every kind of innovation. This will be managed by a very diverse contributions exploring the role and the balancing of internal and external stakeholders in the marketing of innovation.

A. Brem (✉)
The Mads Clausen Institute, University of Southern Denmark, Sønderborg, Denmark
e-mail: brem@idee-innovation.de

É. Viardot
Global Innovation Management Centre, EADA Business School, Barcelona, Spain
e-mail: eviardot@eada.edu

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_1

This book arrives at the perfect time when it comes to the study of innovation management as the adoption of innovation has become a crucial issue for both practitioners and academics.

For the last 5 years at least, innovation has been one of the top priorities for companies' executives and chief marketing officers (Kim et al. 2014) as well as an important topic in management research (see for instance Robins 2013). However, the focus of both practitioners and academics has been mostly on how to connect with external stakeholders in order to find new sources for getting ideas, developing prototypes or creating new products. Concepts such as "open innovation" (Chesbrough 2003) or "networked innovation" (Sawhney and Nambisan 2007) have emerged and are now mainstream in the academic literature about innovation management. At the same time, some companies have shown an extraordinary ability to open their innovation process to external partners—suppliers, distributors, customers, even individual volunteers or members of social communities.

In other words, the emphasis was on the upstream activities of the innovation management process and specifically about how to obtain as well as to integrate new sources of innovation beyond the traditional and internal R&D function. Customers were considered mostly as one additional source of innovation among others, through the interaction process of co-creation, more than a key component of the commercialization of innovation.

The downstream activities of the innovation process, specifically marketing and commercialization, have attracted little research, but this situation is changing now. Indeed, companies and governments have realized that in order for an innovation to be successful, it is not enough to have good new ideas: it must foremost be adopted by the market. Without market success, an innovation is just a useless invention whose failure will dent the profitability of the company which is selling it or will even lead it to bankruptcy. And at the same time, employees, suppliers, etc. must be informed and convinced as well, that the innovation is a win for them.

As a consequence, there is currently a shift in priorities and interest in the management of innovation. The European Union for instance has been considering shifting its priorities in order to stimulate innovation, by making the adoption of innovation one of its 10 priorities in its new Research and Innovation Programme from 2014 to 2020, named Horizon 2020 (Salmelin 2013). Similarly, the importance of strengthening the adoption innovation at consumers level is illustrated by the recent emergence of the conceptual model of Quadruple Helix Innovation where citizens are added as a fourth element to the more traditional combination of partnership for innovation between the industry, the government, and the universities (Afonso et al. 2010; Carayannis and Campbell 2006). Those conceptual evolutions are strongly encouraged by some large companies such as Intel or Rolls Royce (Curley and Salmelin 2013).

Hence, there is now a renewed interest in the marketing of innovation and especially in the adoption of original products or services, because one important function of marketing is to contribute to the adoption of innovative solutions by potential customers, which can be consumers or organizations.

1 Contents

This book aims to contribute to this advancement and to provide fresh conceptual insights and thinking about the manners to stimulate and to facilitate the adoption of every kind of innovation, either radically or incrementally as well as either at the level of products or processes or business models. To ensure the quality of the material in this book, all articles have been through a blind peer-review process.

The first chapter of the book by Christian Horn and Björn Ivens analyzes how new marketing tools, known as "Prediction Markets", can help companies to get a better knowledge of their future market environments and conditions which translates into a better marketing planning and therefore into an improvement of their innovation success rates. Prediction markets can be defined as (virtual) markets that organize information with the help of market mechanisms, namely prices and trading. The authors introduce the theoretical foundations of prediction markets. Then they present how those tools can be used in various stages of the innovation management process as well as when forecasting demand or anticipating changes in a competitive environment. Prediction markets are especially useful in business environments where knowledge is dispersed and predictive reports are needed continuously or periodically for the evaluation and rating of huge amounts of ideas, concepts, alternatives and new product market entries.

The following chapter by Sharad Agarwal and M. J. Xavier sheds a new light on how to get a better understanding of customers' needs and expectations thanks to the application of the recent progress made in neuroscience. Today, it is estimated that more than 90 % of the information is processed unconsciously and subconsciously in human beings as any individual receives far more information than a human brain is capable of absorbing consciously. Actually the unconscious mind of the "homo sapiens" takes care of all the vital processes in the body and plays a critical role in decision-making. First the authors remind us of the latest development in the application of neurosciences to marketing. Then they discuss how those neuro-marketing tools help companies to get enhanced consumer insights about their desires. The authors provide various examples of how consequently the use of those neuro-marketing tools facilitate the development of innovative new products that are more easily and quickly adopted by the market.

Another revolution has made a big impact on the marketing of innovative solutions: it is the technology of cloud computing, which is discussed at large by Vanessa Ratten in the chapter "Social Cognitive Theory and the Technology Acceptance Model in the Cloud Computing Context: The Role of Social Networks, Privacy Concerns and Behavioural Advertising". Cloud computing is a form of utility and platform computing that has managed to become widely available in the very recent years and which has a deep effect on customers' behavior. It has increased in popularity due to more consumers that want interactive technology applications. Cloud computing has changed the way consumers access information services as they are maintained and updated as technology can be configured on demand. Companies can now constantly generate information available on demand and based on consumer tastes and preferences. Theoretically with cloud computing,

companies may have a vast potential to facilitate the adoption of innovative solutions by providing qualified information to the customers as well as receiving direct feedback from the clients. The author analyzes the reasons why consumers adopt cloud computing and identifies the main drivers but also the main impediments for the adoption of this promising technology by the markets. Hence, the article provides a powerful theoretical framework to understand the consumers' intention to adopt cloud computing. It also provides useful insights for companies, which plan to rely more extensively on cloud computing to accelerate the adoption of their own innovations.

In chapter "Customer Co-Production and Service Innovation Characteristics: A Conceptual Argument", Mohammad Ali Zolfagharian and Audhesh Paswan discuss the specific case of the adoption of innovative services. One key specificity of services is that they are always partly produced by the user at the time of their consumption. This customer co-production has been studied for a long time when it comes to service management, but the author is using the concept differently. At a time where the adoption of innovation by customers is getting so important, the research aims to understand how the customers' perception of service innovation characteristics are influenced by their co-production of the service for themselves or for other customers. The chapter offers a conceptual framework, which is helpful for academics to apprehend the theoretical linkages between customer co-production and innovation. Practitioners will also find this framework very useful to help them to derive its practical implications in the design of appealing co-production features for innovative services in order to make them more attractive and easier to adopt.

Another effective way to stimulate the adoption of an innovation is the branding strategy. In chapter "Building Innovative Competitive Advantage in the Minds of Customers", Taskin Dirsehan ponders about how to build a competitive advantage for an innovation in the mind of the customers by encapsulating the value of an innovation into a brand. Indeed branding has proven to be a source of sustainable competitive advantage when consumers show a strong, favorable and unique association with a brand. Most specifically the author applies a proven research tool, the brand concept mapping, to evaluate the degree of perceived innovativeness associated to the brands of existing markets. The chapter presents interesting results coming from an application to the mobile phone industry which illustrates the practical application of the brand concept map used to reveal brands' perceived innovation-related associations.

In the next chapter, Chander Velu explores the importance and the role of developing institutions as a means to manage the balance between external and internal stakeholders for a successful adoption of innovation. The author uses the prisoner's dilemma game and the consequential empirical results as an analogy to draw lessons about how institutions could be developed to enhance collaborative innovations. Conclusions are drawn for managers to shape the institutional structure for collaboration by demonstrating the importance of fairness, reciprocity, development of social capital and understanding demographic characteristics of the

participants. The chapter shows also the need for the creation of a formal external agency to encourage collaboration when participants are less homogenous in a given industry.

This argument is reprised and developed in chapter "Organizing Open Innovation for Sustainability" by Paul Ingenbleek and Gé Backus who focus on the marketing of innovation in low-tech industries, because innovation does not take place only in high technology fast changing sectors. The authors scrutinize how once a mature, low-tech industry reaches the limits of a closed innovation model, open innovation may also promise opportunities for sustainable development. Their main finding is that in low-tech environments open innovation is unlikely to emerge spontaneously from the spillovers of R&D, so specific institutions are required to actively initiate and coordinate open innovation processes. Understandably, this has important consequences for marketing, because buyers and sellers may jointly embark on innovation processes that are guided by a third party organization. This intriguing chapter identifies the potential impacts and pitfalls of those third party facilitating organizations, which are acting as matchmakers between firms, potential trading partners, and research institutes. They are a necessary path to initiate a continuous learning process and to provide platforms for ideas in industries which are very far in their technological life cycle, with a very low innovation intensity and where companies are locked into a certain technological frame and path-dependency and are unable to change from the inside. One conclusion of the chapter is that the marketing of innovation should not only be concerned with the customers but with other external important stakeholders. Other conclusions are practical implications for policy makers and managers of companies working in mature sectors.

In chapter "Visions and Radical Innovation: A Typology", Susan Reid underlines the importance of building and communicating a strong vision for ensuring the success of innovations. This is essential for radical innovations, which by nature are risky and inclined to have a high failure rate in the market, because they tend to involve dramatic departures from existing products. As a result, the development and implementation of radical innovations usually implies to build new technical and commercial skills, different infrastructures, as well as fresh problem-solving approaches. Reid advocates that a powerful vision, or an image of a desired future, developed for the internal stakeholders, namely all the parties involved in a firm, plays an important role in ensuring the success of developing and marketing radical innovation. This is because visioning enables risk reduction through offering different points of convergence around technology development goals and specific market goals. The chapter provides a powerful deconstruction of the concept of vision in its three core components—the goal, the passion underlying it and the clarity of the vision. But the author points out that, under every great radical innovation lies not one, but several visions which help bring it to fruition and that those different visions tend to occur at different times during the trajectory of a radical innovation. Thus the paper offers a detailed typology of radically innovative visions : value-driven vision, technology vision, bottom-up market vision and top-down market vision. Consequently this research

offers not only a conceptual synthesis for academics working on innovation management but it is also of great help to managers who want to elaborate and to communicate internally powerful and efficient visions for radical innovation. This way their development and their acceptance first internally-by convincing the employees, the managers, and the investors- and then externally by the markets can be facilitated.

If there is an industry where vision is important, it could be the space industry, which has recently experienced an explosion of innovative projects on behalf of new entrants. This provides a good transition with another important consideration when it comes to innovating : sometimes innovations do not come at all from the R&D but just from changing the way a company does its business, in other words its business model. In chapter "Innovating the Business Model: The Case of Space", Alessandra Vecchi and Louis Brennan show clearly that business model innovation (BMI) has some intricate consequences in the relationship with the internal stakeholders. They make a thorough analysis of the space industry where they emphasize the three main components of BMI, which are the content, the structure and the governance of the business models. Any change in one or many of those elements has deep implications for the internal stakeholders of a firm as detailed by the authors in the chapter. Additionally, the research demonstrates that BMI has also an impact on external stakeholders as for instance in the case of the space industries, the new entrants—which are all private companies—have proved to be extremely resourceful in order to involve non-space actors in their business and to diversify their sources for revenues outside of the space business. The reading of the detailed case studies will also provide interesting ideas and examples to professionals from other industries, which are looking to improve the marketing of their innovation by modifying their business model.

In chapter "Real Options Reasoning and Innovative Performance in the Context of Dynamic Capabilities", Asghar Jahanshahi and Stephen Zhang contemplate another way for companies to manage and to adapt their resources in order to not only be more innovative but also to be able to deal with the risks associated with innovations, especially in terms of adoption. There is always the danger that the design or the quality of a new product or service will not match the needs and desires of potential customers. The reaction of competition is another important threat as a successful innovation may stir the aggressiveness of bigger existing players or new entrants, which may jeopardize the situation of the firm which has launched the innovation. They present the financial and management concept of "real option" as an effective way for the firms to mitigate the risk of innovation by appropriately exploiting their resources—tangibles and intangibles- or creating new ones if needed. Real option reasoning is about the opportunity to pursue a specific investment or management decision along time, from deferring to staging, expanding, switching or abandoning. The authors offer an interesting conceptual framework to support their argument that real options thinking is an effective way to improve the performance of the innovation management process when it is combined with organizational learning and a strong level of absorptive capacity. They also develop some interesting suggestions for managers who want to

implement real option reasoning in their management practice in order to adapt their innovation strategy to fast changes in technology and markets.

In the final chapter of this book, Maria Smirnova and her colleagues provide a practical illustration about the importance of balancing internal and external stakeholders' interest in the marketing of innovation with a study of a large sample of innovative Russian companies. They also evaluate the role of external cooperation in innovation as a way to overcome market and institutional context inefficiencies and achieve better performance outcomes. This chapter delivers a sound theoretical framework detailing what are internal and external cooperation for innovation and how they have an effect on the innovation outcome with the identification of five possible cooperation strategies. But the research gives also absorbing results, which are confirming other investigations. For instance, the firms that are most active in cooperation demonstrate better performance in terms of introduction of new products to the market; but a focus on internal cooperation with a lack of attention to external partners can also produce good performance. Only the companies who are "stuck in the middle" and are described in the chapter as "average cooperators" are not performing well. The detailed portrayal of the clusters of innovative Russian firms provides the reader with very useful insights to understand what it takes to make innovations more palatable to the markets.

2 Implications for Future Research

The big variety of articles in this book shows how wide-ranging the field of innovation marketing is still in the research landscape. This might be due to the fact that innovation and marketing are still treated as two different research streams with only selective interactions. Based on that, we think that this situation offers attractive perspectives for young new-to-the-field researchers to work on the boundaries of these two disciplines.

In research, there are many different models, which formalize how companies can profit from innovations. A recent article by West and Bogers (2014) offers a useful synthesis of those models to describe the open innovation management process articulating around four phases. The first step is to obtain innovations (from external sources), through a structured process of searching, enabling and filtering, as well as acquiring. The second stage is to integrate innovation within the firm, not only within its processes but also within its core competencies and its corporate culture. The third phase is the commercialization of the innovation to transform it into a market success. A last and important part is the interaction between the three original phases as the management of innovation is not unidirectional but it integrates reverse flows and feedback between the various innovation stakeholders. This model does not consider the strategic analysis and decisions, which have to be made before deciding to innovate, but it is an interesting framework to map out further research about the marketing of innovation, as it

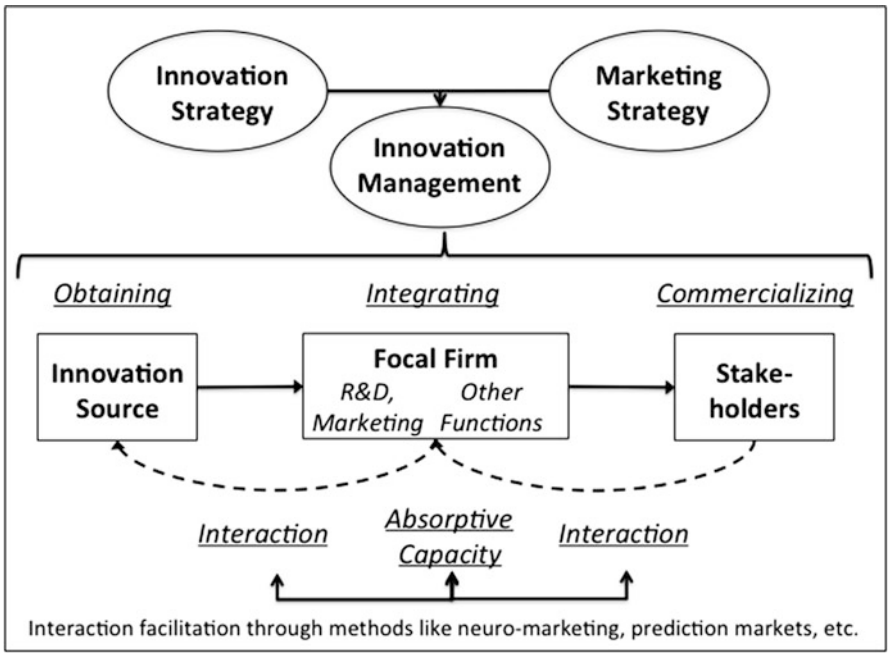


Fig. 1 Process model of innovation management [Adapted from West and Bogers (2014, p. 816)]

can be extended from the open innovation to a general innovation management view (See Fig. 1).

The first avenue for research is to explore a better integration between marketing strategy and innovation strategy, as so far there are only minor linkages between both. In the innovation management literature, marketing strategy is not considered or is often limited to a vague analysis of how to create value with innovation while a clear goal of innovation strategy is to achieve a competitive and sustainable advantage in a given market with the accurate positioning of the product and the right marketing mix. Further research might look into approaches about how to combine the innovation and marketing strategy processes in the early development phases, and how to embed them into a firm's organization in order to achieve a sustainable competitive advantage, in addition to increase sales with a better and faster acceptance of an innovation by the markets.

A second direction for research is to extend the study of the marketing of innovation by considering all the stakeholders and not only the customers, as it is very often the case today. Suppliers, employees, and many other stakeholders can actively support the commercialization phase of an innovation; the more diverse and the more positive they are, the highest are the probability of success. Moreover, the adoption of innovation requires more than just addressing the external stakeholder issues like finding the right customers or using new distribution channels, for example. It has also to be considered the internal stakeholders' perspective and

especially to analyze how the employees, the management structure and the overall structure of the firm can contribute to ease the adoption process of innovation by the markets.

On that matter, internal marketing and communication (Pfeffermann et al. 2014) are also important in order to inform and convince those internal stakeholders that they will beneficiate from the innovation. The support and adhesion of the internal interested parties is a critical success factor because they have to move from an endocentric to an exocentric consideration of their activities. As a consequence, the success in the marketing of innovation depends on a delicate balance between external and internal stakeholders. Additionally, it is a dynamic balance, which makes it difficult to keep as the markets, the customers' behaviors and the environment of the firms are changing constantly while firms are also evolving internally over time.

A third path for research stands on the fact that marketing has an active role in the innovation management process which goes far beyond the commercialization process and the interaction with the R&D department at the early stage of the product development phase. Various works related to open innovation tends to suggest that the marketing function is necessary when finding new innovation sources, not only working with the famous "lead users" or with the "creative consumers" (McCarthy 2014) but also with social communities and other participants. It is often critical to integrate those stakeholders very early in the innovation process in order to be successful, at least with incremental innovations. More research could be made about how marketing management can effectively contribute to this integration.

A fourth field of investigation for the marketing of innovation is about its role in the interaction phase of innovation management. For instance, while marketing can help to find new ideas with users or customers through the organization of idea contests, few research like the one by Bilgram (2013) have been made on the positive—or sometimes negative- impact of those contests on the brand image of a company. Some chapters in the book explore how innovative market research such as neuro-marketing or prediction markets facilitate the interaction with innovation sources. But other marketing tools are also contributing to an increased interaction with the stakeholders and they offer a high potential to improve the innovation process of companies, independent from their actual size. For instance, there are still few works about how the latest innovations in distribution, communication, or pricing can contribute to accelerate the adoption of an innovation.

Finally, the ability of a firm to evaluate and utilize external knowledge, called absorptive capacity, is a critical capability to manage innovation (Cohen and Levinthal 1990) and to facilitate its adoption by the markets. Although there might be a high level of interactions with customers and other stakeholders, the conversion of an innovation into value will depend ultimately on the absorptive capacity of a company. This is because the level of absorptive capacity affects all interactions between innovation sources, the focal firm, as well as stakeholders. Different levels of absorptive capacities must be taken into consideration, which are

supposed to exist on a potential and realized level (Zahra and George 2002). How those level of capacities can be managed might inspire researchers in this field.

With such an open field of exciting research, we would like to encourage especially marketing researchers to be more open for and active on applying proven marketing approaches in the innovation process, while we hope to give all readers—academics as well as practitioners—an interesting and inspiring reading. We are looking forward to the further development in this field.

Acknowledgements We thank Prashanth Mahagaonkar from Springer for his invaluable and encouraging support. Moreover, we thank explicitly all authors for their high commitment to this book project.

References

Afonso, O., Monteiro, S., & Thompson, M. (2010). *A growth model for the quadruple helix innovation theory*. FEP Working papers no. 370. Porto: University of Porto.

Bilgram, V. (2013). Performance assessment of co-creation initiatives: A conceptual framework for measuring the value of idea contests. In A. Brem & É. Viardot (Eds.), *Evolution of innovation management: Trends in an international context*. Basingstoke: Palgrave Macmillan.

Carayannis, E. G., & Campbell, D. F. (2006). *Knowledge creation, diffusion and use in innovation networks and knowledge clusters. A comparative system approach across the United States, Europe and Asia* (pp. ix–xxvi). Westport, Connecticut: Praeger.

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128–152.

Curley, M., & Salmelin, B. (2013). Dublin Declaration in Open Innovation 2.0, Conference Dublin, May 20–21 2013. Retrieved September 18, from www.slideshare.net/DCSF/martin-curley-closing-final

Kim, W., Andrew, T., Hadi, Z., & Eugene, F. (2014). The most innovative companies 2014: Breaking through is hard to do. *BCG. Perspectives*. Retrieved November 4, 2014, from https://www.bcgperspectives.com/Images/Most_Innovative_Companies_2014_Oct_2014_tcm80-174313.pdf

McCarthy. Ian P: (2014). User innovation and the role of creative consumers. *International Journal of Technology Marketing*, *9*(1), 1–5.

Pfeffermann, N., Minshall, T., & Mortara, L. (2014). *Strategy and communication for innovation* (2nd ed.). New York, NY: Springer.

Robins, J. (2013). Managing business models for innovation, strategic change and value creation. *Long Range Planning, 46*(6), 417–488.

Salmelin, B. (2013). Innovation in Horizon 2020 – Reflections from Open Innovation 2.0 paradigm, Open Innovation 2.0 Conference, Brussels, November 28, 2013. Retrieved September 17, 2014, from www.euris-programme.eu/

Sawhney, M., & Nambisan, S. (2007). *The global brain: Your roadmap for innovating faster and smarter in a networked world*. Upper Saddle River, NJ: Wharton School Publishing.

West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation (with Joel West). *Journal of Product Innovation Management, 31*(4), 814–831.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualisation, and extension. *Academy of Management Review, 27*(2), 185–203.

Corporate Prediction Markets for Innovation Management

Theoretical Foundations and Practical Examples for Business Use

Christian Franz Horn and Björn Sven Ivens

Abstract

This chapter summarizes latest developments concerning prediction markets used by corporations during the innovation process. Though not widely-known yet, prediction markets provide the double possibility of organizing dispersed knowledge efficiently and producing accurate forecasts. Many theoretical aspects of prediction markets and also various practical fields of using them (mainly politics and sports results) have been extensively investigated and discussed before by other authors. This chapter deals with the practical use of prediction markets in business and innovation-driven environments. Major fields in which prediction markets can be successfully used in the innovation process are idea creation, idea screening and filtering, concept evaluation, lead user identification, market success forecasting and pricing, demand forecasting, project management and the forecasting of changes in a competitive environment.

1 Introduction

Where innovation marketing and product innovation are concerned, good knowledge of future market environments and conditions is needed to reduce product failure rates and to make sure that companies stay one step ahead of their competitors. Precise predictions in all stages of the innovation process, either long- or short-term, can help to manage marketing planning. For example, it is crucial to find out the best prototypes and ideas in an early stage of the innovation process in order to prevent failure of investments into products and services. In later

C.F. Horn (✉) • B.S. Ivens
Department of Marketing, Otto-Friedrich-University Bamberg, Bamberg, Germany
e-mail: christian.horn@uni-bamberg.de

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_2

stages, companies ask for the possible market shares of different product variants or for the number of units sold after going to market. To address this problem, it is necessary to improve the innovation process of a firm and support the innovation process with new tools and techniques (Brem 2008) as well as employing external (c.f. Chesbrough 2003; Franke et al. 2006) or internal sources (van Dijk and van den Ende 2002). Prediction markets (PM) are a tool that can help firms to innovate more successfully. They can be defined as

> (virtual) markets that organize information with the help of market mechanisms, namely prices and trading. The stock prices of certain assets (e.g. predictions of future market conditions or ratings on new product ideas) represent the valuation of the market players and is assessed through trading on these topics with the help of (virtual) money.

This chapter shows how *prediction markets* (PM) can be used for forecasting tasks or for information aggregation in companies or other organizations. Though these and other fields of use are described, the focus lies on prediction markets that are used or organized by companies (*corporate prediction markets*, CPM). After introducing CPMs, the theoretical foundations of PMs[1] are explained. Practical examples for the use of PMs and more detailed aspects of prediction market design are discussed afterwards.

2 Application of Prediction Markets

2.1 General Fields of Usage

The online-supported use of prediction markets is relatively new, though theoretical foundations were set in the early twentieth century. In the 1920s, the New York Betting Markets already used market mechanisms to bet on the results of political elections (Berneburg 2008). Wall Street traders placed bets on election results. For scientific use, the first popular prediction markets were the *Iowa Electronic Markets* (IEM) that started in the late 1980s. These markets were set up at the University of Iowa to investigate the behavior of individual traders and the market design variable for prediction markets, mainly on political topics, such as presidential or gubernatorial elections. Also those markets were, due to technological progress, the first known to the public to be organized online instead of using real order books or trading agents. Other examples for an early use of PMs are the *Trade-Sports Markets*, where mainly sports results could be traded or the *Policy Analysis Markets*, which dealt with possible targets of terrorist attacks (Polk et al. 2003). Van Bruggen et al. (2010) stated that especially in institutional forecasting and information gathering, prediction markets can be useful.

Before focusing on the innovation management usage of prediction markets, a brief overview over general applications shall be given. Major applications are

[1] Sometimes also called *preference markets* (Dahan et al. 2009), *idea futures* (Tziralis and Tatsiopoulos 2007), *information markets* (Hahn and Tetlock 2006) or *virtual markets*.

(1) Political Markets, (2) Sports Markets, (3) Movie Markets, (4) Business and Economic Markets and (5) other markets.

Years ago, Forsythe et al. (1992) or Berg et al. (2003a, b) and many others showed the superiority of the political markets for the prediction of political events, especially elections, over other forecasting methods. Open-to-the-public markets and closed-group markets were both researched. Areas of interest were for example presidential or gubernatorial elections.

Sports markets have been researched by e.g. Luckner et al. (2012). They give a good overview over other sports and sport-betting markets. Events that were forecast include soccer championships such as world cups, European cups, horse racing or American football matches.

As one of the first applications for business-related forecasting, the Hollywood Stock Exchange (HSX) was investigated by numerous articles and authors. Box office revenues of Hollywood movies were to be anticipated by using the principles of markets. Although these markets are well researched, the field of usage is rather special and not easily transferrable to other industries or forecasting tasks. Spann and Skiera (2003) as well as Gruca et al. (2003) or Pennock et al. (2001) have shown the feasibility of forecasting with the help of these public markets.

Field of usage number five is represented by *other* usages such as futures on terrorism targets by the US DARPA and predictions on rainfalls in Australia.

2.2 Corporate Prediction Markets

Although there are several fields where prediction markets have been used, not too many studies have been published on corporate prediction markets (CPM). It remains unclear if this is due to reasons of confidentiality or due to a small prevalence *in praxi*. There are reports about companies such as Abbott Labs, Arcelor Mittal, Best Buy, Chrysler, Corning, Deutsche Telekom, Electronic Arts, Eli Lilly, Frito Lay, General Electric, Hewlett-Packard, Intel, InterContinental Hotels, Masterfoods, Microsoft, Motorola, Nokia, Pfizer, Qualcomm, Siemens, and TNT, as Cowgill et al. (2009) or Graefe (2011) state. Graefe also shows in his literature review that prediction accuracy can be improved when prediction markets are used for business forecasting. But he also supports the call for more extensive research in this field, as Snowberg et al. (2012) do in their article. Following this call, the existing studies in this field shall be summarized and gaps in research will be identified.

The fields in which prediction markets are used for business are shown in Table 1. After that, innovation management usage for corporations is discussed in detail. The table only takes into account prediction markets run in real world setups rather than in hypothetical or experimental environments. Only cases with scientific reports about it were considered. Key design aspects, such as duration, employees involved and subjects of forecasting are shown in the columns.

Some examples are e.g. Ortner (1998), who used prediction markets to find out project timelines e.g. for software projects and showed that this tool is highly

Table 1 Prediction markets for business use: innovation management

Company	Duration	Traders involved	Further information	Innovation support in the field of...
General Electric	22 days	Employees	LaComb et al. (2007)	Technology assessment
Hewlett Packard	7 days	Employees	Chen and Plott (2002)	Sales figures
Siemens	3 months	Employees	Ortner (1998)	Project management
Technology Company	36 days	Employees	Soukhoroukova et al. (2012)	Idea sourcing and filtering
Communications	n/a	Employees	Spann and Skiera (2003)	Figures
Finance company	22 days	Employees	Van Bruggen et al. (2010)	Figures
Movie Industry	1 month	Public	Spann et al. (2009)	Lead user identification

accurate compared to qualitative methods of project deadline estimations. Project team members could trade contracts on which a deadline would possibly be realized.

Chen and Plott (2002) showed at Hewlett Packard that the printer sales forecast could be improved in 15 out of 16 cases compared to the official company forecast, with employees trading 1 week.

Yahoo's Tech Buzz Game was a platform to assess technological trends, but no scientific report was published on these markets.

2.3 Innovation Management with Prediction Markets

As shown above, prediction markets can be used in many different settings. Especially for the different stages of innovation management, this tool can be useful. Figure 1 shows the six different stages within the innovation process. In the following paragraph, the theoretical foundations provided by Soukhoroukova (2005) and Cooper (2008) shall be discussed and developed further. As prediction markets can also be useful for supporting product innovations directly after the initial introduction to the market, this phase is shown here as "Market Phase".

At the fuzzy front-end of innovation, there are mainly two problems for innovation managers: the creation and gathering of new ideas and the screening and evaluation of the many ideas that were created in the step before. Prediction markets can support both phases. Users and customers from "the crowd" (van Hippel 2005), as well as employees from different departments can hand in ideas and concepts to the prediction market tool. At the same time, those persons or experts can use the prediction markets for the evaluation of ideas with the help of virtual money and virtual stocks. For example, virtual money can be invested into new ideas for a product (stocks) that were entered by a user, by other users or

Fig. 1 Based on Soukhoroukova (2005) and Horn et al. (2014)

employees. The ideas (stocks) with the highest virtual stock price are those which are the most promising ideas.

In the second phase, when ideas have been developed into concepts or mock-ups, a new evaluation phase can be started. Different stocks for different concepts can be presented on a virtual stock market and be traded e.g. by consumers, sales persons, or marketing experts.

During phase three, the design and engineering phase, prediction markets can help to find a consensus amongst persons that are relevant during the creation phase. The markets can act as tools where opinions can be gathered and those stocks that reach the highest virtual market value represent the "right" decision. With the help of this tool, it is possible to find decisions anonymously and thus eliminate problems that derive from hierarchical power structures in R&D teams. In settings, where certain persons shall have higher influence on the outcome of the market, it is possible to promote the opinion of those persons by giving them more virtual initial capital to invest into the markets. With the higher amount of money, they can e.g. influence the stock price more strongly than players with less capital.

Phase four differs little from the concept evaluation phase. Pilot products that are tested with only few customers can be evaluated by marketing personnel or the customers themselves.

During the launch phase and the post-launch or market phase (phases five and six), it is possible to forecast e.g. sales figures, market shares or possible reactions of competitors (Gruca et al. 2003). Traders that can be integrated in the market are again customers, sales staff or marketing managers.

Example 1 Idea Markets

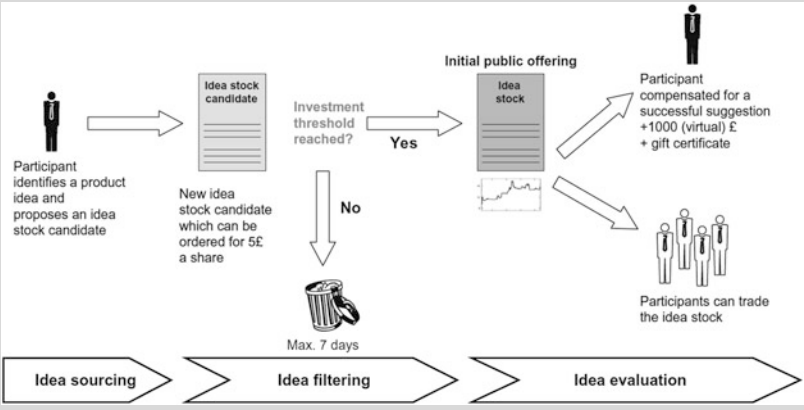
To show the use of prediction markets for the evaluation of ideas, another important example can be seen in the figure below. It shows how virtual markets can be used in a different way for idea finding and evaluation in the innovation process and is one of the few examples how the prediction market principles can be used in companies.

(continued)

The innovation process can also be supported by prediction markets in very early stages. The so-called "fuzzy front end" of innovation deals with the problem that many sources of ideas for new products or services can arise from intra- and extra-organizational sources. There can be only a small number but also thousands of variations or concepts. To evaluate the best ideas, it is necessary to find a lean, fast and cost-efficient process to screen and rate these ideas. Crawford and Di Benedetto (2006) show many tools and approaches to these issues.

To manage this task, the special form of *idea markets* can be used. In the figure below, the concept of Soukhoroukova et al. (2012) is described. Users can enter their ideas as virtual stocks to the markets. All users can invest an amount of their virtual money into these stocks if they think the stock representing the ideas is useful and worth being supported. Only ideas that have reached a certain investment threshold at a certain point in time are kept as virtual stocks. After that, the virtual stock market can be closed or even kept open for further evaluation of those ideas.

The concept of virtual IPOs is rather complex for participants not used to principles of markets, but was successfully described by Soukhoroukova et al. (2012).



Screening process for floating new product ideas (Soukhoroukova et al. 2012)

3 The Details: Theoretical Foundations of Prediction Markets

3.1 Efficient Market Hypothesis and Basic Mechanisms

A prediction market is organized for the primary purpose of accumulating (asynchronously) information dispersed amongst a group of informants (or traders). Von Hayek hypothesized in 1945 that the market price mechanism is an efficient instrument for the aggregation of dispersed knowledge amongst a group of informants who may be major players in an economy or in lower-level contexts. Snowberg et al. (2012) defined a prediction market as

> . . .a wager or outcome (or contract) that pays out if a particular outcome, such as an economic indicator taking a particular value *y*, occurs.

The theoretical principles of efficient markets were postulated by Eugene Fama. At any given time, the market price on an efficient market represents all available information about the future development of the contract the price is about. Plott and Sunder (1982, 1988) and other authors showed that the efficient-market hypothesis (by Fama 1970) can be used for forecasting tasks besides financial markets. In their fundamental article, Wolfers and Zitzewitz (2004) described three aspects of those markets that are crucial for efficiency. Firstly, markets are incentives for market players to seek information and use new sources of information in order to realize gains and earnings from those markets. Superior information enables players with accurate and highly valuable information, so-called *marginal traders*, to outperform less informed traders. Secondly, markets make players reveal the most accurate information they can find, as gains can usually only be realized through virtual capital invested into the right information "stocks". Thirdly, to get back to von Hayeks assumptions, markets are efficient in aggregating information from different persons.

Example 2 Prediction Markets: Basic Mechanisms

To explain the theoretical foundations with a practical and simplified example, we choose the predicting of future sales figures for clothing in the next time period with an *Index*-contract.

In a prediction market, the initial price for the number of polo-shirts sold in the next fall collection is at 30,000 (virtual currency units) at the moment, which represents a total sales number of 30,000 pieces. In Fig. 1, these values can be seen.

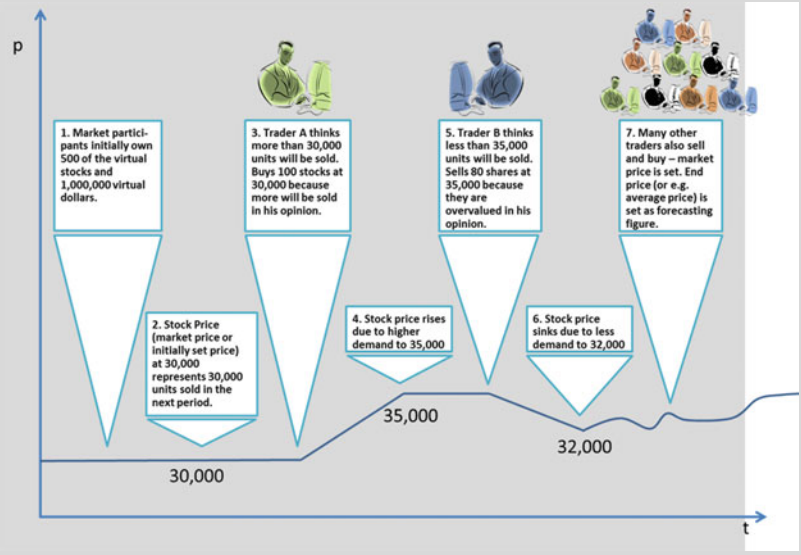
If player A anticipates a sales number of 35,000 pieces, he will buy this stock, because he thinks it is undervalued and its price will rise in the future. Thus, the stock price rises due to higher demand on the market, e.g. to a price of 35,000. Player B thinks that the price of 35,000 is too high; as he holds

(continued)

these stocks, he sells a large number. The market price decreases to e.g. 32,000, the forecast being that 32,000 units will be sold in the next period.

Due to Player B's high confidence in his information, he invested more virtual money from his depot than player A, thus, the price decreased more strongly than it increased from player A's order. If many players are trading on the markets, the equilibrium price represents the information dispersed amongst all market participants at any point in time. Payoffs of the contracts are set by the market price of the stock, in contrast to *winner-takes-all* contracts, where a payoff for the players can only be realized if the *right* contract is bought.

Naturally, a number of practical and theoretical problems are not shown in this example but will be addressed later.



Practical example of the principles of a prediction market (Authors' own figure)

3.2 Design Aspects of Prediction Markets for Innovation Management

The design of prediction markets depends on several conditions. Markets can employ different kinds of market mechanisms to set the prices and organize the bids. Main factors for the design will be discussed here and further advice for setting up one's own prediction markets is given.

3.2.1 Traders and Trading Activities

In prediction markets designed for use in innovation management, it is especially crucial to employ the right "experts". Experts can be customers, employees, scientists and researchers, depending on the industry, product, or information that is to be found. In topics where staff from a company wants to know what prototype is liked most by customers, only customers should be employed as traders. In other cases, if the R&D department wants to organize and evaluate their ideas, both external customers and employees can be asked. In some settings, for example where confidentiality about newly developed products is necessary, only employees or researchers are invited and the number of traders is much lower.

Experiments on the *Iowa Electronic Markets* that were set up to predict election results showed that a small group of traders performed significantly higher numbers of trades, invested more capital and placed their stop-and-buy orders closer to market prices. Therefore, they had higher returns from the markets (Forsythe et al. 1998). Such *Marginal Traders* (cf. Sect. 3.1), are extremely important for entering the *relevant* and *right* information to the markets, as they push the market price to its right value. *Noise traders*, in contrast, are relatively uninformed players who help to keep the market liquid but push prices towards incorrect levels. As they are less active and less successful in gaining (virtual) money, due to their limited funds, their influence on prices is not very powerful, though. Surowiecki (2004) opposes the marginal trader concept, but lacks a convincing alternative theory for explaining market behavior. However, to implement the available information, trader motivation is an important issue in prediction markets. Servan-Schreiber et al. (2004) argued that players should have intrinsic motivation to participate in the markets, other authors and practitioners also used lotteries or prizes for the best players to motivate participants (Horn et al. 2014; Soukhoroukova et al. 2012).

3.2.2 Liquidity and Motivation

The number of market participants depends, as shown above, on two main factors: the information that potential participants hold and the availability of those informants for participation.

A crucial aspect that is strongly connected with the latter is the motivation of participants. Unless it is possible to motivate participants to input their knowledge to the market, it will not work properly (Rosenbloom and Notz 2006), as also stated above. The higher market liquidity (the number of transactions) the better, as every offer will find a buyer more quickly. Thus, prediction market designers need to motivate participants not only to take part in the market regularly, but also to buy *and sell* stocks, as selling is less intuitive than buying stocks, especially in the early phases of the market when only the initial stock is found in the virtual depot and no buy orders have been placed so far. Also, a more liquid market can help to prevent the manipulation of results. Especially in public markets, this aspect can be important. In corporate markets, participants are often employees that have no motivation to manipulate the results of the markets, e.g. to enter data they do not believe is true. In public markets, participants possibly try to achieve gains, e.g. through showing speculative behavior that is not induced by fundamental

data, but solely by market and equity price data. Guarnaschelli et al. (2003) show that manipulation can be avoided through preventive measures in the design of prediction markets.

3.2.3 Contracts

Basically, there are three types of prediction market contracts or "stocks": *winner-takes-all* markets, *spread* markets and *linear* or *index* markets.

Winner-takes-all contracts occur quite frequently in prediction markets, as they are simple to understand for players. For these contracts, each virtual contract held by one player pays a fixed amount of (virtual) money if the event to which it relates occurs—and zero if it does not. Cowgill et al. (2009) showed that prices for those contracts reflect the current probability of the realization.

Contract type two, the *spread*-type, is rather rarely used. It can predict the median expectations of all players. Luckner et al. (2012) describe this contract more extensively.

Index contracts are not often used either, but especially for forecasting sales figures in business, for instance, they are often the best choice (cf. e.g. Horn et al. 2014). Payoffs are assigned to the price of the index contracts, as seen in example 1. The contracts pay off, e.g. the value of virtual currency units at a certain point in time or a fixed share of it.

3.2.4 Mechanisms

The mechanism most commonly used is that of *Continuous Double Auction*, where offers and bids are matched with the help of order books. This ensures high market liquidity even on relatively thin markets with few traders. Usually, such markets are designed to avoid the risk of losing (virtual) money for the organizers of the markets (Berg et al. 2003a, b). Other markets such as Combinatorial Market Maker mechanisms usually cannot avoid the risk of having to compensate some of the traders' gains by the organizers of the market. Therefore, and due to their complexity, they are not so commonly used.

3.2.5 Stock and Formulation of Stock Sets

Prediction questions and variables can aim at dichotomous outcomes, such as "Will our competitors enter the market within two months after product launch?" or to numbers or numeric relationships and represent the virtual "stocks". The wording of the prediction is crucial for the use of prediction markets in practical environments.

The formulation of the stocks and prediction questions has to meet several criteria. The statements must be correct and precise, free from ambiguity, and easily understood by participants (Borison and Hamm 2010; Christiansen 2007). Firstly, it has to be clear for the traders, not only for the organizers of the market, what the stocks they trade on are about. Therefore, the formulation has to be made as simple as possible. At the same time, the formulation should give as much information about the innovation-relevant questions to the organizers as possible. For example to find the best prototype out of five options, it is necessary to give

enough information about the differences between the variants. Also, it should be clearly communicated what the goal of the market is: For example to find out the best design, the best set of features or the product with the highest probability to succeed on the markets later on.

Second, the stocks and trading phase must be explained well enough for the participants to realize the relevance of the tool (especially for employees) or the mechanisms and the "rules of stock trading", especially for customers that usually have not been trading on an online market or with stocks before.

4 Future Developments

It can be seen that prediction markets have had a long time of development since their first larger-scale use in the 1920s and their return in the 1990s with the *Iowa Electronic Markets* and succeeding implementations, which became possible with the emergence of information technology. Potentially successful fields of application for prediction markets in business environments are those where knowledge is dispersed and predictive reports are needed continuously or periodically. Especially in innovation management, these capabilities are needed for the evaluation and rating of huge amounts of ideas, concepts, alternatives and new product market entries.

To give an example of the future use of prediction markets in innovation management, sales figures for newly developed consumer goods which are important e.g. for logistics could be predicted on a weekly basis. Store managers could trade together with product managers in markets for the weeks following market entry and give quick and direct qualitative feedback to innovation and marketing managers. It seems possible that for consumer goods, experienced users or customers could be better experts than employees such as marketing managers or product developers. This can especially be true in industries that are strongly driven by trends and fads and where market research usually is difficult such as fashion, consumer electronics or fast moving consumer goods. Thus, including customers into the forecasting with prediction markets could be promising, but has rarely been investigated yet. Customers could be integrated in traditional markets or preference markets for concept testing, sales predictions, idea creation and evaluation.

Also, practical issues of the integration of prediction markets into existing organizations can occur, e.g. motivational problems and not limited to problems coming from internationally working, or intercultural teams. Virtual markets can be intuitive in usage, but there is little experience in keeping these systems running. In this context, the long-term motivation of employees or customers to trade can be problematic. Besides experimental and scientific markets such as the *Iowa Electronic Markets*, there is little knowledge about long-term motivation. From the numerous prediction markets software providers, such as *Crowdcast, Crowdworkx, Inklingmarkets, Kenforx* or *Voycer AG*, there is a huge potential for the commercial success of prediction markets software.

References

Berg, J. E., Forsythe, R., Nelson, F., & Rietz, T. A. (2003a). Results from a dozen years of election futures markets research. *Elsevier Science, 1*(1), 742–751.

Berg, J. E., Nelson, F., & Rietz, T. A. (2003b). *Accuracy and forecast standard error of prediction markets*. Working paper, College of Business, University of Iowa.

Berneburg, M. (2008). Prediction Markets: Prognosemärkte in Praxis und Theorie: Ein Überblick. *Review of Economics, 59*, 60–75 (Stuttgart, Lucius & Lucius).

Borison, A., & Hamm, G. (2010). Prediction markets: A new tool for strategic decision making. *California Management Review, 52*(4), 125–141.

Brem, A. (2008). *The boundaries of innovation and entrepreneurship – Conceptual background and selected theoretical and empirical aspects*. Wiesbaden: Springer-Gabler.

Chen, K. Y., & Plott, C. R. (2002). *Information aggregation mechanisms: Concept, design and implementation for a sales forecasting problem.* Working paper no. 1131. Pasadena: California Institute of Technology.

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Cambridge, MA: Harvard Business School Press.

Christiansen, J. D. (2007). Prediction markets: Practical experiments in small markets and behaviours observed. *Journal of Prediction Markets, 1*(1), 17–41.

Cooper, R. G. (2008). Perspective: The stage-gates idea-to-launch process—update, what's new, and NexGen systems. *Journal of Product Innovation Management, 25*(3), 213–232.

Cowgill, B., Wolfers, E., & Zitzewitz, J. (2009). Using prediction markets to track information flows: Evidence from Google. In S. Das, M. Ostrovsky, D. Pennock, & B. D. Szymanski (Eds.), *Auctions, market mechanisms and their applications* (Vol. 14). Berlin: Springer.

Crawford, M., & Di Benedetto, A. (2006). *New products management*. Boston, MA: McGraw Hill.

Dahan, E., Soukhoroukova, A., & Spann, M. (2009). New product development 2.0: Preference markets. How scalable securities markets identify winning product concepts & attributes. *Journal of Product Innovation Management, 27*(7), 937–954.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance, 25*(2), 383–417.

Forsythe, R., Frank, M., Krishnamurthy, V., & Ross, T. W. (1998). Markets as predictors of election outcomes: Campaign events and judgment bias in the 1993 UBC election stock market. *Canadian Public Policy, 24*, 329–351.

Forsythe, R., Nelson, G. R., Neumann, J., & Wright, J. (1992). Anatomy of an experimental political stock market. *American Economic Review, 82*(5), 1142–1161.

Franke, N., von Hippel, E., & Schreier, M. (2006). Finding commercially attractive user innovations: A test of lead-user theory. *Journal of Product Innovation Management, 23*(4), 301–315.

Graefe, A. (2011). Prediction market accuracy for business forecasting. In W. L. Vaughan (Ed.), *Prediction markets* (pp. 87–95). New York, NY: Routledge.

Gruca, T. S., Berg, J. E., & Cipriano, M. (2003). The effect of electronic markets on forecasts of new product success. *Information Systems Frontiers, 5*(1), 95–105.

Guarnaschelli, S., Kwasnica, A. M., & Plott, C. R. (2003). Information aggregation in double auctions: Rational expectations and the winners curse. *Information Systems Frontiers, 5*(1), 63–77.

Hahn, R. W., & Tetlock, P. C. (2006). A new approach for regulating information markets. *Journal of Regulatory Economics, 29*(3), 265–281.

Horn, C., Ivens, B. S., & Brem, A. (2014). Damaging brands through market research: Can customer involvement in prediction markets damage brands? *Marketing Intelligence and Planning, 32*(2), 232–248.

LaComb, C. A., Barnett J.A. & Pan, Q. (2007). The imagination market. *Information Systems Frontiers, 9*(2–3), 245–256.

Luckner, S., Schröder, J., Slamka, C., et al. (2012). *Prediction markets: Fundamentals, designs, and applications*. Wiesbaden: Gabler.

Ortner, G. (1998). *Forecasting markets – an industrial application*: Part II. Working Paper. Vienna: University of Vienna.

Pennock, D. M., Lawrence, S., Nielsen, F. A., & Giles, C. L. (2001). *The power of play: Efficiency and forecast accuracy in web market games*. NEC Research Institute Technical Report 2000–168, NEC Research Institute, Princeton.

Plott, C. R., & Sunder, S. (1982). Efficiency of experimental security markets with insider information: An application of rational-expectations models. *Journal of Political Economy, 90*(4), 663–698.

Plott, C. R., & Sunder, S. (1988). Rational expectations and the aggregation of diverse information in laboratory security markets. *Journal of the Econometric Society, 56*, 1085–1118.

Polk, C., Ledyard, J., Hanson, R., & Ishikida, T. (2003). *The policy analysis market: An electronic commerce application of a combinatorial information market*. In Proceedings of the 4th ACM conference on electronic commerce, pp. 272–273.

Rosenbloom, E. S., & Notz, W. (2006). Statistical tests of real-money versus play-money prediction markets. *Electronic Markets, 16*(1), 63–69.

Servan-Schreiber, E., Wolfers, J., Pennock, D., & Galebach, B. (2004). Prediction markets: Does money matter? *Electronic Markets, 14*(3), 243–251.

Snowberg, E., Wolfers, J., & Zityewitz, E. (2012). *Prediction markets for economic forecasting*. Working Paper 18222. National Bureau of Economic Forecasting.

Soukhoroukova, A. (2005). New product development with Internet-based information markets: Theory and application. In D. Bartmann, F. Rajola, J. Kallinikos, D. Avison, R. Winter, P. Ein-Dor, et al. (Eds.), *Proceedings of the Thirteenth European Conference on Information Systems (ECIS)*.

Soukhoroukova, A., Spann, M., & Skiera, B. (2012). Sourcing, filtering, and evaluating new product ideas: An empirical exploration of the performance of idea markets. *Journal of Product Innovation Management, 29*(1), 100–112.

Spann, M., Ernst, H., Skiera, B., & Soll, J. H. (2009). Identification of lead users for consumer products via virtual stock markets. *Journal of Product Innovation Management, 26*(3), 322–335.

Spann, M., & Skiera, B. (2003). Internet-based virtual stock markets for business forecasting. *Management Science, 49*(10), 1310–1326.

Surowiecki, J. (2004). *The wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations*. New York, NY: Anchor Books.

Tziralis, G., & Tatsiopoulos, I. (2007). Prediction markets: An extended literature review. *Journal of Prediction Markets, 1*(1), 75–91.

Van Bruggen, G. H., Spann, M., Lilien, G., & Skiera B. (2010). Prediction markets as institutional forecasting support systems. *Decision Support Systems, 49*(4), 404–416.

van Dijk, C., & van den Ende, J. (2002). Suggestion systems: Transferring employee creativity into practicable ideas. *R&D Management, 32*(5), 387–395.

von Hayek, F. A. (1945). The use of knowledge in society. *American Economic Review, 35*(4), 519–530.

von Hippel, E. (2005). *Democratizing innovation*. Cambridge, MA: MIT Press.

Wolfers, J., & Zitzewitz, E. (2004). Prediction markets. *Journal of Economic Perspectives, 18*(1), 107–126.

Innovations in Consumer Science: Applications of Neuro-Scientific Research Tools

Sharad Agarwal and M.J. Xavier

Abstract

The study of the biological aspects of the consumer behaviour through the application of neuroscience is one among the many innovations in the area of marketing, particularly in understanding the consumer behaviour. Only recently management scientists have started applying the principles of neuroscience in the management applications and theory building. The new methodologies of 'Consumer Neuroscience' provide an opportunity to understand the neural level processes in the brains of the consumers which in turn offer valuable insights into the cognitive decision making process of the consumers, which are otherwise not captured through traditional methods of management research. This chapter introduces the readers to the most commonly used tools of neuromarketing, such as fMRI, EEG, and ERP (P300) and then explains their applications in marketing. This chapter presents several examples that highlight the application of neurosciences to study aesthetics and sensory factors that have helped companies innovate and improve their products and in-store experience of their customers.

S. Agarwal (✉)
Indian Institute of Management (IIM), Suchana Bhawan, Audrey House Campus, Ranchi, Jharkhand 834008, India
e-mail: sharad.agarwal12fpm@iimranchi.ac.in

M.J. Xavier
VIT University, Vellore 632014, India
e-mail: mj.xavier@vit.ac.in

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_3

1 Introduction

An individual receives far more information than a human brain is capable of absorbing consciously. The unconscious mind of a human being takes care of all the vital processes in the body, playing a greater role in decision making of human beings. More than 90 % of the information is processed unconsciously and subconsciously in the human beings; hence, the conscious component is only the tip of the perception iceberg which for the most part remains unconscious (Zurawicki 2010). The traditional tools and techniques used in consumer research for understanding and explaining the consumer behaviour are developed to study the conscious component responsible for their decision making process while the greater part in decision making is governed by the unconscious processes, which needs to be studied and explained for better understanding of human decision making process.

The recent developments in the field of neurosciences, largely in the last decade, have enabled us with tools and techniques capable to study the unconscious processes of the human brain. The neuroscientific tools explain the consumer behaviour with greater accuracy while the consumer makes a choice to purchase a product. These tools and techniques enable the marketer to directly acquire the data from the source of its generation, i.e. the brain of an individual rather than depending upon the responses from the consumers. Scholars, in the past, have found that the expressed buying intention does not match with the actual purchase. However the predisposition to a particular brand elicited through neuro research has a very high degree of correlation with the purchase behaviour of the consumers.

These developments have led to the emergence of a new field called 'Consumer Neuroscience' or 'Neuro-Marketing'. The term 'Neuro Marketing' is a recently invented moniker (Wilson et al. 2008) and is used when neuroscientific methods are applied to investigate marketing and advertising problems. This field of research has started gaining momentum for scientific enquiry to understand consumer behaviour. It has been described as "Applying the methods of neurology lab to the question of the advertising world" [Thomson 2003 quoted in Wilson et al. (2008)]. Lee et al. (2007), taking cue from neuro economics, which describes itself as the application of neuro scientific methods to analyze and understand economically relevant behavior, define neuromarketing as the application of neuroscientific methods to analyze and understand human behavior in relation to markets and marketing exchanges. According to Plassmann et al. (2012) neuroscience is the study of the nervous system that seeks to understand the biological basis of behavior. Neuroscience research ranges from studying single cells (cellular neuroscience) to different brain areas or complex brain systems, such as the visual system (systems neuroscience).

This emerging field borrows its methodology from neuroscience, marketing, psychology, cognitive science and other allied areas. Marketing provides theoretical and managerial research problems, neuroscience sheds light on the anatomy of the human brain and its functions, and neuroscientific methods support the localization and differentiation of the inner conditions and processes. On the basis of these different disciplines, consumer neuroscience can be formally defined as the

study of the neural conditions and processes that underlie consumption, their psychological meaning, and their behavioral consequences. The importance which neuro-scientific methods would have in future can be gauged from the following words of a senior industry executive, "we can say goodbye to those endless expensive bloody research groups where consumer either lie their heads off or tell us what they think we want to hear" (Walton 2004).

The findings of the 'consumer neuroscience' over the last decade have created substantial interest among academics and professionals. Though the cost of these studies are relatively high, the researchers and the practitioners believe that neuro-imaging the benefits far outweigh the costs. The reason is that people cannot and do not fully articulate their preferences when asked to express them explicitly, and their true preferences hidden in some regions of their brains. In many of the recent studies (e.g. Falk et al. 2012) the findings from the neuroscientific studies are found to be more near to the real world results than the self-reported results of the subjects. These facts make it evident that there are some vital information hidden in the brains, which cannot be surfaced through the traditional research methods such as surveys and interviews, but could turn out to be key factors that influence the consumer's buying behavior.

Additionally, the cost of performing neuroimaging studies are expected to go down, which will persuade more and more firms to also opt for this method, which is found to be more accurate than other methods of research. With the introduction of new technologies, we can expect price reduction for products of earlier versions and older technologies. For example, a 3 T fMRI scanner, which is sufficient to perform neuromarketing studies will become obsolete in the market as fMRI scanners of 7 T are becoming the new standard in the markets, so marketers would be able to use 3 T fMRI scanners at more economical prices than before.

2 Advantages of Neuroscientific Methods in Marketing Research

Neuroscientific methods have an edge over the traditional methods of marketing research to understand and investigate the behaviour of consumers. This enhanced understanding empowers the managers to innovate and develop their products and processes which increases the consumer satisfaction leading to greater consumer loyalty. According to Shiv et al. (2005), neuro science can help by (1) providing confirmatory evidence about the existence of a phenomenon, (2) generating more fundamental (i.e., a neural-level) conceptualization and understanding of underlying processes, (3) refining existing conceptualizations of various phenomena, and (4) providing methodologies for testing new as well as existing theories.

Traditional market research methods, like focus group methodology and surveys, are fraught with systemic limitations and biases. They just measure what the customers 'say'. Researchers in the past have often found substantial variation between stated intention and actual behavior of the respondents in the survey method (Jamieson and Bass 1989). While the survey method captures the stated

intention of the respondent towards the product/service, the actual behavior might be different from the intention the respondent had towards the product or service. Currently, cognitive neuroscientific techniques offer a great opportunity to refine the marketing research methods and possibly even redefine the field of marketing through deeper understanding of consumer behavior. The array of techniques that are available to study cortical activity will help marketers understand the buying motives better.

In this section, we present the tools of neuro marketing in Table 1 and Fig. 1, which can be used in consumer studies and then discuss the most commonly used tools; Functional Magnetic Resonance Imaging (fMRI), Electroencephalography (EEG), Event Related Potential (ERP), and P300 along with their application in the marketing research. The readers would then come across the applications of 'Consumer Neuro-Science' in the area of branding, new product development and consumer shopping behaviour (retailing).

2.1 The Tools of Neuro Marketing

2.2 Functional Magnetic Resonance Imaging (fMRI)

Functional Magnetic Resonance Imaging (fMRI), by virtue of its high spatial resolution, i.e. the capability to observe deep into the brain of the consumer, has become popular in neuromarketing research in the last decade, and it combines magnetic field and radio waves, producing a signal that allows viewing brain structures in detail. The first fMRI image of the human brain was based on measurements of task-induced blood volume change assessed with intravenous bolus injection of an MRI contrast agent, a highly paramagnetic substance, into the human subject and tracking the bolus passage through the brain with consecutive, rapidly acquired images (Belliveau et al. 1991). However, the technology has evolved and the most commonly used method, these days relies on the weak magnetic interactions between the nuclear spins of water protons in tissue and blood, and the paramagnetic deoxy-hemoglobin molecule, termed BOLD (blood oxygen level-dependent) contrast, first described for the brain by Ogawa (Ogawa and Lee 1990; Wilson and Kiel 1999). The technique uses a MRI scanner to measure the blood oxygenation level-dependent (BOLD) signal. The BOLD changes are generally correlated with the underlying synaptic activity (Zurawicki 2010). When a certain brain area is active, which is due to the activities in the brain as the brain interprets the stimulus, corresponding blood vessels dilate and more blood rushes in, reducing the amount of oxygen-free hemoglobin and producing a change in the magnetic field in the active area. The output is recorded through a computer screen, which allows viewing this change, displaying colored areas overlapping the grey-scale image of the brain and refreshing the image every 2–5 s. Technology also allows 3D views of coordinates that denote certain location, making possible to investigate established areas. The presence of paramagnetic deoxy-hemoglobin, compartmentalized in red blood cells and in blood vessels, generates local magnetic

Table 1 An overview of predominant psychophysiological techniques (Adapted from Perrachione and Perrachione 2008)

Neuroscientific technique	Acronym	Physical measures	Applied measure	Temporal resolution	Spatial resolution
Neuroimaging technologies					
Magnetic resonance imaging	MRI	Change in energy state of hydrogen	Grey and white matter	Days	<1–3 mm
Functional magnetic resonance imaging	fMRI	Blood oxygenation level	Metabolic activity	Seconds	1–5 mm
Diffusion tensor imaging	DTI	Magnetic diffusion gradient of water	White matter tracts	Days	1 mm
Positron emission tomography	PET	Radioactive 2-deoxyglucose	Metabolic activity	Seconds	3–5 mm
Near infrared spectroscopy	NIRS	Blood oxygenation level	Metabolic activity	Seconds	2 cm
Computed tomography	CT	X-ray absorption	Grey and white matter	NA	<1 mm
Magnetoencephalography	MEG	Magnetic fields	Neural activity	Milliseconds	Centimetres
Electroencephalography	EEG	Electrical fields	Neural activity	Milliseconds	Centimetres
Steady state topography	SST	Electrical fields	Neural activity	Milliseconds	NA
Transcranial magnetic stimulation	TMS	NA	Accuracy and reaction time	Milliseconds	>1 cm
Other psychophysiological techniques					
Voice pitch analysis	VPA	Vocal cord vibration	"Arousal"	Fractional seconds	NA
Galvanic skin response	GSR	Electrical resistance	"Arousal"	Fractional seconds	NA
Eyetracking		Corneal reflectivity	Spatial attention	Milliseconds	NA
Facial electromyography	fEMG	Tiny electrical impulses	Facial muscle activity	Milliseconds	NA

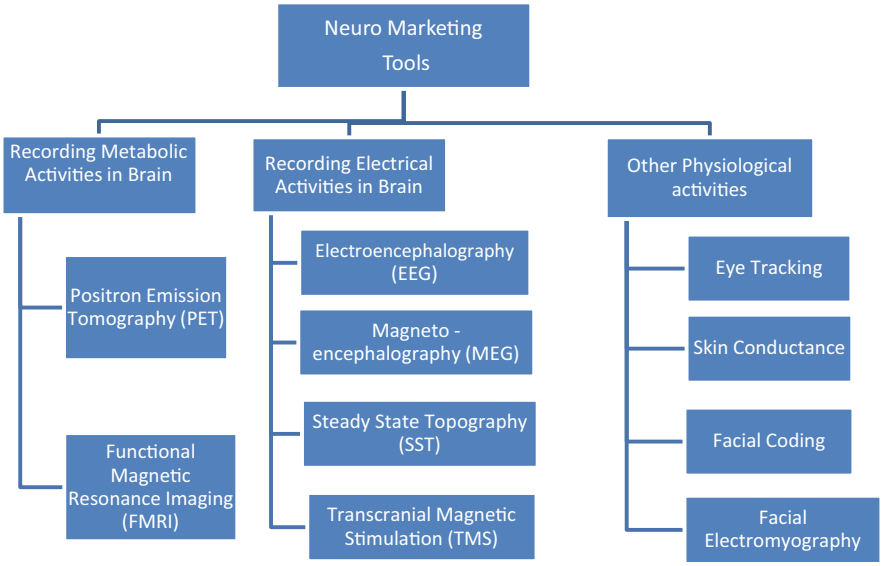


Fig. 1 Categorization of neuro marketing tools [Adapted from Bercea (2012)]

field in homogeneities surrounding these compartments which are dynamically (due to rapid diffusion) or statically averaged over the smallest volume element in the image and lead to signal loss when a delay is introduced between signal excitation and subsequent sampling (Wilson and Kiel 1999).

fMRI allows observation of deep brain structures and it is suitable for neuromarketing studies, as it allows measuring brain activity while subjects perform certain tasks or experience marketing stimuli, searching for patterns. Reimann et al. (2011), discusses following four distinct methodological advantages of neuroimaging, particularly fMRI; first, fMRI permits interpretation of psychological processes in the brain as they are taking place; second, fMRI enables measurement of non-conscious conditions and processes; third, fMRI allows localization and differentiation of constructs that subjectively may seem similar but which are actually processed differently; and fourth, fMRI makes feasible measurement of the simultaneous activation of two antithetical conditions and processes.

As Zurawicki (2010) states, future advances in allowing the fMRI scanner to be used standing up or sitting down would reduce the stress in subjects (as now they have to lie down). Hopefully, advances in technology will allow also improving spatial (1–2 mm for the moment) and temporal resolution (2–5 s for the moment). One of the disadvantages is that the method is very expensive. Restrictions include that the subject must remain still during the procedure and avoid head movement as much as possible.

The first commercial experiment done using fMRI, was on a group of people who drank Coca Cola or Pepsi while their brains were scanned using fMRI. This

experiment was done in 2003 and was called "Pepsi paradox". In this study reported in McClure et al. (2004), the participants were required to taste Coca Cola and Pepsi and then decide which one tastes better. The neuronal activities of the participants were being watched through fMRI while they were making a decision to choose between both of the drinks. Interestingly, when the participants were not aware of the brand of drink what they are drinking, about half of the participants preferred Pepsi while after disclosure of the identity of the brand, three fourth of the participants preferred Coca Cola over Pepsi. According to the study, when people knew that they consumed Coca Cola, they said they prefer Coca Cola over Pepsi and their frontal lobe was activated, an area that coordinates attention, controls short-term memory and directs thinking—especially planning. However, when they did not know the brand used, they have reported that they prefer Pepsi, and the limbic system structure was activated, which is responsible for emotional and instinctual behaviour. The findings revealed that people were more emotionally engaged with Coca Cola rather than Pepsi.

2.3 Electroencephalography (EEG)

Electroencephalography (EEG), as it is cost effective, is one of the most used tools in neuromarketing research, after fMRI. EEG uses electrodes applied to the scalp and measures changes in the electrical field in the brain region underneath. It captures variations in brainwaves, and the amplitudes of the recorded brainwaves correspond to certain mental states, such as wakefulness (beta waves), relaxation (alpha waves), calmness (theta waves) and sleep (delta waves). EEG has very high temporal resolution (milliseconds) and can therefore detect brief neuronal events. The greater the number of electrodes, the better the spatial resolution of the instrument. Apart from the low spatial resolution, EEG has poor sensitivity for deep brain structures as the skull disperses the electrical field; EEG has low spatial resolution (~1 cm) that depends on the number of electrodes used in the equipment. The number of electrodes can be as few as two or range up to hundreds in high-density arrays.

EEG is now also available as portable device and can be used to record brain activity in many circumstances, as for example in supermarkets, where the real time brain activity of consumer can be recorded, while he/she makes a choice to purchase the product. EEG measures electric product of the brain activity, when brain undergoes any stimulus. These stimuli are the events, such as advertisements, which are required to make an impact on observer's memory for a purchase to happen.

2.4 Event Related Potentials (ERP)

Event Related Potentials (ERP) are very small voltages generated in the brain structures in response to specific events or stimuli. They are EEG changes that

are time locked to sensory, motor or cognitive events that provide safe and non-invasive approach to study psychophysiological correlates of mental processes. ERPs can be elicited by a wide variety of sensory, cognitive or motor events. ERPs have been used for a long time particularly in the study of language processing, providing potentially interesting avenues for studying consumer behavior (Shiv et al. 2005). They are thought to reflect the summed activity of postsynaptic potentials produced when a large number of similarly oriented cortical pyramidal neurons (in the order of thousands or millions) fire in synchrony while processing information (Peterson et al. 1995). The ERP recorded by placing electrodes on the scalp overlying the cerebral cortex is known as event related cortical potential. The major advantages of ERP methods lie in the high temporal resolutions they afford and their relatively low cost.

2.5 P300

The P300 (also known as P3) wave was discovered by Sutton et al. in 1965 and since then has been the major component of research in the field of ERP.

P300 is a positive potential with peak latency between 300 and 1,000 ms providing a great deal of information about the neural activity of fundamental cognitive operations, taking place in the brain of an individual while he/she is performing a cognitive task (Ma et al. 2008). Increased P300 amplitudes have been associated with greater neural recruitment during stimulus categorization and evaluation, and subsequently remembered stimuli have been found to elicit greater P300 amplitudes during encoding than subsequently forgotten stimuli, Its amplitude reflects the allocation of attention resources (Deldin et al. 2009) and its peak latency reflects the stimulus classification time (Kutas et al. 1977; Ma et al. 2008). A wide variety of paradigms have been used to elicit the P300 of which the 'Oddball Paradigm' is the most utilized.

Under the 'Oddball Paradigm', two different stimuli are presented in a series such that one of them occurs relatively infrequently—that is the oddball. The subject is instructed to respond to the infrequent or target stimulus and not to the frequently presented or standard stimulus. Majority of studies have employed auditory stimuli to elicit the P3 wave as it is easy to produce, readily captures the subject's attention and produces least artifact.

2.6 P300 and Consumer Behavior

Scholars of marketing and neuroscience have identified P300 wave to provide immense information about the neural activity of fundamental cognitive operations, especially the activity of updating the working memory (Donchin and Coles 1988) and orienting response (Semlitsch et al. 1986). Its amplitude reflects the allocation of attention resources (Humphrey and Kramer 1994) and its peak latency reflects the stimulus classification time (Kutas et al. 1977; Magliero et al. 1984).

The identification of cognitive processes such as updating working memory, orienting response, allocation of attention resources and stimulus classification time have immense usage and importance in marketing and advertising domain. These cognitive processes are collectively responsible for making an impact on the human brain, when an individual decides to make a purchase after viewing the advertisement. ERP and EEG have been used to explore reactions to TV advertisements in a number of ways in the recent past. Ma et al. (2008), found the relationship between P300 and consumers intend towards brand extension and deduced that the companies could potentially use the P300 in marketing researches as an endogenous neural indicator for measuring consumers' attitude towards intended brand extension. Their study also suggested that P300 should be a physiological marker of how the brain processes the categorization of extension products in accordance with the attributes of original brand. Ma et al. (2008) argue that the categorization processing may be one of two processes: If the consumers feel similarity between original brand attribute and extension product, they transfer their perception of original brand to the new product. Or if the consumers do not find the categorical similarity, they look for abstract and scattered similarity of attributes to integrate the beliefs to extension product.

This concept is equally valid for all advertising research, where the consumer try to find a link between the advertisement and the product for example the cause related advertisements, public social advertisements, celebrity advertisements, etc. which try to form a connect between the functional message and the non-functional message of the advertisement for enhancing the impact or recall of the brand or the message in the advertisement. Hence it can be argued that measurement of P300 can be used to infer the connection between the perceived attributes of the product/brand and the advertisement. i.e. the higher perceived similarity of their attributes is, the larger the amplitude of the P300 and the product will attract more neural resources to retrieve the attributes from the memory system. Without doubt, it can promote the consumer to build more associations between the product/brand and the advertisement which will facilitate the purchase of that product.

3 Advantages of ERP

ERP constitute a millisecond-by-millisecond record of neural information processing that occurs between presentation of a discrete stimulus and the production of the motor response. This level of temporal resolution is vastly greater than other functional neuroimaging techniques. By comparison, the temporal resolution of fMRI or Positron Emission Tomography (PET) is on the order of seconds to tens of seconds. ERPs are therefore regarded as an excellent complementary technique to measures such as fMRI, which has exquisite spatial resolution. The spatial resolution of the ERP is difficult to establish but is maybe as much as an order magnitude more than fMRI. The instrumentation is potentially portable so studies can be obtained in a variety of settings. Moreover, while fMRI cannot be performed on some individuals (e.g., if they have implanted metal

devices, or fear enclosed spaces), the ERP technique is generally well tolerated and subject to fewer constraints.

4 Consumer Neuroscience Enabled Innovations in Marketing

As we have seen, Consumer Neuroscience, is about the use of neurology to gain insight in consumer behavior by applying neuroscientific methods to relevant marketing problems. Marketing community has seen an arguably more rigorous, relevant, and scientific approach to the study of marketing questions (Senior and Lee 2008). Neuromarketing studies obtain objective information about the inner workings of the brains of consumers. In the following section, we explore some of the areas where Consumer Neuroscience has been used successfully to create innovative, value adding propositions for the products and their respective brands. We also provide a peek into the future value additions promised by this field in creating values for the internal and external stakeholders.

4.1 Aesthetic Consumption

Recently, consumer scholars have argued that as commercial influences on popular culture increase, aesthetic images make their way into everyday consumption (Venkatesh and Meamber 2008). This is largely because the buying behavior of consumers has been shown to depend a lot on the appearance. The 'look' of products has been found to have a great influence in the buying process of the consumer. Mazzalovo (2012) notes that the world of consumption has become dramatically 'aesthetized' since the 1980s and 1990s and brands are now paying much more attention to the aesthetic treatments of their products and their communication in general. To assert the managerial importance of product and brand aesthetics, Parment (2014, p. 33) says, "Aesthetic offerings—products and brands—are now the key to competitive advantage and commercial success, so companies have to infuse meaning into their products and transform commodities such as cars into concepts and lifestyle".

Venkatesh and Meamber (2008) define aesthetic consumption as those aspects of sensory experiences that are made manifest in the consumption of everyday objects that are presumed to have aesthetic qualities, as well as those experiences relating to art and art-like objects and artistic events. In the context of brand aesthetics Mazzalovo (2012) defines brand aesthetics as: "The aesthetics of a brand is composed of stable and specific elements that characterize its approach to the sensory world; that is to everything that can be perceived by the senses: not only aspects related to vision (shapes, colours, textures, light treatments and so on) but also to sound (music, the noise of engine, a door slamming and so on), odour taste and touch. These are therefore the specific (or proprietary) sensory treatments applied to all brand manifestation".

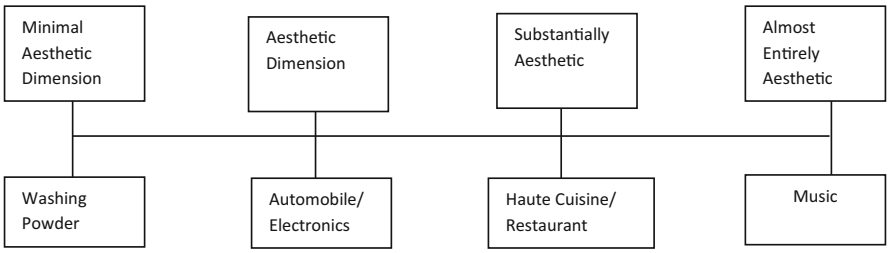


Fig. 2 The range of aesthetics in consumer goods [Adapted from Charters (2006)]

As visualized by Charters (2006), aesthetics has an influence on most consumer goods and services, Fig. 2 visualises the aesthetic dimension of products as a continuum.

The importance of understanding the consumption aesthetics lies in the financial implications it carries for the development of the respective industry, for e.g. the trade revenue generated by an almost entirely aesthetic product like music for the global recorded music industry was around US$15 billion, in addition to US$1 billion generated by the subscription and streaming services during the year 2013 (Ifpi 2014). Parment (2014), talking about aesthetics in the automobile industry, mentions BMW as the first auto brand which had developed a strong corporate identity based on process that included showrooms, workshop fronts, and other visual expressions of the BMW brand worldwide. This added to the consistent product design that has characterized BMW over the years. For a substantially aesthetic product like a restaurant, Krishna (2013) cites an example of the restaurant EI Bulli in Spain, which has been a pioneer in the field of molecular gastronomy, a discipline that seeks to enhance the sensory experience of eating food by focussing on the chemical properties of the food. The unique sensory involvement experienced by the consumers provide the competitive advantage to the restaurant as it is very difficult to replicate the texture, the feel, and the creaminess provided by EI Bulli. Also, in the case of products with relatively lower aesthetical dimension, such as electronics, Kusume and Gridley (2013) quote the example of Dyson, which changed the whole category of vacuum cleaner by using a unique, iconic design to articulate the significance of its product. Dyson's product design complements the functional experience provided by its cyclone technology—by using a transparent cover and then manifest the experience—the highest vacuuming power—with jet engine details, which provides a holistic aesthetic experience to the consumers creating a product differentiation (from the competitors) for the company.

Krishna (2013) refers to casinos as a perfect example of an environment that is carefully controlled to stimulate every one of the consumers' senses. Krishna (2013) quotes, "The longer people play, the more money the house makes, so it's no wonder that casinos have worked very hard to perfect the sights, sounds, scents, tastes, and feelings their patrons encounter". The casinos take care of all the information flowing to the brain through each of the senses of their consumers so as activate the reward centres of the brain of their consumers and provide them a

feel of pleasure as long as they spend their time in their environment. casinos have now established their unique signature for all of the senses. Each of the successful casinos has its own visual, auditory, smell and haptic signatures which provide a unique experience to their visitors and motivate the visitors to spend more time in their environment and consequently spend more money in the casino. As Krishna (2013) mentions, "The only mystery lies in discerning the specific effects of each cue". The neuroscientific methods discussed earlier in this chapter can enable the managers to understand in depth the impact of each of the cues on their visitors which would lead to innovation not only for a particular house of casino but for the complete casino industry and would go a long way to promote tourism industry as well.

In the previous paragraphs, we discussed the role of aesthetics in the process of consumption of goods or services by the consumers. As already discussed, the aesthetic properties of the product play a great role in influencing the consumer to buy those over the competitor's product. This makes it plausible for the marketer to design aesthetically appreciable products which are able to evoke pleasant emotions in the brain of the consumer. The marketer needs to focus on providing a pleasurable experience to the consumers. Even those sensations that are not intrinsically pleasurable becomes pleasurable by association and activates the same area of brain that is activated by the originally pleasurable sensation (Chatterjee 2013). Marketers can leverage this in creating products and services which would be better appreciated by the consumers. The neuroscientific methods, discussed previously in this chapter, enable the managers to understand the aesthetic dimensions of their respective products and brands. The nascent field which deals with understanding brain and aesthetics is referred as neuro-aesthetics. Detailed discussion of neuro-aesthetics is beyond the scope of this text, the interested readers can refer to Chatterjee (2013) for elaborated discussion.

4.2 Branding

Brands are now ubiquitous in the consumers' environment. It is believed that an individual comes across more than 3,000 brands every day which makes it impossible for the consumer to retain the brand name and recall it while purchasing the product. It has now become a challenge for the consumer companies to register their brand names in the minds of the consumers. Though, in the midst of cut throat competition, brands like Apple, Harry Potter etc. have been able to create a niche for themselves and the customers are ready to stand in the queue whole night braving the chilly weather to grab their new products/editions.

Consumer decisions are largely influenced by prior experiences via memory. Memory is an active constructive process where information is acquired, stored, and then retrieved for use in decision-making (Ratnayake et al. 2010). Noel (2006), in his research found that, the greater the memory of a brand name, the greater the likelihood that the brand enters into the consideration set of the consumer hence an increased probability of purchase of the brand. Consumers evaluate a product based

on the information, they are able to retrieve from their memory which were previously encoded through their experience in their lives, through products' advertisements, word of mouth, etc., hence depending on how brand memories are stored and retrieved in consumers' minds, it affects consumers' subsequent decision processes.

Managerially, 'consumer neuroscience' could result in a tangible impact on the way brands are conceptualized, built, nurtured and marketed, benefiting marketing practice. In their research on branding using fMRI, Ratnayake et al. (2010) find the following three ways in which 'consumer neuroscience' can help brand managers: First, it helps in understanding the consumer learning process as a series of highly accessible personal memories about a brand's usage situations, which may be relevant in managing brand communication strategies effectively. Understanding the context for recollecting and processing brand information may have potential value in designing advertising strategies cueing consumer personal experiences. Second, an understanding of the evolution of consumers' relationship with the brand may enhance the effectiveness of a new product concept or advertising execution testing, supporting the development of brand positioning strategies (i.e. hedonic vs. utilitarian positioning), selecting the target consumer segment, finding most suitable pricing strategy that marketing has the power to leverage in building brand commitment. Third, the use of fMRI in addition to the traditional research techniques can help marketers to create better and more competitive products, design more effective services, and focus on marketing campaigns that enhance the communication process as this knowledge can lead to development of more aesthetically pleasing designs.

4.3 New Product Development

It is a commonly known fact that a substantial percentage of new products fails. According to Schneider and Hall (2011), about 75 % of consumer packaged goods and retail products fail to earn even $7.5 million during their first year. This is especially critical in heavy industries like automobiles which require huge investments in their production lines and processes before the new product actually gets launched in the market. Developing prototypes for product testing and test marketing also cost a lot of money. The applications of 'consumer neuroscience' methods can be of immense benefit in new product development domain where neuromarketing can be reliably employed for design of the product/service, packaging and branding. Survey research and other traditional methods can be used for validation of the findings from neuro research.

The applications of 'consumer neuroscience' methods in the initial phases of new product development would save lot of time and resources of the company and the final product would more efficiently satisfy the needs and wants of the consumer, who himself/herself may not be able to articulate his/her need in the initial phases of the new product development.

As conceptualized by Ariely and Berns (2010), inputs from fMRI or EEG/ERP can be used in the design phase of new product development. It is expected that neuroimaging data would give a more accurate indication of the underlying preferences than data from standard market research studies and would remain insensitive to the types of biases that are often a hallmark of subjective approaches to valuations. The neural level data, which would provide better understanding of consumers processes in the brain, while evaluating the products and decision making processes to purchase the product, would lead to rapid testing of product concepts, and those that are not promising eliminated early in the process. This would allow more efficient allocation of resources to develop a few promising products, and drop others in the initial phases of developmental phase itself, saving the resources, which otherwise would have been wasted, and can now be used for the value addition of the product, making the whole process more efficient than before. The neuroscientific methods can also provide inputs at other stages in the process of new product development such as developing the most impactful advertisements of the products newly developed, by communicating the features of the product and hence maximizing the sales of the product (Fig. 3).

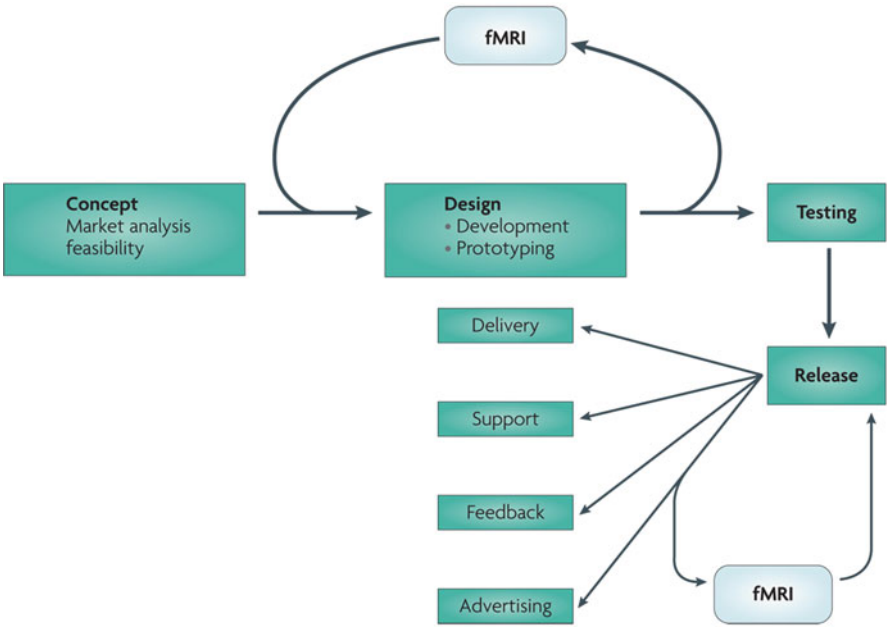


Fig. 3 Application of neuro marketing in new product development (*Source* Ariely and Berns 2010)

4.4 Consumer Shopping Behavior (Retail)

Shopping, as also described by Genco et al. (2013) in their book "Neuromarketing for Dummies" is a multisensory experience for the consumer. All of the five senses of the consumers play an important role in decision making of the consumer. Sight is critically important to the shoppers in the retail store as 'vision' plays a major role (around one third) in consumers' decision making. The store layout, product placement, packaging, signage, color and other visual cues can be used to attract consumers' attentions, prime their behavior towards certain product, etc.. For e.g. a picture displaying a photo of a malnourished child on the package of product or near the aisle where the targeted product is placed would prime the consumer to buy the product which has association with charity and corporate social responsibility in the area of child development or the consumer would be willing to pay more for goods certified as manufactured by 'child free labor'. Smell is another essential sense in humans. The sensory receptors of the nose are directly connected to the limbic area of the brain, which host the memory and the emotions. Retailers use this in their favor by diffusing the scent of their choice in their store's environment. A major retailer in US experience growth of 10–25 % in sales by diffusing the scent of mint via automated devices every time someone approached them (Georges et al. 2013). Touch is an important sensory input in consumer decision making particularly for products which come in contact with the body such as apparels, mobile phones, handbags, wallets, bed sheets, seat covers, etc.. Women are known to have ten times more tactile sensors directly connected to the brain than men. Georges et al. (2013), talks of a European female lingerie brand, Princesse Tam Tam which is reorganizing the texture of its fitting room to provide its customer with a pleasant sensory space.

Taste is important with products which are ingested such as food and beverages. Taste releases chemical substance in the brain which influences the consumers' decision making. Tooth paste companies are known to have patented the taste of their toothpaste to have unique taste of their product and persuade consumers to repurchase their product. Sound also plays a great role in priming the consumer behavior. Previous researchers have found that slow music in the restaurant leads the consumer to spend more time and hence eat more while the fast music in the restaurant leads the consumer to quickly leave the seat leading to fewer sales. Georges et al. (2013) mention that brands like Abercrombie and Fitch as well as Sephora and Nespresso focus on selected ingredients to catch the attention of all five senses, with a view to dramatizing their stores and creating a genuine sensory experience for the visitors.

The recent technological innovations in the area of 'consumer neuroscience' have provided mobile EEG and eye tracking equipment which can be used to gather much information on the consumer behavior in the shopping mall. The consumer can be asked to wear integrated portable EEG cap and portable eye tracking glasses and roam around in the store or make usual shopping while the devices would be transmitting data electronically to the server which would provide a detailed analysis of millisecond by millisecond neural activities.

Bagdziunaite et al. (2014) give the following three managerial advantages of applying these 'consumer neuroscience' techniques: First, the effect on store entry communications and ads on in-store behavior allowing the quantification of both the actual exposure to store entry materials, as well as their effects on in-store behaviors; Second, the long-term effects of advertising on in-store behavior, i.e., whether a particular campaign period alters in-store responses and behavior; and third, the effects of in-store advertising (e.g., sales signs) on actual purchase behaviour. Basically the neuroscience can help retailers improve the store experience and also study the impact of in-store promotions and also the ad effectiveness.

5 Conclusions

Advances and innovations in neuroimaging over the past three decades have transformed human neuroscience. The ability to observe localized brain activity in living human beings has opened the door to tremendous scientific progress, its recent application to understand human behavioral aspect and decision making process has provided tremendous opportunities for the marketers to borrow from neuroscience to provide better products to their consumers. In the last decade, much has been studied about human cognition and emotion, but we still are at the tip of the iceberg and there is much more to be explored, however, like other sciences, applications of neuroscience in business research is not without criticism and concerns over ethics of the applications of the neuroscience in business. Neuromarketing, is still in its nascent stages and needs constructive criticisms to grow and bring itself into mainstream marketing research. Though, the early researchers created hype in this area by claiming to have found a "Buy Button" in the consumer's brain, we now know that there is no such button which can be pressed to create 'Zombie Consumers'. However the 'consumer neuroscience' or 'neuromarketing' has evolved into a rigorous scientific area of study, enhancing the marketers' understanding of the sensory and intangible aspects to serve their customers better.

Efficiency in the management processes, derived from neuroscientific methods will allow the marketer to understand the neural level processes in decision making and preferences of the brain, which will in turn allow producing products largely aligned with the needs of the consumers, saving on the product failure and product rejection costs, making the resources available for companies to innovate and serve the need of communities in a better manner.

'Consumer neuroscience' can be applied to develop innovative products for the bottom of pyramid (BOP) consumers in the emerging economies. This consumer segments represent approximately 4 billion people of the world with a per capita income of less than $2 per day or less than $1,500 annual per capita income (Prahalad and Hart 2002). This consumer segment together constitutes US$5 trillion consumer market, their aggregate purchasing power suggests significant opportunities for market-based approaches to better understand and meet their needs. This area is currently neglected by the 'consumer neuroscientists' probably

due to the initial high costs required in investments or unavailability of experts in these markets. However, applications in these areas have the potential to understand these consumers better than other traditional methods, as these consumers have low awareness about the products, education, etc. which makes it difficult for the traditional research methods to understand the needs of BOP consumers. The scale of the BOP consumer would in future make it feasible for the marketer to apply principles of neuromanagement to understand the BOP consumers and develop products and services according to their need.

References

Ariely, D., & Berns, G. S. (2010). Neuromarketing: The hope and hype of neuroimaging in business. *Nature Reviews Neuroscience, 11*(4), 284–292.

Bagdziunaite, D., Nassri, K., Clement, J., & Ramsøy, T. Z. (2014). *An added value of neuroscientific tools to understand consumers' in-store behaviour*. In Proceedings of European marketing academy conference (EMAC), 2014.

Belliveau, J. W., Kennedy, D. N., McKinstry, R. C., Buchbinder, B. R., Weisskoff, R. M., Cohen, M. S., et al. (1991). Functional mapping of the human visual cortex by magnetic resonance imaging. *Science, 254*(5032), 716–719.

Bercea, M. D. (2012). *Anatomy of methodologies for measuring consumer behavior in neuromarketing research*. Available at http://www.lcbronline.com/index_files/proceedingsemc12/12emc023.pdf. Retrieved on November 10, 2013.

Charters, S. (2006). Aesthetic products and aesthetic consumption: A review. *Consumption, Markets and Culture, 9*(3), 235–255.

Chatterjee, A. (2013). *The aesthetic brain: How we evolved to desire beauty and enjoy art*. Oxford: Oxford University Press.

Deldin, P. J., Naidu, S. K., Shestyuk, A. Y., & Casas, B. R. (2009). The learning-oddball paradigm: Data of 24 separate individuals illustrate its potential usefulness as a new clinical tool. *Cognition and Emotion, 23*(5), 1002–1020.

Donchin, E., & Coles, M. G. (1988). Is the P300 component a manifestation of context updating? *Behavioral and Brain Sciences, 11*(3), 357–374.

Falk, E. B., Berkman, E. T., & Lieberman, M. D. (2012). Effects from neural responses to population behavior: Neural focus group predicts population-level media. *Psychological Science, 23*(5), 439–445.

Genco, S. J., Pohlmann, A. P., & Steidl, P. (2013). *Neuromarketing for dummies*. Mississauga, ON: Wiley.

Georges, M. P., Tourtoulou, A. S., & Badoc, M. (2013). *Neuromarketing in action: How to talk and sell to the brain*. London: Kogan Page.

Humphrey, D. G., & Kramer, A. F. (1994). Toward a psychophysiological assessment of dynamic changes in mental workload. *Human Factors, 36*(1), 3–26.

Ifpi. (2014). *An industry of growing digital revenues and multiple income streams internationally*. Available at http://www.ifpi.org/facts-and-stats.php. Retrieved on May 1, 2014.

Jamieson, L. F., & Bass, F. M. (1989). Adjusting stated intention measures to predict trial purchase of new products: A comparison of models and methods. *Journal of Marketing Research, 26*(3), 336–345.

Krishna, A. (2013). *Customer sense: How the 5 senses influence buying behavior*. New York, NY: Palgrave Macmillan.

Kusume, Y., & Gridley, N. (2013). *Brand romance: Using the power of high design to build a lifelong relationship with your audience*. Basingstoke: Palgrave Macmillan.

Kutas, M., McCarthy, G., & Donchin, E. (1977). Augmenting mental chronometry: The P300 as a measure of stimulus evaluation time. *Science, 197*(4305), 792–795.

Lee, N., Broderick, A. J., & Chamberlain, L. (2007). What is 'neuromarketing'? A discussion and agenda for future research. *International Journal of Psychophysiology, 63*(2), 199–204.

Ma, Q., Wang, X., Shu, L., & Dai, S. (2008). P300 and categorization in brand extension. *Neuroscience Letters, 431*(1), 57–61.

Magliero, A., Bashore, T. R., Coles, M. G. H., & Donchin, E. (1984). On the dependence of P300 latency on stimulus evaluation processes. *Psychophysiology, 21*(2), 171–186.

Mazzalovo, G. (2012). *Brand aesthetics*. Basingstoke: Palgrave Macmillan.

McClure, S. M., Li, J., Tomlin, D., Cypert, K. S., Montague, L. M., & Montague, P. R. (2004). Neural correlates of behavioral preference for culturally familiar drinks. *Neuron, 44*(2), 379–387.

Noel, H. (2006). The spacing effect: Enhancing memory for repeated marketing stimuli. *Journal of Consumer Psychology, 16*(3), 306–332.

Ogawa, S., & Lee, T. M. (1990). Magnetic resonance imaging of blood vessels at high fields: In vivo and in vitro measurements and image simulation. *Magnetic Resonance in Medicine, 16* (1), 9–18.

Parment, A. (2014). *Auto brand: Building successful car brands for the future*. London: Kogan Page.

Perrachione, T. K., & Perrachione, J. R. (2008). Brains and brands: Developing mutually informative research in neuroscience and marketing. *Journal of Consumer Behaviour, 7*(4–5), 303–318.

Peterson, N. N., Schroeder, C. E., & Arezzo, J. C. (1995). Neural generators of early cortical somatosensory evoked potentials in the awake monkey. *Electroencephalography and Clinical Neurophysiology/Evoked Potentials Section, 96*(3), 248–260.

Plassmann, H., Ramsøy, T. Z., & Milosavljevic, M. (2012). Branding the brain: A critical review and outlook. *Journal of Consumer Psychology, 22*(1), 18–36.

Prahalad, C. K., & Hart, S. L. (2002). The fortune at the bottom of the pyramid. *Strategy + Business, 26*, 54–67.

Ratnayake, N., Broderick, A. J., & Mitchell, R. L. (2010). A neurocognitive approach to brand memory. *Journal of Marketing Management, 26*(13–14), 1295–1318.

Reimann, M., Schilke, O., Weber, B., Neuhaus, C., & Zaichkowsky, J. (2011). Functional magnetic resonance imaging in consumer research: A review and application. *Psychology & Marketing, 28*(6), 608–637.

Schneider, J., & Hall, J. (2011). Why most product launches fail. *Harvard Business Review, 89*(4), 21–23.

Semlitsch, H. V., Anderer, P., Schuster, P., & Presslich, O. (1986). A solution for reliable and valid reduction of ocular artifacts, applied to the P300 ERP. *Psychophysiology, 23*(6), 695–703.

Senior, C., & Lee, N. J. (2008). A manifesto for neuromarketing science. *Journal of Consumer Behavior, 7*(4/5), 263–271.

Shiv, B., Bechara, A., Levin, I., Alba, J. W., Bettman, J. R., Dube, L., et al. (2005). Decision neuroscience. *Marketing Letters, 16*(3–4), 375–386.

Venkatesh, A., & Meamber, L. A. (2008). The aesthetics of consumption and the consumer as an aesthetic subject. *Consumption, Markets and Culture, 11*(1), 45–70.

Walton, C. (2004, November 19). The brave new world of neuromarketing is here. *B&T (Australia)*, p. 22.

Wilson, R., Gaines, J., & Hill, R. P. (2008). Neuromarketing and consumer free will. *Journal of Consumer Affairs, 42*(3), 389–410.

Wilson, R. A., & Kiel, F. C. (1999). *The MIT encyclopedia of the cognitive sciences*. London: The MIT Press.

Zurawicki, L. (2010). *Neuromarketing, exploring the brain of the consumer*. Berlin: Springer.

Social Cognitive Theory and the Technology Acceptance Model in the Cloud Computing Context: The Role of Social Networks, Privacy Concerns and Behavioural Advertising

Vanessa Ratten

Abstract

Cloud computing is one of the major innovation advances in information technology. In order for more consumers to adopt cloud computing as a technological innovation there needs to be a better understanding of the issues involved in consumer adoption processes. Whilst there is an increasing amount of interest in cloud computing as a technological innovation there is an important need to examine the reasons why consumers adopt cloud computing. In this paper, the technology acceptance model and social cognitive theory are identified as the theoretical frameworks to understand the consumer adoption process of cloud computing. A set of research hypotheses are stated from both theoretical frameworks to test their relationship with a consumer's intention to adopt cloud computing as a technological innovation. These hypotheses focus on perceived usefulness, perceived ease of use, online behavioural advertising knowledge, social networks and online privacy concerns. The findings of the study outline the different areas of technological innovation research that are needed in order to advance the information technology industry in the future. The findings suggest that perceived ease of use, perceived usefulness and online privacy concerns can determine a consumer's intention to adopt cloud computing but online behavioural advertising knowledge and social networks differ amongst consumers in different countries. Finally, some of the key issues influencing consumer adoption of cloud computing are outlined, which due to the emerging nature of this technological innovation will influence the regulation and marketing of cloud computing services by firms and governments in the technology sector.

V. Ratten (✉)
La Trobe Business School, La Trobe University, Melbourne, VIC, Australia
e-mail: v.ratten@latrobe.edu.au

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_4

1 Introduction

Mobile technology has rapidly emerged as one of the most popular innovations due to its usefulness and ease of use by consumers (Smit et al. 2014). Cloud computing is a mobile technology that has given consumers access to multiple information services in a convenient format (Marston et al. 2011). This has enabled consumers to access information from any geographic, time and computing device (Stein et al. 2013). Cloud computing provides consumers with flexibility as they acquire technology infrastructure, which was previously expensive to acquire (Bradshaw et al. 2011). A major benefit of cloud computing for consumers is that they can access on demand different types of technology via their mobile technology device.

Cloud computing has changed the way consumers access information services as they are maintained and updated as technology can be configured on demand (Marston et al. 2011). The information available on demand has been further expanded so that it is constantly being generated and converged based on consumer tastes and preferences (Karakas and Manisaligil 2012). Consumers are increasingly adopting cloud computing as a technological innovation as it enables them to access multiple technology services that is made possible by more flexible deployment of information infrastructure (Vouk 2008).

A broad definition of cloud computing is the use of remote servers over the internet in order to provide consumers with on-demand access to software, hardware and technology infrastructure (Stein et al. 2013). Consumers can use cloud computing for a variety of applications and platforms depending on need and resource requirements. Cloud computing is a form of utility and platform computing that has increased in popularity due to more consumers wanting interactive technology applications (Marston et al. 2011).

There has been a general trend with technology innovation towards better efficiency and agility for consumers (Hameed et al. 2012). Consumers want better efficiency so that software and hardware resources can respond to user requirements with minimal interaction with the service provider. As more consumers have multiple technology devices, agility is important in order to encourage more widespread usage of technology in different geographic areas.

The main interest of this paper is on consumer adoption of cloud computing services. Much research on consumer's adoption of technology innovations is based on the technology acceptance model (Shen et al. 2010). This paper suggests that there is a need for an additional theoretical framework to understand innovation adoption behaviour. Social cognitive theory is employed in this paper to complement the technology acceptance model in order to study consumer adoption of cloud computing services. The motivation for this paper is to show the need for further investigation of an emerging technology in the form of cloud computing services. When both the technology acceptance model and social cognitive theory are taken into account, it should be able to better reveal a more complete picture of technology innovation adoption behaviour. The next section will discuss the literature on innovation, followed by a discussion of the research hypotheses from this study.

2 Literature Review

Innovations are ideas, products, programs, services or technology that are new to consumers (Hameed et al. 2012). Technological innovations focus more on computer hardware or software applications that help consumers with activities and decision making processes (Thong and Yap 1995). In the technological innovation literature, the two major approaches to adoption behaviour are the factor and process approach (Raza and Standing 2010). The factor approach involves examining the patterns of innovation. The process approach looks at how individuals evaluate and implement an innovation and is the approach adopted in this paper. The process of adopting an innovation involves the stages of initiation, decision and implementation (Gallivan 2001). The initiation or pre-adoption stage involves a consumer recognising the value of an innovation by acquiring knowledge about its usefulness (Rogers 1995).

Once consumers have deployed resources to learning about the innovation then they decide to acquire knowledge about the innovation (Fichman 2001). Consumers will then implement the innovation based on their acceptance of the innovation (Rai et al. 2009). The post adoption stage includes developing and generating new activities based on the innovation's usefulness (Damanpour 1991). The last stage of the adoption process helps in evaluating the acceptance of the technology with consumers.

The technology acceptance model suggests that consumer's adoption of technology services is determined by the perceived ease of use and perceived usefulness (Shen et al. 2010). The technology acceptance model was initially based on Davis et al. (1989) work on computer adoption but has been widened to include the technology innovations including smart phones and multimedia messaging services. The technology acceptance model is a strong theoretical model used to explain consumer technology adoption behaviour (Shen et al. 2010).

The technology acceptance model is considered the most common theory for understanding electronic commerce and technological innovations (Tong 2010). The technology acceptance model was developed in the United States, which means its use in other geographic locations needs to be validated (Tong 2010). The technology acceptance model was based on social psychology theories to propose that there is a causal relationship between belief, attitude and intention (Venkatesh and Davis 2000).

Prior research has found that the technology acceptance model is a robust framework for explaining consumer adoption of technology in various contexts (Chen and Chang 2013). Recent uses of the technology acceptance model framework suggest that utilitarian considerations affect consumer intentions to use a technology (Revels et al. 2010). The technology acceptance model provides a useful foundation for researching consumer acceptance of innovative technology services (Yousafzai et al. 2010). This is due to the electronic behaviour of consumers in an innovative context that is utilized in more complex technology service environments (Wang and Lin 2012). The technology acceptance model has been expanded to include more innovative characteristics that influence a consumer's adoption decisions (Kulviwat et al. 2007).

Whilst the usage of the technology acceptance model is widespread, it has been criticized for not taking into account more cognitive approaches to consumer behaviour decisions (Gao et al. 2012). This leads to some researchers suggesting that the technology acceptance model does not take into account multiple stakeholder perspectives in the environment that affect consumer decisions (Raza and Standing 2010). There is a need for social cognitive theory to be used in conjunction with the technology acceptance model as there are some features of cloud computing that consumers have yet to experience. A synthesis of the technology acceptance model with social cognitive theory is a good direction to pursue for the understanding of consumers intention to adopt cloud computing services.

Social cognitive theory is a framework that incorporates environmental factors affecting consumer behaviour (Bandura 1986). Social cognitive theory is a learning model as it focuses on how individuals change their behaviour based on different environmental variables (Pincus 2004). Behaviour is a complex process that is dependent on current and future goals. The behaviour of individuals is a result of environmental changes and this can help predict adoption of technological innovations (Ratten 2009). The key focus of social cognitive theory in the innovation realm is on how individual ability and skills form part of behavioural changes that affect adoption rates (Compeau et al. 1999). As much behaviour is based on learning via social dimensions, social cognitive theory has become more popular in studies on technology innovation (Compeau et al. 1999). The next section will discuss the research hypotheses, which are derived from both the technology acceptance model and social cognitive theory.

3 Research Hypotheses

3.1 Perceived Usefulness

Perceived usefulness is defined as the degree a person believes that using a new technology enhances their performance (Tong 2010). Perceived usefulness in the electronic commerce context refers to whether technological innovations are useful in the internet arena (Tong 2010). Perceived usefulness is the main determinant in the use of new technologies and measures the level of belief an individual thinks using a technology will help them complete a task (Pagani 2004). In the innovation context, consumers often make assessments about the benefits of using a technology based on assumptions about is usefulness (Rai et al. 2009). Consumers will more likely accept innovations when they believe there are benefits of using the technology (Ratten 2010). In the online environment, there are new innovations continually emerging in that affect usage of technology services. When an individual believes they have the ability to confirm the usefulness of the technology they are likely to adopt the innovation (Fenech 1998). Consumers engage in this adoption process as they make assessments about the potential of the innovation (Gopalakrishnan and Damanpour 1997). Consumer's perceptions of the usefulness of a technology innovation are based on previous usages of similar services.

Therefore, in line with the technology acceptance model, the following hypothesis is proposed:

Hypothesis 1: Increased perceived usefulness will lead to higher adoption intentions of technological innovations in the cloud computing context.

3.2 Perceived Ease of Use

Perceived ease of use is defined as the degree a person believes that using a new technology does not require much mental or physical effort (Tong 2010). Perceived ease of use refers to whether a technology is easy to understand and use (Tong 2010). When a technological innovation is easy to use then it can help consumers adopt it at a faster rate (Davis et al. 1989). Perceived ease of use measures the level of belief an individual believes using a technology is easy (Taylor and Todd 1995). Technology that is perceived as being easy to understand and use will be adopted at quicker rates (Featherman and Pavlou 2003). Some technology is hard to use because of the knowledge and expertise required, which means consumers lacking technical competence will have difficulty using the technology (Ratten 2015). Thus on conjunction with the technology acceptance model, the following hypothesis is proposed:

Hypothesis 2: Increased perceived ease of use will lead to higher adoption intentions of technological innovations in the cloud computing context.

3.3 Online Behavioural Advertising Knowledge

Online behavioural advertising is concerned with adjusting advertisements based on previous online surfing behaviour (Smit et al. 2014). Most marketers use online behavioural advertising as a way to collect profile information about users. As part of online behavioural advertising information is obtained by installing cookies that obtain knowledge about individual behaviour. Some individuals are concerned with cookies due to the potential misuse of private data without informed consent of users (Smit et al. 2014). As more technological innovations are being used by consumers there is a lot of debate about how data is stored and accessed by online marketers. Some consumers cope with online advertising by moderating their behaviour by accepting or blocking cookies (McDonald and Cranor 2010). Consumers who are more comfortable and knowledgeable about online behavioural advertising are likely to adopt technological innovations at a faster rate (Ratten 2015). Therefore, the next hypothesis is:

Hypothesis 3: Increased online behavioural advertising knowledge will lead to higher adoption intentions of technological innovations in the cloud computing context.

3.4 Social Networks

Social networks are friends, family and acquaintances of an individual that influence his or her behaviour (Ratten 2015). These social networks are important factors that affect whether an individual believes that they should use a new system or technological innovation (Chen and Chang 2013). Technology systems are important innovations, which consumers adopt depending on the influence of other individuals (Venkatesh et al. 2003). Individuals adopt an innovation when they perceive there is increased value obtained from using the technology (Pavon and Brown 2010). The suggestions of an individual's social networks will drive the perceived value from adopting a technological innovation. Therefore, this leads to the next hypothesis:

Hypothesis 4: Increased social networks of an individual will lead to higher adoption intentions of technological innovations in the cloud computing context.

3.5 Online Privacy Concerns

Online privacy concerns are an important issue that is becoming more relevant to consumers due to the large amounts of information and knowledge stored on mobile technology devices (Ratten 2011). Online privacy is defined as an individual's concerns about information being stored, accessed and inappropriately used (Gao et al. 2012). Individuals often misunderstand the role of cookies and data stored on online devices due to the uncertainty of confidential data and information (McDonald and Cranor 2010). Smit et al. (2014) found that individuals are worried about online privacy due to the confusion about privacy statements. In order to protect their online privacy individuals clear their browsing history, block pop-ups and check for spyware (Smit et al. 2014). Often individuals are anxious about using computer technology due to privacy issues that have been more common in the online internet environment (Ratten 2012). Some of the most common privacy concerns are how service providers obtain, store and use information (Loch and Conger 1996).

The use of new technology is influenced by privacy cognition, which includes the ability of an individual to understand how information may be used by outside parties (Ratten 2013). When third party service providers save information made available on technology devices then individuals feel threatened by the safety of their data (Chen and Chang 2013). Some individuals use the adoption of location-based services as a way to evaluate potential privacy implications (Xu and Gupta 2009). This means that when consumers are more concerned about online privacy they are less likely to adopt technological innovations. Therefore, this leads to the next hypothesis:

Hypothesis 5: Increased online privacy concerns will lead to lower adoption intentions of technological innovations in the cloud computing context.

4 Methodology

A paper questionnaire was given to students in the United States and Australia with the condition that they had not previously used cloud computing services. Students were chosen as the respondents due to convenience but also to control for education and demographic issues that may affect adoption intentions of technological innovations (Altinay et al. 2012). An analysis of late and early respondents to the survey questionnaire was undertaken but no significant differences were found (Armstrong and Overton 1977). A student sample was utilized to collect the data as cloud computing is a technological innovation that many young consumers are adopting. The survey questionnaire was pilot tested amongst a small number of university students then distributed in paper format to a large number of students at a United States and Australian university.

The survey questionnaire included the constructs from the proposed hypotheses in random order. Table 1 states the construct items, which were mostly measured on a seven point likert scale from strongly disagree to strongly agree. Some constructs were reverse scored to minimise response bias. Table 1 also shows the construct reliability and factor loading scores suggested by Fornell and Larcker (1981). Both the United States and Australian samples contained 120 completed questionnaires with the gender balance being 52 % male, 48 % female in the United States and 55 % male and 45 % female in Australia. A confirmatory factor analysis using LISREL 8.8 was conducted to test the reliability and validity of the construct items. The United States and Australian samples had separate measurement models and confirmatory factor analysis for each construct.

5 Results

The consumer samples for both Australia and the United States have adequate fit with the measurement model (Jöreskog and Sörbom 1999). Structural equivalence with the measurement models were indicated from the fit indices (confirmatory factor analysis, root mean square error of approximation) from both samples. A series of analysis to evaluate discriminant validity of all constructs in the sample indicated the correlation coefficients between factors were significantly different from 1.0 (Anderson and Gerbing 1988). Composite reliability was evaluated and the results indicated all constructs exceeded the 0.60 recommended level, which indicates reliability amongst construct items (Bagozzi 2007). As both samples had path coefficients from latent factors to their indicators high this appears to indicate convergent validity (Jöreskog and Sörbom 1999).

Most of the hypotheses were supported by the data analysis. Hypotheses 1, 2, and 5 were supported by the data in both samples. The data results from hypothesis 1 suggest that there is a strong positive relationship between perceived usefulness and intention to adopt cloud computing services, which is in line with the technology acceptance model. Similarly, the results from hypothesis 2 suggest that there is a weak positive relationship between perceived ease of use and intention to adopt

Table 1 Confirmatory factor analyses

Constructs and items	Standardized loadings United States	Standardized loadings Australia
Perceived usefulness (adapted from Tong 2010) 1. Using cloud computing would enable me to accomplish more tasks more quickly 2. Using cloud computing would increase my productivity 3. Using cloud computing would make it easier to store information 4. Overall, using cloud computing is advantageous 5. Using cloud computing would improve my life	$\alpha = 0.77$	$\alpha = 0.79$
Perceived ease of use (adapted from Tong 2010) 1. Instructions for cloud computing are hard to follow 2. Cloud computing is easy to understand and clear 3. I would find cloud computing easy to use 4. I would find it easy to use cloud computing for accessing information 5. It would be easy for me to become skilfuil at using cloud computing	$\alpha = 0.71$	$\alpha = 0.72$
Online behavioural advertising knowledge (adapted from McDonald and Cranor 2010; Smit et al. 2014; Ratten 2015) 1. When I visit a website I see the same advertising as everyone else 2. Companies should only gather information about my internet use when I give them permission 3. The advertisements that appear in a website differ per visitor 4. It is punishable for companies to gather and store information about the internet use of individuals 5. Your browsing history helps determine which advertisements you see during your next visit 6. Companies are allowed to share information about internet usage provided it is not traceable to the person 7. Companies create different user segments based on their internet behaviour and they show these groups targeted advertisements 8. Online content and services can be free because of online advertising	$\alpha = 0.65$	$\alpha = 0.79$
Social networks (adapted from Chen and Chang 2013; Ratten 2015) 1. My social network (family, friends, acquaintances) think I should use cloud computing services 2. I will discuss cloud computing services with my family and friends 3. I will use cloud computing services because I am influenced by my family and friends	$\alpha = 0.76$	$\alpha = 0.73$
Online privacy (adapted from Baek and Morimoto 2012; Ratten 2015) 1. I think that personal data has been misused too often 2. I worry about receiving online advertisements that I am not interested in	$\alpha = 0.73$	$\alpha = 0.77$

(continued)

Table 1 (continued)

Constructs and items	Standardized loadings United States	Standardized loadings Australia
3. I am concerned about potential misuse of personal information 4. I worry that information has not been stored safely 5. I feel uncomfortable when personal data is shared without permission		
Adoption intention (adapted from Anton et al. 2013; Ratten 2014) 1. How likely are you to purchase cloud computing services? 2. If you had access to cloud computing, would you use it to store and access information?	$\alpha = 0.86$	$\alpha = 0.82$

cloud computing, which is also in conjunction to previous research on the technology acceptance model. The positive support for the relationship between online privacy concerns and intention to adopt cloud computing as espoused by hypothesis 5 supports the notion that privacy is a major concern for consumers adopting technological innovations. Hypothesis 3 was supported in the United States but not by the Australian sample. This suggests that perhaps online behavioural advertising is more prevalent in the United States and consumers are more aware about this form of advertising as a technological innovation. It may be the case that more companies use online advertising in the United States because of the internet capabilities of college campuses, which may be limited in Australia by Australian students. The results of hypothesis 4 which predicted social networks to influence adoption of cloud computing services were supported in the Australian sample but not in the United States sample. This is an interesting finding as it suggests that social networks to university students are important influencers of behavioural intention. Overall, these findings suggest there are more similarities in consumers in the United States and Australia despite the different geographic locations. Table 2 depicts the measurement model fit indices for the Australian and the United States sample. The statistics were evaluated using the model and data fit indices from a structural equation modelling approach of LISREL 8.8 (Jöreskog and Sörbom 1999). The data analysis indicated good model fit with the comparative fit index (CFI) of 0.095 and the root mean square error of approximation (RMSEA) close to the 0.05 required level.

The findings moderately support the prediction that online behavioural advertising knowledge plays an important role when consumers are deciding whether to adopt new technological innovations. Table 3 depicts the results of each of the hypotheses tested in both country samples. The finding suggests that cloud computing service providers aware of online behavioural advertising are likely to recruit more consumers if they devote more time to privacy issues. In addition, the results shed some light on the affect of social networks on technology adoption behaviour.

Table 2 Measurement model fit indices

United States model	Australian model
$\chi = 298.55$	$\chi = 476.04$
df = 191	df = 191
CFI = 0.95	CFI = 0.95
RMSEA = 0.05	RMSEA = 0.05

Table 3 Hypotheses' results

Hypothesis	United States n = 120	Australia n = 120	χ^2 (df = 1)
H1 Perceived usefulness and intention to adopt technological innovations in the form of cloud computing services	0.69	0.64	11.12
H2 Perceived ease of use and intention to adopt technological innovations in the form of cloud computing services	0.07	0.29	0.74
H3 Online behavioural advertising knowledge and intention to adopt technological innovations in the form of cloud computing services	0.74	0.08	1.78
H4 Social networks and intention to adopt technological innovations in the form of cloud computing services	0.09	0.44	1.88
H6 Online privacy concerns and intention to adopt technological innovations in the form of cloud computing services	−0.07	−0.67	3.12

6 Managerial Implications

The managerial implications of the results of the study are that managers need to know that online behavioural advertising and online privacy concerns affect the adoption rates of technological innovations. A marketing approach that includes the perceived ease of use and perceived usefulness of cloud computing would help consumers feel more comfortable with the technological innovation. Managers should understand that their technological innovation strategy should include focusing on the social and technological capabilities of cloud computing in order to achieve better consumer adoption outcomes.

The results of the study imply that firms should understand that consumer's social networks function in different ways, which helps facilitate technological innovation adoption outcomes. Firms should carefully monitor social networking behaviour and online activity to encourage better consumer adoption rates of cloud computing services. Accordingly, technology firms with different online privacy and behaviour advertising strategies could utilize better marketing resources to improve innovation adoption outcomes.

7 Limitations and Future Research Suggestions

There are several important implications for policy and future research on cloud computing services and the adoption of technological innovations. The first implication relates to the sharing of information amongst potential users of cloud computing services. In this paper the role of social networks was included in addition to measures from the technology acceptance model. The findings from the data analysis suggest that the explanation of the drivers of adoption intention are still not fully known, which is an interesting proposition for future researchers. Prior research by Smit et al. (2014) has suggested that the emotional appeal of innovation is an important component of privacy concerns. This implies that emotional connections to technology innovations like cloud computing services are useful in order to further understand how quickly individuals feel at ease with privacy matters.

The second limitation is that the study is limited to two countries, the United States and Australia, extending the study to other countries would enable a better understanding of the international attitudes towards cloud computing services. Tong (2010) stressed that by extending international studies of online purchase intentions to multiple countries it adds external validity to a study. As the technology acceptance model and social cognitive theory was used in this study there are some factors that were omitted from the study that might influence consumer attitudes (e.g. income level, prior technology usage), which future studies should research in more detail.

The third implication is that as the results are obtained from university students this raises some limitations for consideration of future research. Future research should empirically test the hypotheses in other demographic sectors to check the validity of the results. In addition, this study used the technology acceptance model and social cognitive theory as the theoretical frameworks of consumer intentions to adopt cloud computing but other sources such as online purchases could be supplemented as objective measures of adoption. Future research can explore in more detail whether additional theories such as social identity theory also contribute to the impact of adoption intention of technological innovations.

References

Altinay, L., Madanoglu, M., Daniele, R., & Lashley, C. (2012). The influence of family tradition and psychological traits on entrepreneurial intention. *International Journal of Hospitality Management, 31*, 489–499.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modelling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*, 411–423.

Anton, C., Camerero, E., & Rodriguez, J. (2013). Usefulness, enjoyment and self-image congruence: The adoption of e-book readers. *Psychology and Marketing, 30*(4), 372–384.

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of MarketingResearch, 14*, 396–402.

Baek, T. H., & Morimoto, M. (2012). Stay away from me: Examining the determinants of consumer avoidance of personalized advertising. *Journal of Advertising, 41*(1), 59–76.

Bagozzi, R. P. (2007). The legacy of the technology acceptance model and a proposal for a paradigm shift. *Journal of the Association for Information Systems, 8*(4), 244–254.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bradshaw, S., Millard, C., & Walden, I. (2011). Contracts for clouds: Comparison and analysis of the terms and conditions of cloud computing services. *International Journal of Law and Information Technology, 19*(3), 187–223.

Chen, K. Y., & Chang, M. L. (2013). User acceptance of 'near field communication' mobile phone service: An investigation based on the unified theory of acceptance and use of technology model. *The Services Industries Journal, 33*(6), 609–623.

Compeau, D., Higgins, C., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly, 23*(2), 145–158.

Damanpour, C. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal, 34*(3), 555–590.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.

Den Hertog, P., Van der Aa, W., & De Jong, M. W. (2010). Capabilities for managing service innovation: Towards a conceptual framework. *Journal of Service Management, 21*(4), 490–514.

Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International Journal of Human–Computer Studies, 59*, 451–474.

Fenech, T. (1998). Using perceived ease of use and perceived usefulness to predict acceptance of the World Wide Web. *Computer Networks and ISDN Systems, 30*, 629–630.

Fichman, R. G. (2001). The role of aggregation in the measurement of IT related organizational innovation. *MIS Quarterly, 25*(4), 427–455.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobserved variables and measurement error. *Journal of Marketing Research, 18*, 39–50.

Gallivan, M. J. (2001). Organizational adoption and assimilation of complex technological innovations: Development and application of a new framework. *The Database for Advances in Information Systems, 32*(3), 51–85.

Gao, T., Rohm, A. J., Sultan, F., & Huang, S. (2012). Antecedents of consumer attitudes toward mobile marketing: A comparative study of youth markets in the United States and China. *Thunderbird International Business Review, 54*(2), 211–225.

Gopalakrishnan, S., & Damanpour, F. (1997). A review of innovation research in economics, sociology and technology management. *Omega International Journal of Management Science, 25*(1), 15–28.

Hameed, M. A., Counsell, S., & Swift, S. (2012). A conceptual model for the process of IT innovation adoption in organizations. *Journal of Engineering and Technology Management, 29*, 358–390.

Jöreskog, K. G., & Sörbom, D. (1999). *Interactive LISREL: A new interaction for windows*. Chicago, IL: Scientific Software International.

Karakas, F., & Manisaligil, A. (2012). Reorienting self-directed learning for the creative digital era. *European Journal of Training and Development, 36*(7), 712–731.

Kulviwat, S., Bruner, G. C., Kumar, A., Nasco, S. A., & Clark, T. (2007). Toward a unified theory of consumer acceptance technology. *Psychology & Marketing, 24*(12), 1059–1084.

Loch, K. D., & Conger, S. (1996). Evaluating ethical decision making and computer use. *Communications of ACM, 39*(7), 74–83.

Marston, S., Li, Z., Bandyopadhyay, S., Chang, J., & Ghalsasi, A. (2011). Cloud computing-the business perspective. *Decision Support Systems, 51*, 176–189.

McDonald, A., & Cranor, L. F. (2010, August 16). *Beliefs and behaviors: Internet users' understanding of behavioral advertising*. TPRC 2010. Available at SSRN: http://ssrn.com/abstract=1989092

Pagani, M. (2004). Determinants of adoption of third-generation mobile multimedia services. *Journal of Interactive Marketing, 18*(3), 46–59.

Pavon, F., & Brown, I. (2010). Factors influencing the adoption of the World Wide Web for job-seeking in South Africa. *SA Journal of Information Management, 12*(1), 443–452.

Pincus, J. (2004). The consequences of unmet needs: The evolving role of motivation in consumer research. *Journal of Consumer Behavior, 3*(4), 375–387.

Rai, A., Brown, P., & Tang, X. (2009). Organizational assimilation of electronic procurement innovations. *Journal of Management Information Systems, 26*(1), 257–296.

Ratten, V. (2009). Adoption of technological innovations in the m-commerce industry. *International Journal of Technology Marketing, 4*(4), 355–367.

Ratten, V. (2010). E-book devices and m-commerce: What might be the impact on organizational learning? *Development and Learning in Organizations: An International Journal, 24*(6), 6–7.

Ratten, V. (2011). Ethics, entrepreneurship and the adoption of e-book devices. *International Journal of Innovation and Learning, 10*(3), 310–325.

Ratten, V. (2012). Implementing cloud learning in an organization: A training perspective. *Industrial and Commercial Training, 44*(6), 334–336.

Ratten, V. (2013). The evolution of mobile social networks through technological innovation. In A. Brem & E. Viardot (Eds.), *Evolution of innovation management* (pp. 132–150). Basingstoke: Palgrave MacMillan.

Ratten, V. (2014). Behavioral intentions to adopt technological innovations: The role of trust, innovation and performance. *International Journal of Enterprise Information Systems, 10*(3), 1–13.

Ratten, V. (2015). A cross-cultural comparison of online behavioural advertising knowledge, online privacy concerns and social networking using the technology acceptance model and social cognitive theory. *Journal of Science and Technology Policy Management*, 6(1), forthcoming.

Raza, S. A., & Standing, C. (2010). Towards a systemic model on information systems' adoption using critical systems thinking. *Journal of Systems and Information Technology, 12*(3), 196–209.

Revels, J., Tojib, D., & Tsarenko, Y. (2010). Understanding consumer intention to use mobile services. *Australasian Marketing Journal, 18*(2), 74–80.

Rogers, E. M. (1995). *Diffusion of innovations*. New York, NY: The Free Press.

Shen, Y.-C., Huang, C.-Y., Chu, C.-H., & Hsu, C.-T. (2010). A benefit-cost perspective of the consumer adoption of the mobile banking system. *Behavior & Information Technology, 29*(5), 497–511.

Smit, E. G., Van Noort, G., & Voorveld, H. A. M. (2014). Understanding online behavioural advertising: User knowledge, privacy concerns and online coping behaviour in Europe. *Computers in Human Behavior, 32*, 15–22.

Stein, S., Ware, J., Laboy, J., & Schaffer, H. E. (2013). Improving K-12 pedagogy via a cloud designed for education. *International Journal of Information Management, 33*, 235–241.

Taylor, S., & Todd, P. A. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly, 19*, 561–571.

Thong, J. Y. L., & Yap, C. S. (1995). CEO characteristics, organizational characteristics and information technology adoption in small businesses. *Omega International Journal of Management Science, 23*(4), 429–442.

Tong, X. (2010). A cross-national investigation of an extended technology acceptance model in the online context. *International Journal of Retail and Distribution Management, 38*(10), 742–758.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478.

Vouk, M. A. (2008). Cloud computing- issues, research and implementations. *Journal of Computing and Information Technology, 16*(4), 235–246.

Wang, K., & Lin, C. L. (2012). The adoption of mobile value-added services: Investigating the influence of IS quality and perceived playfulness. *Managing Service Quality, 22*(2), 184–208.

Xu, H., & Gupta, S. (2009). The effects of privacy concerns and personal innovativeness on potential and experienced customers' adoption of location-based services. *Electronic Markets, 19*, 137–149.

Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2010). Explaining internet banking behavior: Theory of reasoned action, theory of planned behavior, or technology acceptance model? *Journal of Applied Social Psychology, 40*(5), 1172–1202.

Customer Co-Production and Service Innovation Characteristics: A Conceptual Argument

Mohammadali Zolfagharian and Audhesh K. Paswan

Abstract

With the servuction system as its overarching framework, this chapter aims to understand how the customer's perception of service innovation characteristics is influenced by his/her co-production of the service for self (CPS) and the co-production of the service for others (CPO). A set of propositions articulate these relationships: (a) shifts in CPS and CPO are positively related to perceived relative advantage and negatively to perceived risk; (b) upward and downward shifts in CPS and CPO reduce perceived compatibility; and (c) shifts in CPS and CPO are inversely and positively related to perceived complexity, respectively. Since the nature of a service and its managerial consequences are intertwined, our findings in the two spheres of customer co-production (CPS and CPO) have important implications for service researchers and managers with respect to both short- and long-term service operation issues.

1 Introduction

This chapter is about customers' role in the creation of value with respect to service innovations. Value is often co-created by the service firm and its customers who share the same service facility. Consider the following hypothetical example.

> *At his usual grocery store, Jeff is waiting to use one of the self-check-out stations. He notices that the lady in front of him is having difficulty picking up and scanning her case of bottled water. He reaches for the water case, scans it, places it in her cart, and returns to his position in the queue. The lady completes her transaction and heads toward the exit. Jeff*

M. Zolfagharian (✉)
University of Texas–Rio Grande Valley, Edinburg, TX, USA
e-mail: zolfagharian@utpa.edu

A.K. Paswan
University of North Texas, Denton, TX, USA

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_5

then approaches the station, scans the items in his cart, bags them, completes the payment using a credit card, and leaves the store.

Two customer-related service experience issues are identifiable in this example. First, Jeff co-produces the check-out service for himself by scanning and bagging his items. This comprises Jeff's Co-Production for Self (CPS). Second, he helps the lady move and scan her case of water. This is Jeff's Co-Production for Other customers (CPO). The objective of this chapter is to delineate the effects of such customer behaviors on service innovations characteristics.

The findings of innovation research in marketing are inconsistent and important questions are yet to be addressed (Meuter et al. 2005; Rogers 2003). For instance, relative advantage, a key innovation characteristic, has been found as irrelevant, as positively related, and as negatively related to customer adoption behavior, sometimes even within the same study (Venkatraman 1989). Further, it is unknown why customers of services face a higher level of perceived risk than customers of goods (Bateson 1985). The current research attempts to shed light on such discords in service innovation research by focusing on customer co-production, rooted in service characteristics, and using it to predict perceived innovation characteristics. Innovations often modify the nature and/or extent of customer co-production (Eiglier et al. 1977). Such modifications affect customer evaluation of innovation characteristics (Lovelock and Young 1979). In fact, Prahalad and Ramaswamy (2003) regard co-creation as the "next practice and the future of innovation" programs.

Customer co-production is rooted in production-consumption inseparability of service offerings (Judd 1968; Rathmell 1974; Sasser 1976). Inseparability is one of the two fundamental service characteristics, with the other being intangibility (Eiglier et al. 1977). All other characteristics are derivatives of these two (Bateson 1985; Hill 1977; Zeithaml et al. 1985). The question might arise: Why not focus on intangibility or inseparability? Eiglier and Langeard (1977a) and Bateson (1985) provide a viable answer: Intangibility and inseparability are highly abstract concepts and the difficulty of analyzing them hinders the generation of propositions suitable for empirical investigation. Co-production is at a lower level of abstraction and, thus, amenable to testing (Bateson 1985).

This research links two previously unrelated streams of research: service characteristics and diffusion of innovations. The contribution derives less from the novelty of such attempt and more from the urgency of the knowledge gap it exposes. This urgency is evident with the recently revitalized interest in co-production, which not only distinguishes services from goods, but also differentiates between diverse service industries (Eiglier and Langeard 1977a). The importance of customer co-production for various areas of marketing research, especially service innovation, is evident with the collection of writings on the Service-Dominant Logic of marketing (Lusch and Vargo 2006), Consumer Culture Theory (Arnould and Thompson 2005), and the several specialized conferences and *Journal of Marketing* and *Journal of the Academy of Marketing Science* special issues on these topics.

With the servuction system (Eiglier 1977; Langeard et al. 1981) as its overarching framework, this research aims to understand how the customer's perception of

service innovation characteristics are influenced by his/her co-production of the service (a) for self, hereafter CPS, and (b) for other customers, hereafter CPO. CPS is defined as the contributions that a focal customer makes towards his or her own service experience. CPO is the contribution the focal customer makes towards the service experience of one or more other customers.

2 The Conceptual Model

The overarching conceptual framework guiding this research is servuction, which combines the words *serv*ice and prod*uction* (Eiglier et al. 1977; Langeard et al. 1981). Its main thesis revolves around the inseparability of customers from the production and delivery of service offerings. It holds that perceptions about a service experience are rooted in the manifold interactions among the customer, service facilities, service personnel, and other customers (Green et al. 1974). Customers become part of the service production process through their interactions with the firm's delivery system.

The servuction approach divides the service firm into those parts that are visible to the customer and those that are not. The visible part of the service firm (i.e., contact personnel and service facilities) and customers (i.e., the focal customer and other customers) constitute the servuction system (Bateson 1985). Developing a comprehensive service marketing strategy requires that we clearly define and adequately understand each element and relationship in the servuction system (Eiglier et al. 1977). Identifying their analysis as exploratory and general in nature, Langeard et al. (1981) invite us to extend and adapt the servuction approach to specific sectors and situations. The numerous interplays between servuction elements make it difficult, if not impossible, to tackle the entire system in one study. A concerted, programmatic research is needed to understand this system of interactions. This research focuses on a subset of the interactions in the servuction system, namely the roles that the customer plays in forming his/her evaluation of service innovations (see Fig. 1). The roles played by other customers, back-office employees, customer-contact employees, and service facilities are not addressed here.

2.1 Customer Co-Production: CPS and CPO

Prior to the 1970s, most marketers viewed customers as passive buyers whose participation would disrupt operational routines and efficiencies (Aldrich and Herker 1977; Danet 1984). Thompson (1967) went as far as advising firms to buffer their service delivery from customers' disturbances. Co-production is now known as a foundational premise of marketing (Vargo and Lusch 2004); integral to the marketing concept (Kelley et al. 1992); next frontier in competitive effectiveness (Bendapudi and Leone 2003); and "key to creating value" (Normann and Ramirez 1993).

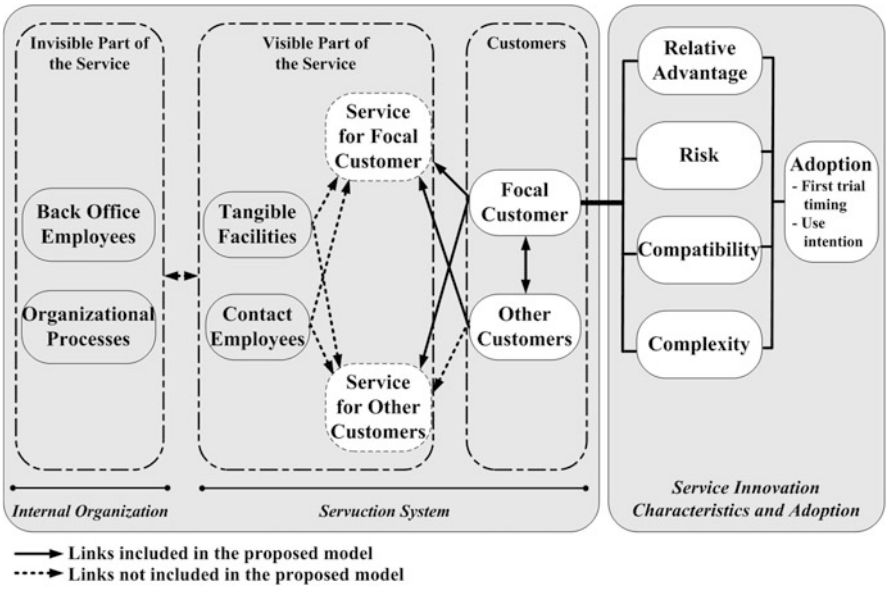


Fig. 1 The servuction system of interactions and service innovation characteristics [Figure adapted from Langeard et al. (1981, p. 15), with written permission from MSI]

Suppliers and customers *together* create value (Firat and Venkatesh 1993; Vargo and Lusch 2004). This holds in both consumer and industrial markets (Wikstrom 1996a). A consensus definition among earlier authors would present customer co-production as the degree to which the customer actively participates and provides input in producing and delivering an offering (Dabholkar 1990).

Examples of co-production abound. Consider tax clients, individual or industrial. Both objective and subjective measures of the value created will in part depend on how accurately the client has maintained his or her tax records throughout the year. The client's input not only influences the value perceived by himself / herself (referred to as CPS in this chapter), but also by the CPA providing tax services, government, and any other related stakeholder. A second example relates to self-checkout as a service innovation. Numerous retail stores have begun encouraging customers to check themselves out without the need to interact with employees. Self-checkout gives rise to both CPS and CPO. CPS includes such behaviors as knowing where to keep non-scanned items, how to interact with the machine efficiently, how to find the barcodes on different items, how to scan them, how to complete the appropriate form of payment, etcetera. These inputs by the customer will in part determine his/her service encounter experience and influence his/her evaluation of self-checkout as a service innovation. Examples of CPO behaviors include the focal customer respecting physical distance from other customer, not distracting them during their self-checkout, notifying them when they forget paid-for items on the counter, etcetera. Such inputs by the focal

customer will affect other customers' service encounter experiences and their reactions to self-checkout as an innovative alternative. Another example is Facebook and other social media as new frontiers in the service sector. Without a doubt, a given Facebook member's communications with the general audience and with his/her friends within Facebook will influence not only his/her own experience (CPS), but also others' (e.g. Facebook friends) experiences (CPO) with this innovative service. It is no wonder that Facebook members constantly recruit, and occasionally let go of, friends.

These examples undergird some of the important challenges encountered by a majority, if not all, of service firms. Rooted in production-consumption inseparability, CPS and CPO behaviors exemplified above are elements in service operations that are far less within the firm's control relative to other elements such as employee recruitment, pricing, or surplus demand. Service managers need to acquire new managerial insights and skills in order to cope with such less controllable sources of operational uncertainty. Moreover, CPS and CPO reinforce the notion of customer compatibility and its management. Where co-production (primarily related to CPS) coincides with co-consumption (giving rise to CPO), as in the latter two of the examples above, service managers face a more nuanced and complex system of interactions to manage.

2.2 Constructs from Diffusion of Innovation Research

Diffusion of innovation research consists of four broad elements: innovation, communication channels, time, and the social system. Among these four elements, innovation is of prime importance in that innovation characteristics can explain 49–87 % of the variation in customer adoption behavior (Henard and Szymanski 2001; Peppers and Rogers 1997). An innovation is "an idea, practice, or object that is perceived as new" (Rogers 2003, p. 12). Innovations diffuse in the marketplace (i.e., are adopted by customers) at different rates, in part due to their different characteristics.

Diffusion of innovation research has identified a parsimonious set of six innovation characteristics: relative advantage, compatibility, complexity, trialability, observability, and risk (see Rogers 2003, pp. 15–17 for definitions). The literature suggests that trialability and observability are not significant characteristics of service innovations (e.g., Kleijnen et al. 2004; Mills 1986; Siu and Cheng 2001). Hence, these two will not be considered here.

Innovation characteristics have always been treated as exogenous variables, whose sources of variation are uninteresting. The current study employs innovation characteristics as the mediators of the impact of customer co-production and co-consumption on adoption decisions. More specifically, it conceptualizes innovation characteristics as higher-order product attributes and proposes that first-order product attributes can serve as antecedents to innovation characteristics. Although this holds for both tangible and intangible products, service offerings provide an appropriate context for initial examination of our thesis. Hence, the

focus will be on customer co-production as a key first-order service attribute that can in part explain the variation in perceptions of innovation characteristics. All of these characteristics, first or higher order, are seen from the customer's point of view.

3 Conceptual Development and Statement of Propositions

Numerous studies from the fields of marketing, management, and operations research stand to support, either explicitly or by implication, that co-production can serve as an antecedent to innovation characteristics. We draw on these three fields to develop a set of substantively meaningful propositions.

3.1 CPS, CPO, Relative Advantage, and Risk

The 'co-production–relative advantage' and the 'co-production–risk' relations share much analytical and empirical rationale. These relations are supported by both financial and non-financial consequences of changes in the level of co-production. Moreover, past research has employed two long-standing theories, namely agency theory and transaction cost economics, to delineate how co-production relates to relative advantage and risk.

3.1.1 Financial Rationale

The literature suggests that an increase in the level of co-production (a) can reduce service provider costs, (b) which results in price discounts, (c) which in turn enhances customer evaluation of the service offering. Service firms usually encourage CPS and CPO in order to enhance their operating efficiency (Bowen 1986; Xue and Harker 2002). They accomplish this by substituting employee labor with self-service technology or with customer labor (Fitzsimmons 1985; Lovelock and Young 1979). Many service firms transfer at least some of their savings to the customer in the form of lower prices and/or via other promotional mechanisms. Ha (1998), Kelley et al. (1990), and Song and Adams (1993) reach a similar conclusion. They find co-productive customers to dedicate greater resources to the service provider, who in turn reciprocates by passing some of the savings back to customers in the form of reduced prices. They argue that, with price reductions, customers perceive greater value in the innovated service.

Two facts about services intensify the effect of price reduction on customer evaluation of services. First, it is far more difficult for service firms, as compared to manufacturing firms, to reduce operational costs by cutting corners or through learning effect (Chase and Erikson 1988). This is primarily due to the slow process of standardization of intangible offerings, which makes it difficult to apply the production-line approach to services (Eiglier and Langeard 1977a). Hence, any price reductions on service offerings can have substantial influence on customers' perceptions of value. Moreover, the psychological aspect of price has a stronger

impact on customers of services, compared to those of goods (Eiglier and Langeard 1977a). In other words, price is a more decisive attribute of services than it is of goods. It follows that price reductions are expected to have a strong influence on service customers' perceptions of value. Therefore, when a service innovation increases CPS and CPO and reduces service retail price, the customer is likely to perceive greater value in the service. Put differently, financial gains can get the customer to perceive the service as more advantageous and favorable relative to pre-innovation type of the service and relative to competing services.

3.1.2 Non-Financial Rationale

Service providers have come to realize that an increase in customer participation during service production and delivery can yield more benefits than the mere cost/price advantage. The non-monetary rationale of the impact of CPS and CPO on relative advantage and risk is recognized in numerous studies. Among marketing scholars, Bateson (1985), Cermak et al. (1994), and Zeithaml (1981) have shown that an increase in CPS and CPO positively affects customer perception of quality and feeling of satisfaction. In a similar vein, Van Raaij and Pruyn (1998) argue that when customers participate in the production and delivery of service offerings, they are more likely to find service specification, production, and/or delivery processes to be valid and reliable; to grow feelings of satisfaction; and to attribute service failures to circumstances rather than to the provider.

Furthermore, Wikstrom (1996a) argues that customers' active participation in the creation and delivery of a given service can improve their perceptions of service benefits and attenuate their perceptions of uncertainty that surround the exchange act and the service offering. Higher levels of co-production enable the customer to exert more control over the course of service provision and to avoid feelings of uncertainty and risk (Kelley et al. 1990; Song and Adams 1993). Bowers et al. (1990) and Goodwin (1988) provide a slightly different insight. They contend that when the customer is involved in the production of service offerings for self or others, he/she often feels partially responsible for the quality of the service as well as the value that customers ultimately receive. Hence, when a service innovation program increases CPS and CPO, the customer is likely to take an even greater responsibility for service outcomes. As a result, the customer is more likely to evaluate favorably the service provider's performance when it enhances CPS and CPO through technology or process innovation.

Bowers et al. (1990) and Langeard et al. (1981) believe that customers find their CPS and CPO throughout service production and delivery enjoyable activities, which can minimize the boredom and anxiety that would otherwise surround the service consumption act, especially during waiting periods. They argue that co-productive customers have greater knowledge of service attributes and can better appreciate service provider's efforts. For instance, Bowers et al. (1990) observe that hospital patients who administer their own pain medication, rather than waiting for nurses, tend to consume less medicine and to prefer their health care providers over competitors. Further, these patients show lower perceptions of risk associated with unnecessary intake of medicine and possible side effects

(Bowers et al. 1990). Moreover, Dellande et al. (2004) show how Weight Watchers' clients who share success stories and support those having difficulties tend to perceive greater benefits and lower risks potent in the service offering. As a conclusion, when a service innovation entails greater co-production, increased knowledge and diminished negative feelings in customers propel them to perceive greater value in the form of superior benefits and lower uncertainty relative to competing services.

Another non-financial benefit for customers is identification with the firm (Eiglier 1977). Although customers might also identify with marketers of goods, customer identification is particularly intense with service firms, especially when customers directly and actively interact with service employees (Eiglier and Langeard 1977a). Generally speaking, as customers assume a stronger CPS and CPO role and engage in a wider variety of co-production activities, they are more likely to identify with the service firm (Eiglier and Langeard 1977b). Therefore, a service innovation that increases co-production can also strengthen the identification bond between the customer and the firm, thereby improving customer perception of value.

Scholars in the field of management have reached similar findings. Bowen (1986) and Mills and Morris (1986) observe that increases in co-production can increase customers' positive feelings such as satisfaction, and reduce their negative feelings such as uncertainty and doubt. Mills and Moshavi's (1999) investigation in knowledge-based services reveals that when customers are held accountable for their input to, and participation in, the specification, production, and delivery of service offerings, three favorable outcomes are likely to accrue: (a) expectation disparity will likely diminish and the overall perceived quality will increase, (b) perceived information asymmetry diminishes and satisfaction with the service outcome increases, (c) perceived service risk diminishes and satisfaction and commitment to the firm increase. Furthermore, when unique customer competencies, such as information about the customer's financial, legal, psychological, or physical statuses are necessary for successful production of a service, the customer will gladly take on a more active role (Larsson and Bowen 1989). Bowen and Schneider (1988), Gartner and Reissman (1974), Holland (1985), and Matties (1979) warn that service innovation programs aiming to reduce customer input and participation in service operations might have adversarial effects on customers' perceptions of the quality and benefits of the service and might alienate them by risking the uniqueness that characterizes every single service encounter.

Operations researchers have also found empirical support for the above contentions. For example, Kellogg et al. (1997) and Hart et al. (1990) suggest that, just as fail-safing strategies can relieve service providers from service failure worries, increased customer participation in service creation and delivery processes might ease their uncertainty and enable them to appreciate the benefits of the service. In a similar vein, Youngdahl and Kellogg (1997) report that customers' engagement in higher levels of information exchange and intervention behavior during service delivery likely enhances their satisfaction with service processes and outcomes. They find that customers' levels of co-production effort contribute to

their perceptions of service value. Interestingly, Youngdahl et al. (2003) find strong similarities in customer participation behaviors across different cultures. They observe that customers from different cultures converge in terms of the type and extent of participation behaviors, perceptions of the efforts they expend, and feelings of satisfaction with services, given their type and extent of their participation behaviors.

3.1.3 Agency Theory

A stream of operations research, primarily attributed to Mills seminal works (1986, 1990), uses agency theory to understand service exchange relationships and encounters. The applicability of agency theory to relationships during service encounters is supported by several scholars (Bergen et al. 1992; Lusch et al. 1996). According to this theory, two sources of uncertainty in principal-agent relationship (e.g., customer-service provider relationship) reduce the service quality and value that the customer perceives to have received and increase the customer's perceived risk associated with the service offering. These sources of uncertainty are adverse selection and moral hazard. Adverse selection occurs when the customer is unable to ascertain one or both of the following: Provider's skills, knowledge, and motivation and the contingencies that can influence the provider's performance (Holstrom 1982). For example, surgery patients not only have to rely on surrogate indicators (e.g., word of mouth or referral by other doctors) when assessing the medical staff's skills, knowledge, and motivation, but also realize that other factors such as medical equipment may affect the outcomes of the surgery. Moral hazard emerges when the quantity and quality of the provider's efforts are difficult to verify and, thus, standards of practice are non-enforceable and meaningless (Pauley 1974). For instance, a disgruntled client of a law firm might file a lawsuit against the firm arguing that the attorney has shirked in representing her.

The two most common mechanisms for customers to cope with adverse selection and moral hazard are monitoring and bonding activities (Fama 1980). As customers elevate their monitoring and bonding activities, they necessarily increase their input during service production and delivery processes (Mills 1990; Mills and Morris 1986). In addition, with any increase in the expected level of monitoring activities, the price the customer will pay for the service declines (Mills and Morris 1986). The customer principal monitors the service agent's fulfilling the service contract, and might decide to actively participate in service creation/delivery in order to guarantee quality and satisfaction (Mills 1990). Because monitoring activities are frequently costly and time-consuming, the customer as well as the provider might supplant it with bonding activities. On the one hand, customers might seek and nurture commercial and noncommercial relationships with providers, hoping to reduce or eliminate the provider's temptation to shirk on service quality. Service providers, on the other hand, might obtain credentials (e.g., CPA, MD), promote goodwill (e.g., donation and community involvement), offer guarantees, or proactively seek and nurture relationships with customers (Mills 1990).

The arguments above suggest that the implicit contract between the principal and the agent not only serves as a way of distinguishing types of service firms

(Fama and Jensen 1983), but also indicates variability in the degree and nature of customer participation in service creation and delivery (Mills and Morris 1986). The agency view of service consumption recognizes co-production as a surrogate mechanism through which customers reduce the uncertainty associated with service encounters and elevate their satisfaction with, and evaluation of, service outcomes.

3.1.4 Transaction-Cost Economics

Bowen and Jones (1986) insightfully link co-production to the concept of performance ambiguity in Transaction Cost Economics (TCE). In TCE, the fundamental concern is efficiency, and the key question is whether a given value element should be produced in-house or bought from the market (i.e., 'make or buy'; Williamson 1985). Furthermore, TCE suggests that increased performance ambiguity translates into increased transaction costs, which in turn necessitate a 'make' decision (Rindfleisch and Heide 1997; Williamson 1985). The notion of co-production is related to TCE in that the question of whether to increase or to reduce co-production is essentially a make-or-buy question (Bowen and Jones 1986). Increasing co-production and co-opting customers as partial employees are analogous to a make (i.e., hierarchy expansion) decision; and reducing customer input in the production process comprises a buy decision (i.e., outsourcing). Since performance ambiguity is higher for firms with intangible, experiential, credential, and labor intensive offerings, such firms can partially alleviate performance ambiguity and enhance their efficiencies by co-opting customers and reinforcing their co-production role (Bowen and Jones 1986).

The above discussion has important implications for service innovation characteristics. A highly ambiguous offering has several adverse consequences, which service firms can partially alleviate by co-opting customers as partial employees (Bowen and Jones 1986; Larsson and Bowen 1989; Rogers 2003). Examples of adverse consequences include customer inability to measure the offering's relative value and benefits, and higher levels of perceived risk throughout the service production and delivery. To reiterate, service innovations that increase the customer's service co-production for self or for others might boost customers' perceptions of relative advantage and attenuate their perceptions of risk associated with the service.

P-1: Shifts in CPS are positively related to relative advantage.
P-2: Shifts in CPO are positively related to relative advantage.
P-3: Shifts in CPS are inversely related to risk.
P-4: Shifts in CPO are inversely related to risk.

3.2 CPS, CPO, and Compatibility

There appears to be a propensity on the part of customers to work at getting the level of quality they desire by actively participating in service production (Kellogg et al. 1997). This propensity is best understood by the application of the role theory

from social psychology to service encounters and from the notion of service script (Grove et al. 1998). A discussion of service encounters is integral to the issue of co-production because such relationships provide an essential, if not the only, mechanism through which customers participate in service production as partial employees (Mills 1990). A distinctive feature of service encounters is their purposive, task-oriented nature and the agreement on short-term goals and codes of conduct among providers and customers (Solomon et al. 1985). Due to the behavioral consensus between providers and customers, ritualized behavior patterns evolve that govern the course of encounters to the extent that each party to the encounter has a role to play and a script from which to read (Eiglier and Langeard 1977a). A role is "a cluster of social cues that guide and direct an individual's behavior in a given setting (Solomon et al. 1985, p. 102) and a service script is a coherent sequence of events expected by the parties to the encounter involving them either as participants or observers (Abelson 1976; Smith and Houston 1985). When an innovation takes place, the service script is subject to slight, and sometimes radical, modifications. Consequently, both the provider and the customer are expected to modify their roles accordingly (Eiglier and Langeard 1977a). It follows that customers might find the sudden changes in the service script to be incompatible with their expectations and behavioral habits, and thus exert resistance towards the innovated service. This perception of incompatibility and subsequent resistance behavior can take place both when the innovation increases CPS and CPO and when it reduces them.

To reiterate, when a service innovation causes a change in customer participation, the customer might perceive the service to be incompatible with his/her existing values, past experiences, and utilitarian and hedonic needs (Bowen 1986). The customer might then decide to delay the act of adoption or even to reject the innovation altogether (Rogers 1995, p.15). Lovelock and Young (1979) provide numerous examples of service innovations that customers have resisted mainly because customers find these innovations to be inconsistent with their existing customer roles (i.e., behavioral habits and past experiences). Further support for this line of thinking comes from Langer's (1978) theory of mindless behavior. According to this theory, people interact with their environment in a passive manner with minimum cognitive activity. Similarly, most routine service encounters take place in an almost automatic style with little cognitive effort by the customer. As long as the structure of a service script is followed, mindless behavior prevails. However, when a service innovation causes change in the service script and roles, the customer is provoked into mindfulness (Langer et al. 1978; Langer and Imber 1979). Suddenly the customer finds it necessary to expend cognitive effort due to the diminished consistency between past experience and new script (Solomon et al. 1985).

The theory of mindless behavior is well supported. For instance, the finding that people cannot accurately remember the obvious details of a given service interaction affords support for this theory (Solomon et al. 1985). Further, Swan et al. (2001) find that more than half of the buyers of low-involvement, frequently purchased goods do not recall forming any opinion at all about the purchase

experience as there was no substantial deviation from expectations and subsequently little cognitive effort by the customer. In applying the employee socialization model to customers, Goodwin (1988) and Mills and Morris (1986) recommend that each of the four socialization processes is equally applicable to employees and customers. These processes include (a) learning new skills, (b) developing a new self-image, (c) developing new relationships with providers and often with fellow customers, and (d) acquiring new values (Gross 1981). When a service innovation changes the level of participation required of the customer, the service provider and the customer together make modifications to one or more of the learned skills, self-image, relationships, and values. These required modifications result in a decline in perceived compatibility of the service with past experiences and habits. Bowers et al. (1990) contend that effective management of the service encounter, including employee behavior and customer input, might prevent the perceptions of the incompatibility between the customer and the service. If one relaxes the assumption of 'effective management' in Bowers et al. (1990) argument, the position taken here will be supported: Customers will likely find structural changes in CPS and CPO as incompatible with their behavioral habits (Eiglier and Langeard 1977a). In summary, (a) service innovation changes service script and expected roles, (b) which translate into perceived incompatibility, and (c) propel the customer to expend more cognitive effort.

P-5: Upward and downward shifts in CPS reduce compatibility.
P-6: Upward and downward shifts in CPO reduce compatibility.

3.3 CPS, CPO, and Complexity

The literature contains mixed findings as to how changes in the customer's service co-production for self due to service innovations affect perceptions of innovation complexity. On the one hand, Bowen (1986) and Mills and Morris (1986) imply a positive association between CPS and perceived service complexity. These authors contend that, with increased co-production, customers find purchasing, consuming, and evaluating the offering to be more complex. Eiglier and Langeard (1977b) concur with this perspective and introduce CPS as one of the five factors that cause a service offering to be perceived as more complex in the mind of the customer. On the other hand, Wikstrom (1996a, b) suggests that customers' active participation in the creation and/or delivery of a given service eases their perceptions of the complexity that surround the exchange act and the service offering.

Using agency theory to explain service exchange relationships, Mills (1990) suggests that as the two sources of uncertainty (i.e., adverse selection and moral hazard) intensify, the principal customer perceives greater complexity in the process of service production, delivery, and consumption. To cope with increased complexity, both customers and service providers engage in monitoring and bonding activities. These activities, in turn, motivate the customer to exert greater co-productive role in order to bring the degree of complexity down to a more

manageable level (Mills 1990). As is implied above, CPS and complexity are related to each other in a circular manner (Eiglier 1977). First, an increase in complexity prompts the principal customer and the agent provider to allow for greater CPS. This comprises the positive link 'complexity→CPS'. Second, as CPS grows, some of the complexity associated with the service offering disappears. This signifies the negative link 'CPS→complexity'. We believe that the latter directionality is of greater theoretical and practical significance to marketing community, and propose a negative 'CPS→complexity' relation for two reasons. First, the arguments underlying the positive relation between co-production and complexity are essentially anecdotal assertions that lack empirical support. Second, the burden of evidence is stronger on the negative relation.

P-7: Shifts in CPS are inversely related to complexity.

The reviewed literature (Bowen 1986; Eiglier 1977; Mills and Morris 1986) offers more resolute insight into the 'CPO→complexity. As a service innovation increases the level of CPO, the customer tends to experience more complexity in the production, delivery, and consumption of the innovated service. Hence, depending on whether the customer co-produces the service for self or for others, the relation between co-production and complexity might be either negative or positive.

P-8: Shifts in CPO are positively related to complexity.

4 Managerial Relevance and Limitations

The managerial importance of this study is the fact that ignoring customer co-production in service research will result in findings and recommendations that have less relevance and use for service managers (Eiglier and Langeard 1977a). Other service characteristics help to better appreciate the complex nature of services, but do not aid in resolving it (Eiglier and Langeard 1977a). Since the nature of a service and its managerial consequences are intertwined, customer co-production is pivotal to service research (Eiglier and Langeard 1977a). If a study incorporates all but CPS and CPO, the findings will provide little managerial insight (Eiglier 1977).

Another reason for the selection of customer co-production is its relevance to service manager's short- and long-term problems. Managers tend to underestimate the pervasiveness and significance of the concept (Eiglier 1977; Martin and Pranter 1989). Yet, when co-production is employed to classify services, the majority of the problems that come to the fore are key strategic issues (Eiglier and Langeard 1977b). Moreover, co-production is cited as the increasingly important determinant of perceived service quality value, satisfaction, and loyalty (Baker 1987; Hill 1977). If played well, the role of co-producing consumers can help not only assimilate new customers and equip them with service expectations and script, but also magnify

and emphasize, for self and for others, the positive attitudes and beliefs about the service experience (Baron et al. 1996; Goffman 1959; Johnston 1989; Kelley et al. 1990).

There are limitations to the application of CPS and CPO in modern innovation research. Thanks to the impressive body of literature on related constructs such as co-creation and participation, we now know significantly more about customer co-production in various contexts than we did a decade ago. However, the roles of these constructs have not been explored within new product/new service contexts. Nor have they been linked to the interdisciplinary innovation literature in general. The dearth of research is even greater with respect to theoretical linkages between customer co-production and innovation. This chapter is one of the first attempts to conceptualize where customer co-production could be incorporated in existing theories. We invite future research to continue our work incorporating customer co-production (or co-creation or participation) into existing theories of innovation. Even more interesting would be to build new theories if so doing would result in greater or more parsimonious explanations.

References

Abelson, R. F. (1976). Script processing in attitude formation and decision making. In J. S. Carroll & J. S. Payne (Eds.), *Cognition and social behavior* (pp. 33–45). Hillsdale, NJ: Erlbraum.

Aldrich, H. A., & Herker, D. (1977). Boundary-spanning roles and organization structure. *Academy of Management Review, 2*(2), 217–230.

Arnould, E. J., & Thompson, C. J. (2005). Consumer culture theory (CCT): Twenty years of research. *Journal of Consumer Research, 31*(4), 868–882.

Baker, J. (1987). The role of the environment in marketing services: The consumer perspective. In J. A. Czepiel, C. A. Congram, & J. Shanahan (Eds.), *The service challenge: Integrating for competitive advantage* (pp. 79–84). Chicago, IL: American Marketing Association.

Baron, S., Harris, K., & Davies, B. (1996). Oral participation in retail service delivery: A comparison of the roles of contact personnel and customers. *European Journal of Marketing, 30*(9), 75–90.

Bateson, J. E. G. (1985). Self-service consumer: An exploratory study. *Journal of Retailing, 61*(3), 49–76.

Bendapudi, N., & Leone, R. P. (2003). Psychological implications of customer participation in co-production.*Journal of Marketing, 67*(1), 14–28.

Bergen, M., Dutta, S., & Walker, O. C. (1992). Agency relationships in marketing: A review of the implications and applications of agency and related theories. *Journal of Marketing, 56*(1), 1–24.

Bowen, D. E. (1986). Managing customers as human resources in service organizations. *Human Resource Management, 25*(3), 371–383.

Bowen, D. E., & Jones, G. (1986). Transaction cost analysis of service organization-customer exchange. *Academy of Management Review, 11*(2), 428–441.

Bowen, D. E., & Schneider, B. (1988). Services marketing and management: Implications for organizational behavior. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 10, pp. 43–80). Greenwich: JAI Press.

Bowers, M. R., Martin, C. L., & Luker, A. (1990). Trading places: Employees as customers, customers as employees. *The Journal of Services Marketing, 4*(2), 55–69.

Cermak, D. S. P., File, K. M., & Prince, R. A. (1994). Customer participation in service specification and delivery. *Journal of Applied Business Research, 10*(2), 90–97.

Chase, R. B., & Erikson, W. J. (1988). The service factory. *The Academy of Management Executive, 2*(3), 191–196.

Dabholkar, P. A. (1990). How to improve perceived service quality by increasing customer participation. In B. J. Dunlap (Ed.), *Developments in marketing science* (Vol. 13, pp. 483–487). Cullowhee, NC: Academy of Marketing Science.

Danet, B. (1984). Client-organization relationships. In P. Nystrom & W. H. Starbuck (Eds.), *Handbook of organizational design* (Vol. 2, pp. 382–428). New York, NY: Oxford University Press.

Dellande, S., Gilly, M. C., & Graham, J. L. (2004). Gaining compliance and losing weight: The role of the service provider in health care services. *Journal of Marketing, 68*(3), 78–91.

Eiglier, P. (1977). A note on the commonality of problems in service management: A field study. In P. Eiglier et al. (Eds.), *Marketing consumer services: New insights* (pp. 61–82). Cambridge, MA: Marketing Science Institute.

Eiglier, P., & Langeard, E. (1977a). A new approach to service marketing. In P. Eiglier et al. (Eds.), *Marketing consumer services: New insights* (pp. 33–58). Cambridge, MA: Marketing Science Institute.

Eiglier, P., & Langeard, E. (1977b). Services as systems: Marketing implications. In P. Eiglier et al. (Eds.), *Marketing consumer services: New insights* (pp. 85–103). Cambridge, MA: Marketing Science Institute.

Eiglier, P., Langeard, E., Lovelock, C. H., Bateson, J., & Young, R. F. (1977). *Marketing consumer services: New insights*. Cambridge, MA: Marketing Science Institute.

Fama, E. F. (1980). Agency problems and the theory of the firm. Journal of Political Economy, 88(2), 288–307.

Fama, E. F., & Jensen, M. C. (1983). Agency problems and residual claims. *Journal of Law and Economics, 26*(2), 327–369.

Firat, A. F., & Venkatesh, A. (1993). Postmodernity: The age of marketing. *International Journal of Research in Marketing, 10*(3), 227–249.

Fitzsimmons, J. A. (1985). Consumer participation and productivity in service operations. *Interfaces, 15*(3), 60–67.

Gartner, A., & Reissman, F. (1974). *The service society and the consumer Vanguard*. New York, NY: Harper and Row.

Goffman, E. R. (1959). *The presentation of self in everyday life*. New York, NY: Doubleday.

Goodwin, C. (1988). 'I can do it myself:' Training the service consumer to cont. *The Journal of Services Marketing, 2*(4), 71–78.

Green, R. T., Langeard, E., & Favell, A. C. (1974). Innovation in the service sector: Some empirical findings. *Journal of Marketing Research, 11*(3), 323–326.

Gross, E. (1981). Work roles. In M. E. Olsen & M. Micklin (Eds.), *Handbook of applied sociology: Frontiers of contemporary research*. New York, NY: Praeger.

Grove, S. J., Fisk, R. P., & Dorsch, M. J. (1998). Assessing the theatrical components of the service encounter: A cluster analysis examination. *The Service Industries Journal, 18*(3), 116–134.

Ha, A. Y. (1998). Incentive-compatible pricing for a service facility with joint production and congestion externalities. *Management Science, 44*(12), 1623–1636.

Hart, C. W. L., Heskett, J. L., & Sasser, W. E. (1990). Profitable art of service recovery. *Harvard Business Review, 68*(4), 148–156.

Henard, D. H., & Szymanski, D. M. (2001). Why some new products are more successful than others. *Journal of Marketing Research, 38*(3), 362–375.

Hill, T. P. (1977). On goods and services. *Review of Income and Wealth, 23*(4), 315–338.

Holland, J. L. (1985). *Making vocational choices: A theory of careers*. Englewood Cliffs, NJ: Prentice-Hall.

Holstrom, B. (1982). *The provision of services in a market economy conference*. In The future of the service economy conference proceedings. Boston, MA: Wharton Business School.

Johnston, R. (1989). The customer as employee. *International Journal of Operations and Production Management, 9*(5), 15–23.

Judd, R. C. (1968). Similarities and differences in products and services retailing. *Journal of Retailing, 4*(4), 1–9.

Kelley, S. W., Donnelly, J. H., & Skinner, S. J. (1990). Customer participation in service production and delivery. *Journal of Retailing, 66*(3), 315–335.

Kelley, S. W., Skinner, S. J., & Donnelly, J. H. (1992). Organizational socialization of service customers. *Journal of Business Research, 25*(3), 197–214.

Kellogg, D. L., Youngdahl, W. E., & Bowen, D. E. (1997). On the relationship between customer participation and satisfaction: Two frameworks. *International Journal of Service Industry Management, 8*(3), 206–219.

Kleijnen, M., Ruyter, K., & Wetzels, M. (2004). Consumer adoption of wireless services: Discovering the rules, while playing the game. *Journal of Interactive Marketing, 18*(2), 51–61.

Langeard, E., Bateson, J. E. G., Lovelock, C. H., & Eiglier, P. (1981). *Services marketing: New insights from consumers and managers*. Cambridge, MA: Marketing Science Institute.

Langer, E. (1978). Rethinking the role of thought in social interaction. In J. H. Harvey, W. Ickes, & R. F. Kidd (Eds.), *New directions in attribution research* (Vol. 2, pp. 35–58). New Jersey: Erlbaum.

Langer, E., Blank, A., & Chanowitz, B. (1978). The mindlessness of ostensibly thoughtful action: The role of placebic information in interpersonal interaction. *Journal of Personality and Social Psychology, 36*(6), 635–642.

Langer, E., & Imber, L. G. (1979). When practice makes imperfect: The debilitating effects of overlearning. *Journal of Personality and Social Psychology, 37*(11), 2014–2024.

Larsson, R., & Bowen, D. E. (1989). Organization and customer: Managing design and coordination. *The Academy of Management Review, 14*(2), 213–233.

Lovelock, C. H., & Young, R. F. (1979). Look to consumers to increase productivity. *Harvard Business Review, 57*(3), 168–178.

Lusch, R. F., Boyt, T., & Schuler, D. (1996). Employees as customers: The role of social controls and employee socialization in developing patronage. *Journal of Business Research, 35*(3), 179–187.

Lusch, R. F., & Vargo, S. L. (2006). *The service-dominant logic of marketing*. New York, NY: Sharpe.

Martin, C. L., & Pranter, C. A. (1989). Compatibility management. *The Journal of Services Marketing, 3*(3), 5–15.

Matties, R. J. (1979). The new back office focuses on customer service. *Harvard Business Review, 57*(2), 146–159.

Meuter, M. L., Bitner, M. J., Ostrom, A. L., & Brown, S. W. (2005). Choosing among alternative service delivery modes: An investigation of customer trial of self-service technologies. *Journal of Marketing, 69*(2), 61–83.

Mills, P. K. (1986). *Managing service industries: Organizational practices in post-industrial economy*. Cambridge, MA: Ballinger.

Mills, P. K. (1990). On the quality of services in encounters: An agency perspective. *Journal of Business Research, 20*(1), 31–41.

Mills, P. K., & Morris, J. H. (1986). Clients as "Partial" employees of service organizations: Role development in client participation. *Academy of Management Review, 11*(4), 726–735.

Mills, P. K., & Dan Moshavi, S. (1999). Professional concern: Managing knowledge-based service relationships. International Journal of Service Industry Management, 10(1), 48–67.

Normann, R., & Ramirez, R. (1993). From value chain to value constellation: Designing interactive strategy. *Harvard Business Review, 71*(4), 65–77.

Pauley, M. (1974). Over insurance and public provision of insurance: The role of moral hazard and adverse selection. *Quarterly Journal of Economics, 88*(1), 44–62.

Peppers, D., & Rogers, M. (1997). *Enterprise one to one*. New York, NY: Currency Doubleday.

Prahalad, C. K., & Ramaswamy, V. (2003). The new frontier of experience innovation. *MIT Sloan Management Review, 44*(4), 12–18.

Rathmell, J. M. (1974). *Marketing and the service sector*. Cambridge, MA: Winthrop.

Rindfleisch, A., & Heide, J. B. (1997). Transaction cost analysis: Past, present, and future applications. *Journal of Marketing, 61*(4), 30–54.
Rogers, E. M. (1995). *Diffusion of innovations* (3rd ed.). New York, NY: Free Press.
Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.
Sasser, W. E. (1976). Match supply and demand in service industries. *Harvard Business Review, 54*(6), 133–141.
Siu, N. Y. M., & Cheng, M. M. S. (2001). A study of the expected adoption of online shopping – the case of Hong Kong. *Journal of International Consumer Marketing, 13*(3), 87–106.
Smith, R. A., & Houston, M. J. (1985). A psychometric assessment of measures of scripts in consumer memory. *Journal of Consumer Research, 12*(2), 214–224.
Solomon, M. R., Surprenant, C., Czepiel, J. A., & Gutman, E. G. (1985). A role theory perspective on dyadic interactions: The service encounter. *Journal of Marketing, 49*(1), 99–111.
Song, J. H., & Adams, C. R. (1993). Differentiation through customer involvement in production or delivery. *Journal of Consumer Marketing, 10*(2), 4–12.
Swan, J. E., Goodwin, C., Mayo, M. A., & Richardson, L. D. (2001). Customer identities: Customers as commercial friends, customer coworkers or business acquaintances. *Journal of Personal Selling & Sales Management, 21*(1), 29–37.
Thompson, J. D. (1967). *Organizations in action*. New York, NY: McGraw-Hill.
Van Raaij, W. F., & Pruyn, A. T. H. (1998). Customer control and evaluation of service validity and reliability. *Psychology & Marketing, 15*(8), 811–832.
Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing, 68*(1), 1–17.
Venkatraman, M. P. (1989). Involvement and risk. *Psychology & Marketing, 6*(3), 229–247.
Wikstrom, S. R. (1996a). Value creation by company-consumer interaction. *Journal of Marketing Management, 12*, 359–374.
Wikstrom, S. R. (1996b). The customer as co-producer.*European Journal of Marketing, 30*(4), 6–19.
Williamson, O. E. (1985). *The economic institutions of capitalism*. New York, NY: Free Press.
Xue, M., & Harker, P. T. (2002). Customer efficiency: Concept and its impact on e-business management. *Journal of Service Research, 4*(4), 253–267.
Youngdahl, W. E., & Kellogg, D. L. (1997). The relationship between service customers' quality assurance behaviors, satisfaction, and effort: A cost of quality perspective. *Journal of Operations Management, 15*(1), 19–32.
Youngdahl, W. E., Kellogg, D. L., Nie, W., & Bowen, D. E. (2003). Revisiting customer participation in service encounters: Does culture matter? *Journal of Operations Management, 21*(1), 109–120.
Zeithaml, V. A. (1981). How consumer evaluation processes differ between goods and services. In J. H. Donnelly & W. R. George (Eds.), *Marketing of services* (pp. 186–190). Chicago, IL: American Marketing Association.
Zeithaml, V. A., Parasuraman, A., & Berry, L. L. (1985). Problems and strategies in services marketing. *Journal of Marketing, 49*(2), 33–34.

Building Innovative Competitive Advantage in the Minds of Customers

Taşkın Dirsehan

Abstract

The paradigm shifts of innovation and marketing in prior years have shown that these shifts arrive at a common point: competitive advantage. From the customers' point of view, we recognize that brand associations are structured as a network in their minds and that customers distinguish among brands according to their competitive advantages. Therefore, a brand has innovative competitive advantage if it has strong favorable innovations associated with it in the minds of customers. These associations are created by innovating value that is strategically managed by marketers. Based on these concepts, the purpose of this study is to propose a conceptual model on innovative competitive advantage as a result of a detailed literature survey and a synthesis thereof. In addition, a pilot study follows the steps of brand concept mapping methodology, which enables us to represent brand image as a network of associations. It aims to demonstrate the practical application of brand innovativeness maps.

1 An Introduction to the Interaction of Innovation and Marketing

In 1986, Tushman and Nadler indicated that "organizations can gain competitive advantage only by managing effectively for today while simultaneously creating innovation for tomorrow" (p. 92). Today, this statement is valid as never before. In a world of increasing technology, information, communication and globalization, markets have become highly competitive and customers become very demanding (Blocker et al. 2011). In today's information era, customers have a wide range of

T. Dirsehan (✉)
Department of Production Management and Marketing (in English), Marmara University, Istanbul, Turkey
e-mail: taskin.dirsehan@marmara.edu.tr; taskindirsehan@gmail.com

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_6

alternatives and seek more. They are always in touch with other customers around them thanks to technological solutions. Thus, firms are faced with various difficulties, such as changing populations, experienced competitors and saturated markets (Chou 2009). In markets with large numbers of firms, companies need to be differentiated (Buckley and Casson 1998), and their survival success factor is the ability to manage innovation (Porter 1990). Innovations not only attract new customers, they also build customer equity by helping a company sell more products to existing customers (Schmitt 2003).

The word *innovation* comes from the verb *innovare* in Latin (Oxford Dictionaries 2014), and it refers to both "a new idea, design, product, etc." and "the development of new products, designs, or ideas" (Cambridge Dictionaries 2014). The term innovation denotes both a process (the manner in which the innovation is designed) and its result (new product, process or service) (European Commission 1995). This dual terminology is the key factor of differentiation by nature. Businesses including innovation in their core strategy and making it a component of their corporate identity not only give themselves a competitive advantage but also increases the level of welfare of their stakeholders (shareholders, employees, customers, suppliers, etc.) (Yalçın 2009).

The field of innovation management has emerged with the process of technological change in the 1970s. By the end of the 1980s, innovation studies had shifted from knowledge-driven activity to market-driven activity (Scott-Kemmis et al. 1989), parallel to the shift of marketing focus from satisfying consumer needs to relationship marketing, which involves developing long-term, value-added relationships over time with customers and suppliers (Kurtz and Boone 2010). By the early 1990s, the innovation management field had two main goals: the modeling of innovation process and the use of these models for the creation of competitive advantage (Roberts 1998). On the other hand, in terms of marketing, especially with the introduction of relationship marketing concept (starting in the 1990s), firms have been more oriented to collecting data on their customers, generally known as customer relationship management (CRM) activities, to create profitable relationships with them. The goal behind building long-term relationships is also to create competitive advantage (Gentile et al. 2007). However, the market orientation of firms receiving feedback from customers and competitors, and then interpreting them, is no longer enough. Organizations should innovatively develop unique ways of delivering superior value to customers to create successful brands (O'Cass and Ngo 2007). As a consequence, in recent years we have observed studies revealing that "the interaction of innovation and marketing capabilities significantly influences firms' marketplace performance more than they do individually" (O'Cass and Ngo 2011). This is because:

1. marketing and innovation are complementary, and
2. marketing and innovation are converged in the aim of creating competitive advantage.

In this study, further investigation into the interaction of innovation and marketing strategies will be beneficial to deeply understand the basis for creating

competitive advantages. For this purpose, a tripod basis is offered to build innovative competitive advantage; value, innovation, and marketing strategy. As marketing strategies' ultimate competition field is the mind of customers, a research method, called Brand Concept Map is defined to illustrate the innovation-based associations of brands in the mind of consumers. Then, a practical research application of this method is conducted in the Turkish mobile sector. In the conclusion part, a pyramid model for innovative competitive advantage is presented as a result of dual relationships of the concepts explained in this chapter.

2 The Tripod Basis for Innovative Competitive Advantage

Global competition, short product life cycles, and evolving customer needs create a fast-changing global marketplace where continuous innovations are in the heart of organizations' superior performance and competitive advantage (Greve 2009; Artz et al. 2010; Bindroo et al. 2012; Urbancová 2013).

The state of competition in an industry depends on five basic forces, as indicated in the famous Porter's Five Forces Model: rivalry among existing competitors, threat of new entrants, bargaining power of suppliers, threat of substitute products or services and bargaining power of buyers (Porter 1979, 2008). Although some of them are uncontrollable (such as the threat of new entrants), firms manage their own resources strategically to strengthen its competitive tools to overcome in the competitive environments. These resources should be used effectively to analyze customers' perceived values, which are captured by the marketing strategy and created by innovation on which innovative competitive advantage is grounded. Accordingly, the tripod basis of innovative competitive advantage are (1) value, (2) innovation, and (3) marketing strategy.

2.1 Value Searched for Preference by Consumers

David (2009) states the aim of strategic management as gaining and maintaining competitive advantage, which is anything a firm does over rival firms (David 2009). Kotler and Armstrong (2012) indicate basically two ways to reach such a distinct advantage: having lower prices or providing more benefits justifying higher prices (Kotler and Armstrong 2012, p. 234). The first option requires minimizing all the costs to as low as possible, which can lead the firms to compete in price wars. In this case, firms should be careful about the customers' asymmetric reaction to price increases versus price decreases, which are explained in detail in kinked-demand curve studies (Sweezy 1939; Rothschild 1992; Dossche et al. 2010). In such a situation, consumers' beliefs and habits are so ingrained that price reductions are attributed to some negative change such as a perceived lowering of quality (Zikmund and D'Amico 1993).

The other option to create competitive advantage concerns the tradeoff of benefits and price, which can be considered another expression of value. Zeithaml (1988) defines consumers' perceived value as follows (Zeithaml 1988, p. 14):

> . . .perceived value is the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given. . . .value represents a tradeoff of the salient give and get components.

Instead of price wars, companies may prefer to compete by creating superior value to consumers to reach sustainability. One of the most effective tools to increase the utility of a product, a service or even a brand is innovation. Actually, it fosters a two-headed value creation:

1. For organizations, it creates value on the operational level (for instance, new products) and on the strategic level (survival and competitiveness of the company) by creating long-range, intangible values like technology leadership and a secured position in an ever-changing market environment (Eschenbaecher 2011).
2. For customers, innovation leads to increases of customer's valuation of the benefits of consumption (Landroguez et al. 2013). As a support, Coutelle-Brillet et al. (2013) reveal the effect of service innovations on different types of perceived value (Coutelle-Brillet et al. 2013). These types include economic value, social value, hedonic value and altruistic value as proposed by Holbrook's (2006) "Typology of Customer Value" (Holbrook 2006). When value is created, Priem (2007) states that the consumer either (Priem 2007):
   (a) *will be willing to pay for a novel benefit*,
   (b) *will be willing to pay more for something perceived to be better, or*
   (c) *will choose to receive a previously available benefit at a lower unit cost, which often results in a greater volume purchased.*

Walters and Lancaster (1999) suggest that the value proposition as a result of considering "value chain alternatives" may strengthen the organization's competitive positioning.

2.2 Innovation for Competitive Effects

When constructing their value chains, firms should consider different innovation types to be differentiated from competitors. In the literature, innovation is investigated with several classifications. Some authors distinguish innovation types according to its degree viewed on a continuum, including radical, incremental, sustaining and disruptive innovations (Abbasi et al. 2012). Some other authors distinguish innovation types based on where it takes place:

– Product and Process Innovations (Kotabe and Murray 1990; Damanpour 2010; Huang and Rice 2012),

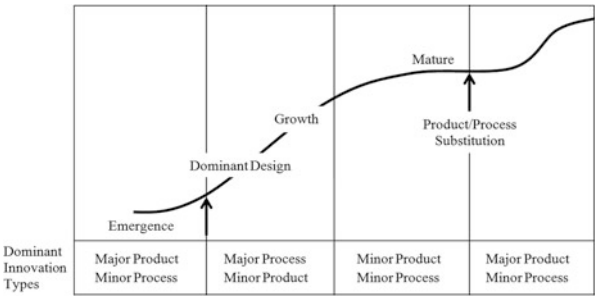


Fig. 1 Types of innovation over product life cycle (Tushman and Nadler 1986, p. 78)

- Technological and Administrative Innovations (Kimberly and Evanisko 1981; Jaskyte 2011), and
- Classifications For Several Specializations (for instance, service innovations, technological process innovations, and administrative process innovations in terms of service organizations) (Damanpour et al. 2009).

The first category (product and process innovations) is a basic classification and Tushman and Nadler (1986) show their changing relative importance over the product life cycle as illustrated in Fig. 1. In the introductory stage, product innovation is relatively more important since several forms of the same product compete for dominance. For instance, in the automobile sector, this period of product competition leads to the emergence of a dominant design which shape the evolution of the firms' product classes for years. In the next stage, competition is based on price, quality and segmentation, in other words, process innovation rather than product innovation. During the mature phase which may be very profitable, only incremental product and process innovations are possible. This stage lasts until some external shock (such as deregulation, technological change, or foreign competition) occurs.

The last category of innovation types (classifications for several specializations) allows to researchers multiplying the innovation classifications according to sectors, processes, organizations and functions.

Consequently, all innovation types contribute to the competitive advantages of companies (Weerawardena and O'Cass 2004; Weerawardena and Mavondo 2011). As a practical example, a research on mobile phones takes place to reveal their innovation-based competitive advantages from the consumers' part. However, different kinds of innovation lead to different competitive effects (Markides 2006). Thus, the market environment should be known completely. Especially consumers, suppliers, competitors, politics, technologic infrastructure and adequate competitive advantages should be developed and managed strategically, which is the role of marketing strategy.

2.3 Marketing Strategy to Manage Innovation Strategically

The competitive strategy is related to the level of innovation orientation of an organization. In other words, firms with high innovation orientations engage in value creation strategies such as market segmentation, developing new products or services for new markets, and product or service customization (Dobni 2010). For instance, marketers may consider "consumer innovativeness" in their segmentation process to make decisions about bringing an innovation to a certain country. Tellis et al. (2009) define consumer innovativeness as "a consumer's propensity to adopt new products," and they suggest that this construct varies from country to country (Tellis et al. 2009). As an example to manage innovation in marketing strategy, Kim (2010) illustrates how a Canadian firm in Japan innovates value in a competitive marketplace by increasing its premium image with an innovative food safety program by creating a new market segment in Japan and attracting consumers who are interested in both brand and price. This process integrates business model innovation and product innovation through marketing strategy.

According to Slater and Narver (1995), successful innovations occur when entrepreneurs recognize a gap between what the market needs and what is offered and directing resources towards meeting that need. Moreover, leading companies do not wait for customers' needs and desires to change but they use innovation to create new ones (Evans 1997). Otherwise, a narrow focus on products rather than customer needs can lead a business into what Levitt (1960) calls the "marketing myopia" trap (Tajeddini and Trueman 2008). Therefore, marketers should propose some new benefits using innovation to be differentiated from competitors in the mind of customers. For this purpose, marketers may find points of differentiation by analyzing every customer contact point, and they can differentiate along the lines of product, services, channels, people, or image (Kotler and Armstrong 2012). In other terms, marketing strategy involves creating competitive advantage by differentiating a customer contact point through innovation, offering superior values to customers.

In conclusion, innovation, marketing strategy and value are interrelated and indispensable to creating innovative competitive advantage. The term of "innovative competitive advantage" is used to differentiate the competitive advantage created by innovation as a provider of value from the one competing with the lowest prices possible.

A practical example is useful to reveal the firms' innovation-based competitive advantages. As Trout and Rivkin (1995) indicate, ultimate marketing battleground is the mind. So, an investigation of firm innovativeness in the consumer minds is necessary to see firms' innovative positions.

3 How Do Consumers Associate Innovation with Brand in their Minds?

Aaker (2007) stresses that, mostly the organization brand will benefit from being perceived as being innovative. The perception of an object is affected by what is associated with it, such as the perception of a person's personality by his or her clothes, friends, activities, living space, and much more characteristics. So, innovation efforts are designed not only to create innovative processes and products, but also to affect the perception of the organization in the marketplace.

Keller et al. (2012) emphasize the close relationship of sustainable competitive advantage with brands' points of difference, which are strong, favorable and unique associations for a brand. These associations in the mind of consumers are organized in a network around a brand, consistent with an associative network model of memory (John et al. 2006).

3.1 Theoretical Basis of Concept Maps

The first attempt of mapping the human mind was the adoption of "cognitive mapping" by Tolman's (1948) study proposing that rats built up their cognitive maps in their minds when they navigated through experimental mazes. This experiment was the base to introduce maps in the learning process.

As explained by Novak (1993), until the 1970s, the dominant view of learning, behaviorism, contended that a stimulus from the environment produced a response from the organism and, with repetition, a stimulus was almost associated with a response. Then, rejecting this idea, Novak (1993), considering the Assimilation Theory of Ausubel (1963), supported constructivist ideas, proposing that "knowledge is a construction based on previous knowledge and constantly evolving over time." He developed concept maps as a powerful tool characterizing knowledge structures with his research group at Cornell University (Novak 1993). Novak and Cañas (2006) define concept maps as follows:

> Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts.

In addition, Novak defines "concept" as (2013):

> perceived regularity or pattern in events or objects, or records of events or objects, designated by a label, which usually is a word.

Concept maps are used with two main purposes: instruction and evaluation (Novak and Cañas 2006). While the instruction purpose is used in general by teachers in education, the evaluation purpose is adequate also for marketers to retrieve knowledge existing in the consumer minds. In the case of brands, the concepts are the associations related with the brands, and the concept map for a brand will represent the associations customers have in their minds.

3.2 Brand Concept Map as a Method to Reveal the Associations in the Consumer Mind

After observing consumer researchers' attention to consumers' marketing-related cognitive structures, Joiner (1998) introduces a concept mapping as a research technique in marketing to reliably uncover consumers' knowledge structure associations (Joiner 1998). In a brand-specific approach, brand image refers to the strength, uniqueness, and favorability of brand associations, organized in a network in the consumer's memory (Keller 1993). John et al. (2006) propose a brand concept map (BCM) as a measurement technique for brand image using a three-stage method to construct a BCM: elicitation stage, mapping the elicited associations stage and aggregating the maps stage (John et al. 2006). Brandt et al. widens BCM applications to cities, in addition to services and consumer goods (Brandt and de Mortanges 2011). Schnittka et al. (2012) also measure the favorability of brand associations when constructing BCM and developing the Brand Association Network Value (BANV) metric (Schnittka et al. 2012). French and Smith (2013) use BCM, along with network analysis measures, to produce a measure of brand association strength (French and Smith 2013). The emerging focus on BCM studies indicate the importance of the subject and should be considered in marketing strategies.

When concept maps are constructed for different brands, a representation like that in Fig. 2 can be obtained. In such a map conducted with three brands, three types of associations can be obtained:

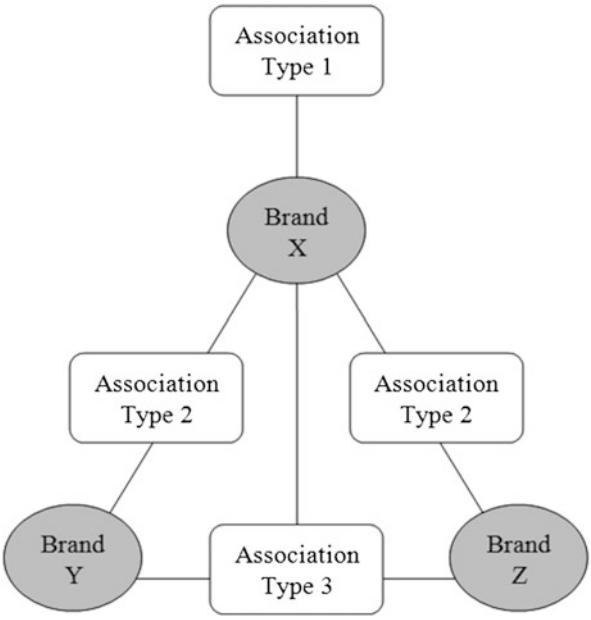


Fig. 2 A basic illustration of a brand concept map (developed by the author based on relevant literature review)

- Association Type 1 represents the differentiating association for Brand X.
- Association Type 2 represents the common associations of Brand X with the other brands.
- Association Type 3 represents the common association of all three brands (in general the association related to the sector).

In this kind of concept map, the aim of a brand should be associations of type 1, which will be used as a competitive tool in marketing strategies. The necessary condition is that associations of type 1 should be favorable and strongly associated to the brand (it is unique by nature.). The degree of strength may be represented by the darkness of the line, and the favorability of an association may be represented with the length of the diameter of its circle.

A brand will improve its innovative competitive advantages as much as it has innovation-related associations of type 1 in the mind of consumers. If a firm innovates a value in marketing strategy, consumers will differentiate the brand according to the innovative association and position it strongly among competitors. As a result, the brand with innovative associations will improve its image based on innovation.

4 Methodology for a Pilot Research on Mobile Phone Sector

In this part of the study, a pilot research is conducted to show the practical application of the BCM use to reveal brands' perceived innovation-related associations. For this purpose, the adjectives of the scale "Perceived Firm Innovativeness (PFI)" are used. This scale is developed by Kunz et al. (2011) and it is conceptualized as the consumer's perception of an enduring firm capability that results in novel, creative, and impactful ideas and solutions. After testing the validity of the scale, the authors show that PFI impacts consumer loyalty via two processing routes: a functional–cognitive route and an affective–experiential route. The adjectives derived from the PFI scale are "Creative, Forward-Looking, Dynamic, Pioneer, Generating New Ideas, Changing the Market with its Offerings, Creating Market Trend, Launching New Products".

As previous research indicate the mobile phone sector as one of the innovation-driven sectors and the PFI scale was previously used in this sector by the authors in the scale developing process, four leading brands constituting the majority of the Turkish mobile sector are chosen in this study, which are Nokia, Samsung, iPhone and Blackberry. Due to the time and budget constraints, a convenience sample method is selected. So, 163 people aged between 20 and 30 (young people are thought as sensitive to innovation with ability to buy) in Istanbul are included in the sample. They are asked three types of questions.

Firstly, the favorability of the adjectives listed above are asked to respondents on a Likert scale. In this first step there were no brand names. Then, the strength of the relationship between the adjectives and the four brands are asked to respondents measured by the four options (0: no relationship, 1: weak strength, 2: average

strength, 3: strong strength). In this step, all the adjectives are repeated for each brand. Finally, the demographic characteristics are identified for the respondents. There were 82 females and 81 males in the sample with an average age of 23.94 years.

5 Research Findings and Maps for Perceived Brand Innovativeness

The means and standard deviations for the favorability of innovation-related associations are presented in Table 1.

According to Table 1, it is possible to say that all these associations are favorable for respondents. However, three associations (Creative, Generating New Ideas and Forward-Looking) are particularly more favorable than the others. Thus, these associations will provide competitive advantage for brands. However, there is another point to be investigated: How strongly are these associations related to the brands? In order to answer this question, all the associations' relationship strength for each brand will be investigated with the respondents. Table 2 summarizes the result for this step.

Table 2 indicates that Samsung and iPhone are perceived to be more innovative than their competitors considering all the associations. Samsung's main innovative association is "Launching New Products," while iPhone's is "Changing the Market with its Offerings." In terms of "Creative, Generating New Ideas and Forward Looking" associations, which are the most favorable ones, iPhone has more strong relationships compared with its competitors. In order to facilitate comments on these tables, brand maps can be built to illustrate:

- which one is the strongest within a brand's associations,
- which associations represent the brand's competitive advantages,
- if the strong associations of a brand are also strongly related to those of other brands,
- if the strong associations of a brand are also favored by consumers,
- which are the strong associations of a brand's competitors.

Table 1 Favorability of innovation-related associations, N = 163

Association	Mean	Std. deviation
Creative	4.26	0.93
Generating New Ideas	4.22	0.93
Forward-Looking	4.20	1.00
Dynamic	3.89	1.03
Launching New Products	3.82	1.09
Pioneer	3.82	1.15
Changing the Market with its Offerings	3.82	1.07
Creating a Market Trend	3.50	1.08

Table 2 Means (*std. deviations*) of associations' relationship strength with brands, N = 163

Association	Nokia	Samsung	iPhone	BlackBerry
Creative	1.37 (*0.90*)	2.39 (*0.71*)	2.61 (*0.65*)	1.36 (*0.97*)
Generating New Ideas	1.42 (*1.00*)	2.37 (*0.72*)	2.66 (*0.62*)	1.25 (*1.02*)
Forward-Looking	1.01 (*0.94*)	2.25 (*0.90*)	2.45 (*0.84*)	0.98 (*0.80*)
Dynamic	1.12 (*0.89*)	2.28 (*0.80*)	2.32 (*0.92*)	1.08 (*0.80*)
Launching New Products	1.52 (*0.91*)	2.60 (*0.61*)	2.50 (*0.65*)	1.30 (*1.01*)
Pioneer	1.14 (*0.94*)	2.12 (*0.79*)	2.54 (*0.78*)	1.10 (*0.85*)
Changing the Market with its Offerings	1.24 (*1.03*)	2.45 (*0.63*)	2.68 (*0.57*)	1.25 (*0.99*)
Creating a Market Trend	1.10 (*0.95*)	2.31 (*0.86*)	2.53 (*0.88*)	1.11 (*0.86*)

Innovativeness maps can be built for each brand and also aggregated to represent the whole sector. Figures 3, 4, 5, and 6 illustrate the associations of the brands separately for Nokia, Samsung, iPhone and BlackBerry, respectively. The diameters of associations represent their means of favorability scores. The circles with larger diameters indicate association with a higher favorability score. The diameters of the brands represent the average of all innovation-related associations. The brands drawn with higher circles indicate a higher average for the brand in terms of the brand's general relationship with the associations. The thickness of the lines between association and brand represents how strong the association is relative to the brand. The thick lines indicate strong relationships. The darkness of the circles is used to differentiate the brands, the associations and the unique associations for brands that could be represented in future studies. Figure 7 illustrates the innovativeness of the firms in the sector as a whole.

Fig. 7 indicates that there are no unique brand associations in this case, so all the brands in the mobile sector include innovation-related associations but in different weights. So, this demonstration provides a clear vision with which to interpret the figures presented in the tables above. When we focus on "creative" association, it is the most favorable association (represented with the largest association circle) and it's more strongly related with iPhone than the other brands (represented with the thickest line), but it is shared with other brands (represented with lines to other brands). Thus, this representation makes easier to interpret different dimensions together for each association.

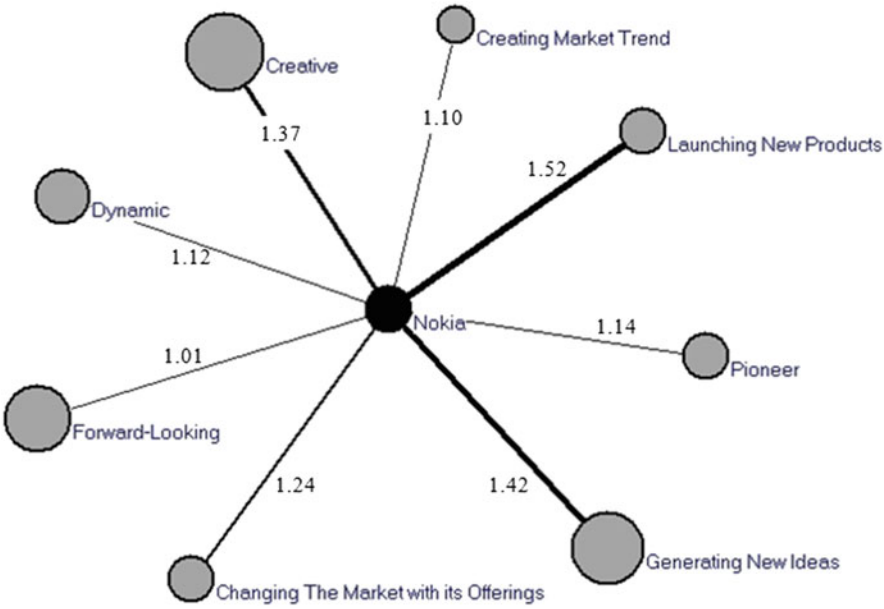


Fig. 3 Brand innovativeness map for Nokia (developed by the author based on own computations)

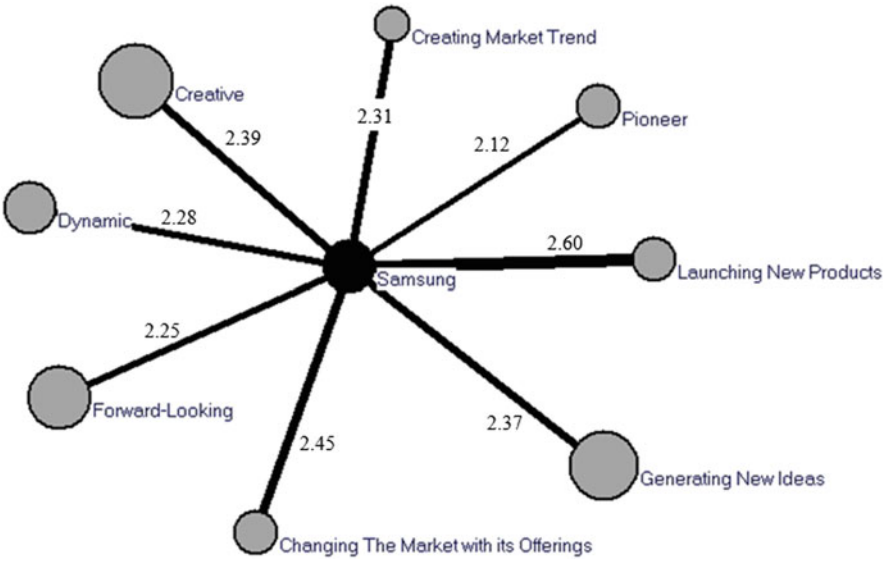


Fig. 4 Brand innovativeness map for Samsung (developed by the author based on own computations)

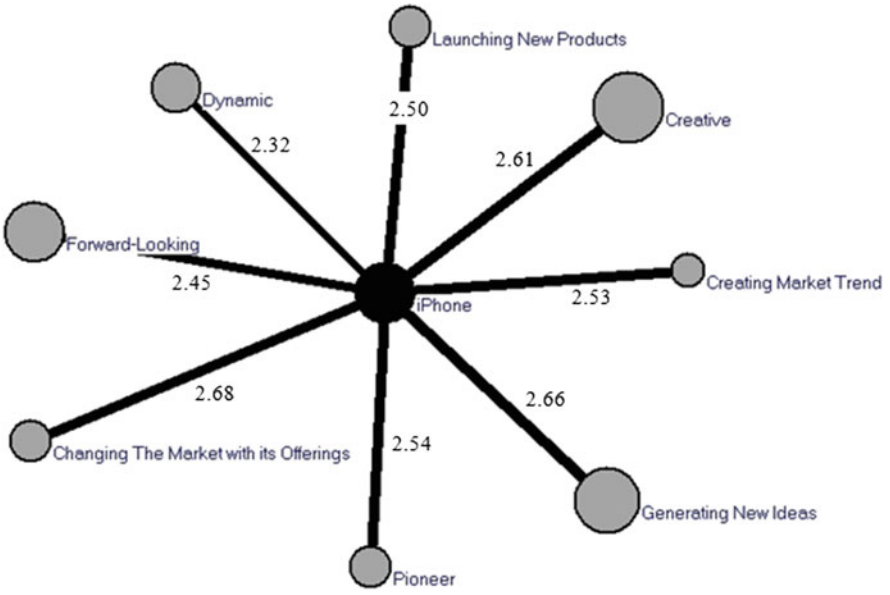


Fig. 5 Brand innovativeness map for iPhone (developed by the author based on own computations)

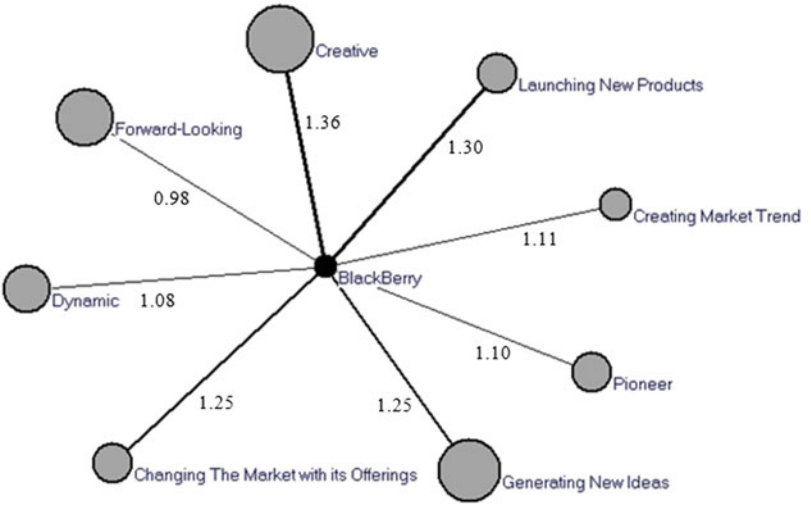


Fig. 6 Brand innovativeness map for BlackBerry (developed by the author based on own computations)

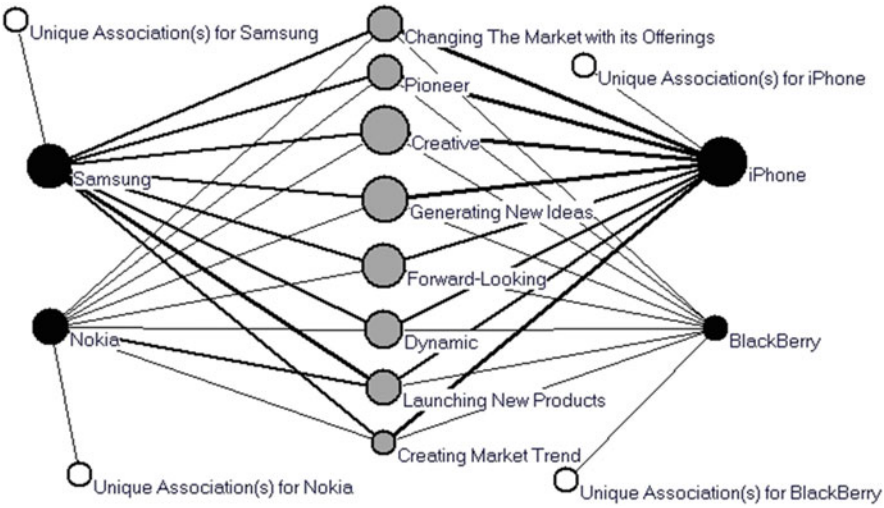


Fig. 7 Aggregated brand innovativeness map (developed by the author based on own computations)

6 Concluding Remarks to Aggregate Proposed Pyramid Model

This study tries to conceptualize innovative competitive advantage, which can be defined as brands' favorable and differentiating associations in the mind of consumers and is created by innovating value that is strategically managed by marketers.

This definition conveys that innovative competitive advantage is based on marketing strategy, value and innovation, which are interconnected and hold customers at an intersection point. Customers structure a network of associations about a brand as a result of the interconnection, differentiating groundbreaking brands that represent an innovative competitive advantage. To demonstrate its practical application, a pilot study with the brands in the mobile phone sector, where innovation is considered a main competitive advantage, is conducted; innovativeness maps are developed for each brand and an aggregated map is also constructed to clearly show the competitive advantages of the brands in terms of innovation-related associations. So, this is a first attempt to integrate brand concept maps in the innovation area to visualize firms' innovativeness associations.

The elicitation stage of this research takes into consideration the adjectives of the Perceived Firm Innovativeness Scale. Further studies may use qualitative research techniques such as the Zaltman Metaphor Elicitation Technique (See Zaltman and Coulter 1995) to reveal different innovative-related associations.

In the mapping stage, a quantitative technique is used and the maps are drawn according to respondents' results to two Likert questionnaires: (1) the strength between associations and brands and (2) favorability of the associations.

In the aggregate mapping stage (which is labeled as "Aggregated Brand Innovativeness Map" in this case), all the brands with their associations are captured on a unique map that clearly displays the competitive advantages in the minds of customers. This mapping technique has three important advantages for academics and practitioners:

1. The Aggregated Brand Innovativeness Map demonstrates all the associations and the strength of the links connected to brands in the sector as a whole. So, it visualizes the competitive advantages of the brands.
2. In such a map, the favorability of the associations is also represented in the size of the circles' diameters.
3. This visualization helps readers to see the brands' unique associations (which have no links connected to other brands).
4. The previous characteristics of this technique make it useful in brand image measurements based on Keller's (1993) definition: Brand image refers to the strength, uniqueness, and favorability of brand associations, organized in a network in the consumer's memory.
5. This technique reveals the competition structures, in terms of associations, one by one, while other positioning map approaches, such as Multidimensional Scaling or Boston Consulting Technique, limit themselves in lower associations or factors.

Innovative competitive advantages obtained as a result of this research are visualized in a map-form that reflects the minds of customers, which are analyzed by marketing strategies. Innovation is built upon the feedback of customers. Moreover, the integration of marketing strategy and innovation delivers value to them.

To summarize the concepts, the relationships are illustrated in a triangular pyramid form. The reasons behind the three surfaces can be investigated in dyads:

- Innovation–marketing strategy: Innovation should occur in every process of marketing strategy, so the two concepts should be integrated. Marketing strategy is roughly characterized as segmentation, targeting and positioning. An organization may innovate its segmentation and targeting processes by leaving traditional methods and using innovation; for instance, taking into consideration consumer innovativeness. In terms of positioning, a firm may create differentiations by innovation; for instance, offering new designs, packages, creating new usage areas, addressing new lifestyles, communicating in a new way, etc.
- Innovation–value: Innovation creates more dedication. If the innovation is about product use, the customer will be ready to devote more to obtain the brand since it will be more valuable.
- Value–marketing strategy: Marketing strategy captures value and offers it to customers. One of the basic functions of marketing is creating value for customers.
- Customers–innovation: Innovation requires customer feedback to create new innovations. In other terms, innovation can be created through feedback from customers.

- Customers–value: Value is offered to customers.
- Customers–marketing strategy: The basis of marketing strategy is customers, and they should be analyzed in detail so the business can become a customer-centric organization.
- Customers–BCM in the mind: Customers learn about the brand and associate the attributes to a mental network.
- BCM in the mind–innovative competitive advantage: The innovative differentiating associations lead to an innovative competitive advantage.
- Innovative competitive advantage–innovation: Innovation is used as a tool to create innovative differentiating associations.
- Innovative competitive advantage–marketing strategy: The ultimate goal of marketing strategy is to position the brand differently from one's competitors based on competitive advantages.
- Innovative competitive advantage–value: Innovative differentiating associations derive from the benefits.

Aggregating these dual relationships, the proposed model, shaped as a pyramid, is illustrated in Fig. 8. This model may be reconsidered and detailed with different innovation types and/or value types and can be specialized for different marketing strategy processes in further studies and investigations.

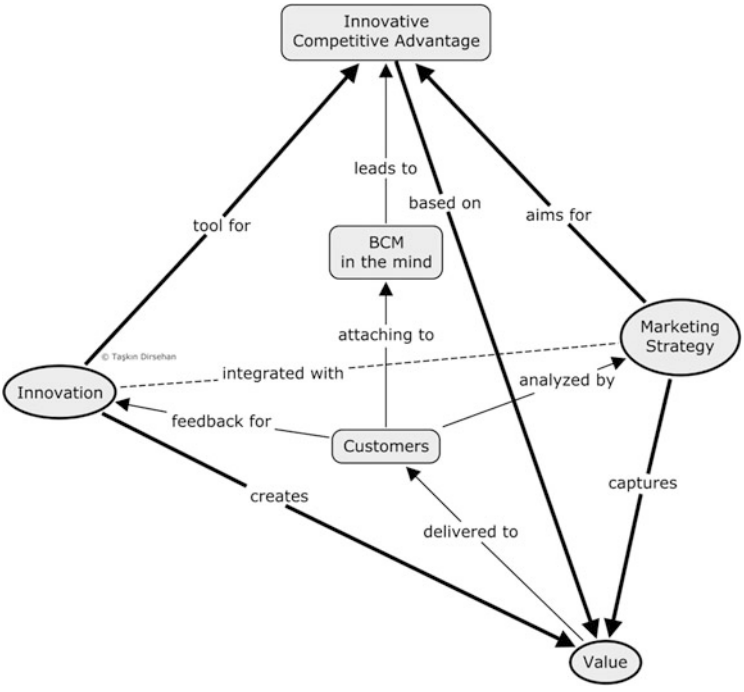


Fig. 8 The pyramid model for innovative competitive advantage (developed by the author based on relevant literature review)

References

Aaker, D. (2007). Innovation: Brand it or lose it. *California Management Review, 50*(1), 8–19.

Abbasi, S., Belhadjali, M., & Whaley, G. (2012). Innovation: A descriptive approach to the new form of competitiveness. *Competition Forum, 10*(1), 76–78.

Artz, K., Norman, P., Hatfield, D., & Cardinal, L. (2010). A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. *Journal of Product Innovation Management, 27*, 725–740.

Ausubel, D. (1963). *The psychology of meaningful verbal learning*. New York, NY: Grune & Stratton.

Bindroo, V., Mariadoss, B., & Pillai, R. (2012). Customer clusters as sources of innovation-based competitive advantage. *Journal of International Marketing, 20*(3), 17–33.

Blocker, C., Flint, D., Myers, M., & Slater, S. (2011). Proactive customer orientation and its role for creating customer value in global markets. *Journal of the Academy of Marketing Science, 39*(2), 216–233.

Brandt, C., & de Mortanges, C. (2011). City branding: A brand concept map analysis of a university town. *Place Branding and Public Diplomacy, 7*(1), 50–63.

Buckley, P., & Casson, M. (1998). Models of multinational enterprises. *Journal of International Business Studies, 29*(1), 21–44.

Cambridge Dictionaries (2014). Accessed January 12, 2014, from http://dictionary.cambridge.org/dictionary/business-english/innovation?q=innovation

Chou, H. (2009). The effect of experiential and relationship marketing on customer value: A case study of international American casual dining chains in Taiwan. *Social Behavior and Personality, 37*(7), 993–1008.

Coutelle-Brillet, P., Riviere, A., & des Garets, V. (2013). Perceived value of service innovation: A conceptual framework. *Journal of Business & Industrial Marketing, 29*(2).

Damanpour, F. (2010). An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management, 21*, 996–1010.

Damanpour, F., Walker, R., & Avellaneda, C. (2009). Combinative effects of innovation types and organizational performance: A longitudinal study of service organizations. *Journal of Management Studies, 46*(4), 650–675.

David, F. (2009). *Strategic management: Concepts and cases* (12th ed.). Upper Saddle River, NJ: Pearson.

Dobni, C. (2010). The relationship between an innovation orientation and competitive strategy. *International Journal of Innovation Management, 14*(2), 331–357.

Dossche, M., Heylen, F., & den Poel, D. (2010). The kinked demand curve and price rigidity: Evidence from scanner data. *Scandinavian Journal of Economics, 112*(4), 723–752.

Eschenbaecher, J. (2011). Managing and optimizing innovation processes in collaborative and value creating values. *International Journal of Innovation and Technology Management, 8*(3), 373–391.

European Commission. (1995, December). Green paper on innovation, pp. 1–59.

Evans, J. (1997). *Production/operations management: Quality, performance, and value* (5th ed.). Minneapolis/St. Paul, MN: West Publishing Company.

French, A., & Smith, G. (2013). Measuring brand association strength: A consumer based brand equity approach. *European Journal of Marketing, 47*(8), 1356–1367.

Gentile, C., Spiller, N., & Noci, G. (2007). How to sustain the customer experience: An overview of experience components that co-create value with the customer. *European Management Journal, 25*(5), 395–410.

Greve, H. (2009). Bigger and safer: The diffusion of competitive advantage. *Strategic Management Journal, 30*, 1–23.

Holbrook, M. (2006). Consumption experience, customer value, and subjective personal introspection: An illustrative photographic essay. *Journal of Business Research, 59*, 714–725.

Huang, F., & Rice, J. (2012). Openness in product and process innovation. *International Journal of Innovation Management, 16*(4), 1–24 (1250020).
Jaskyte, K. (2011). Predictors of administrative and technological innovations in nonprofit organizations. *Public Administration Review, 71*, 77–86 (January & February).
John, D., Loken, B., Kim, K., & Monga, A. (2006). Brand concept maps: A methodology for identifying brand association networks. *Journal of Marketing Research, 43*(November), 549–563.
Joiner, J. (1998). Concept mapping in marketing: A research tool for uncovering consumers' knowledge structure associations. *Advances in Consumer Research, 25*, 311–317.
Keller, K. (1993). Conceptualizing, measuring, and managing customer-based brand equity. *Journal of Marketing, 57*(January), 1–22.
Keller, K., Apéria, T., & Georgson, M. (2012). *Strategic brand management: A European perspective* (2nd ed.). Harlow: Pearson.
Kim, R. (2010). Value innovation in export marketing strategy: The case of a Canadian firm in Japan. *Journal of Food Products Marketing, 16*(4), 361–372.
Kimberly, J., & Evanisko, M. (1981). Organizational innovation: The influence of individual, organizational and contextual factors on hospital adoption of technological and administrative innovations. *Academy of Management Journal, 24*(4), 689–713.
Kotabe, M., & Murray, J. Y. (1990). Linking product and process innovations and modes of international sourcing in global competition: A case of foreign multinational firms. *Journal of International Business Studies, 21*(3), 383–408.
Kotler, P., & Armstrong, G. (2012). *Principles of marketing* (14th ed.). Harlow: Pearson.
Kunz, W., Schmitt, B., & Meyer, A. (2011). How does perceived firm innovativeness affect the consumer? *Journal of Business Research, 64*, 816–822.
Kurtz, D., & Boone, L. (2010). *Principles of contemporary marketing* (14th ed.). China: South-Western.
Landroguez, S., Castro, C., & Cepeda-Carrión, G. (2013). Developing an integrated vision of customer value. *Journal of Services Marketing, 27*(3), 234–244.
Levitt, T. (1960). Marketing myopia. *Harvard Business Review, 38*(4), 45–56.
Markides, C. (2006). Disruptive innovation: In need of better theory. *Journal of Product Innovation Management, 23*, 19–25.
Novak, J. (1993). Human constructivism: A unification of psychological and epistemological phenomena in meaning making. *International Journal of Personal Construct Psychology, 6*, 167–193.
Novak, J. (2013). Meaningful learning is the foundation for creativity. *Revista Qurriculum, 26*, 27–38.
Novak, J., & Cañas, A. (2006). *The theory underlying concept maps and how to construct them* (pp. 1–33) (Technical Report IHMC Cmap Tools 2006–01), Florida Institute for Human and Machine Cognition.
O'Cass, A., & Ngo, L. (2007). Market orientation versus innovative culture: Two routes to superior brand performance. *European Journal of Marketing, 41*(7/8), 868–887.
O'Cass, A., & Ngo, L. (2011). Winning through innovation and marketing: Lessons from Australia and Vietnam. *Industrial Marketing Management, 40*, 1319–1329.
Oxford Dictionaries (2014). Accessed January 12, 2014, from http://www.oxforddictionaries.com/definition/english/innovation
Porter, M. (1979). How competitive forces shape strategy. *Harvard Business Review*, March–April, 1–10.
Porter, M. (1990). The competitive advantage of nations. *Harvard Business Review*, March–April, 73–91.
Porter, M. (2008). The five competitive forces that shape strategy. *Harvard Business Review*, January, 79–93.
Priem, R. (2007). A consumer perspective on value creation. *Academy of Management Review, 32* (1), 219–235.

Roberts, R. (1998). Managing innovation: The pursuit of competitive advantage and the design of innovation intense environments. *Research Policy, 27*, 159–175.

Rothschild, R. (1992). A simple proof of Sweezy's 'kinked-demand' conjecture. *Scottish Journal of Political Economy, 39*(1), 69–75.

Schmitt, B. (2003). *Customer experience management*. Hoboken, NJ: Wiley.

Schnittka, O., Sattler, H., & Zenker, S. (2012). Advanced brand concept maps: A new approach for evaluating the favorability of brand association networks. *International Journal of Research in Marketing, 29*, 265–274.

Scott-Kemmis, D., Darling, T., & Johnston, R. (1989). Innovation theory: Developments in the 1980s and policy for the 1990s. *ASEAN Journal on Science and Technology for Development, 6*(2), 1–14.

Slater, S., & Narver, J. (1995). Market orientation and the learning organization. *Journal of Marketing, 59*(July), 63–74.

Sweezy, P. (1939). Demand under conditions of oligopoly. *Journal of Political Economy, 47*(4), 568–573.

Tajeddini, K., & Trueman, M. (2008). The potential for innovativeness: A tale of Swiss watch industry. *Journal of Marketing Management, 24*(1–2), 169–184.

Tellis, G., Yin, E., & Bell, S. (2009). Global consumer innovativeness: Cross-country differences and demographic commonalities. *Journal of International Marketing, 17*(2), 1–22.

Tolman, E. (1948). Cognitive maps in rats and men. *The Psychological Review, 55*(4), 189–208.

Trout, J., & Rivkin, S. (1995). *The new positioning: The latest on the world's #1 business strategy*. New York: McGraw-Hill.

Tushman, M., & Nadler, D. (1986). Organizing for innovation. *California Management Review, 28*(3), 74–92.

Urbancová, H. (2013). Competitive advantage achievement through innovation and knowledge. *Journal of Competitiveness, 5*(1), 82–96.

Walters, D., & Lancaster, G. (1999). Value-based marketing and its usefulness to customers. *Management Decision, 37*(9), 697–708.

Weerawardena, J., & Mavondo, F. (2011). Capabilities, innovation and competitive advantage. *Industrial Marketing Management, 40*, 1220–1223.

Weerawardena, J., & O'Cass, A. (2004). Exploring the characteristics of the market-driven firms and antecedents to sustained competitive advantage. *Industrial Marketing Management, 33*, 419–428.

Yalçın, A. (2009). *İnovasyonla hizmet ve deneyim (Service and experience through innovation)*. İstanbul: Yaprak.

Zaltman, G., & Coulter, R. (1995). Seeing the voice of the customer: Metaphor-based advertising research. *Journal of Advertising Research*, July/August, 35–51.

Zeithaml, V. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing, 52*(July), 2–22.

Zikmund, W., & D'Amico, M. (1993). *Marketing* (4th ed.). St. Paul, MN: West Publishing Company.

Institutions and Collaborative Innovation

Chander Velu

Abstract

This paper explores the importance of developing institutions as a means to govern collaborative innovation among stakeholders such as individuals and firms. We argue that institutions are a key element in the creation of markets to enable and sustain collaborative innovation. Institutions can be both informal and formal. Informal institutions include conventions, moral rules and social norms whereby there is no external enforcer. Formal institutions need external enforcement by a third party. We use the prisoner's dilemma game and the empirical results from it as an analogy to draw lessons about how institutions could be developed to enhance collaborative innovations. We use case vignettes to illustrate our findings. We draw implications for managers to shape the institutional structure for collaboration by demonstrating the importance of fairness, reciprocity, development of social capital and understanding demographic characteristics of the participants. In addition, we show when participants are less homogenous, a formal external agency is needed to encourage collaboration.

1 Introduction

Starbucks, the premier roaster and retailer of specialty coffee in the world, uses an online forum called MyStarbucks Idea to enable customers to provide ideas for innovation of its products and services. Starbucks recently launched a cup holder that enables customers to mix sugar with ease while holding the cup. This innovation was developed from the ideas generated by customers through

C. Velu (✉)
Department of Engineering, Institute for Manufacturing, University of Cambridge, 17 Charles Babbage Road, Cambridge, CB3 0FS UK
e-mail: c.velu@eng.cam.ac.uk

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_7

MyStarbucks Idea. HP recently formed an alliance with Brightidea.com to provide custom innovation portals in order to collaborate with customers, employees and partners. The concept of sourcing ideas from outside the firm to stimulate innovation is not new. However, firms are increasingly making the search for new ideas from outside a systematic process and a strategic capability to drive growth. The increasing prevalence of such a phenomenon is resulting in a call for marketing scholars to study innovation within a networked ecosystem of firms (Day 2011; Achrol 1997).

Idea generation to commercialization of new ideas was traditionally done internally, and firms rarely resorted to sharing innovative results as a means to generate competitive advantage (Chesbrough 2003). However, firms are moving to a more collaborative approach with customers, suppliers and even with competitors to drive innovation and growth. Such a process calls for collaboration and management of both multiple stakeholders, namely the hub firm and its partners and among partner firms. The forces that are shaping the move to a more collaborative innovation model are globalization, the intensity of technological change and shift in industry borders (Gassmann 2006). Although the concept of collaborative or open innovation has been extolled much in academic research and the popular press, one of the major issues to consider is the incentive for firms and customers to cooperate among each other (Vanhaverbeke et al. 2008). Often the act of opening up involves the risk of not keeping to the 'open' philosophy and ownership of intellectual property (Von Hippel and von Krogh 2006). Most existing studies in marketing assume that the market already exists and that firms need to find a way of competitively differentiating themselves from competitors (Humphreys 2010). However, in the case of radically new product and service propositions, the market itself needs to be created. Institutions and the associated governance is a key element of creating new markets. The sustainability of the collaborative innovation model calls upon the need for institutions to govern how participants cooperate with each other for their mutual benefit. This paper seeks to show how the development of institutions to govern cooperation of individuals and firms can be developed (Mantzavinos 2001). First, the paper will look at the development of informal institutions such as convention, moral rules and social norms in the absence of a formal external enforcer. Second, the paper will look at the development of formal institutions where third party entities are needed to encourage cooperation.

In this article, we develop a conceptual framework to understand the relationship between institutions and cooperation for collaborative innovation. First, we demonstrate the tension faced by firms in wanting to cooperate in order to benefit from collaboration whilst facing the threat of defection by using the prisoner's dilemma game as an analogy. We then use empirical results from past research on the prisoner's dilemma to draw lessons about how firms can develop the appropriate institutional structure to encourage cooperation between stakeholders in an ecosystem. We illustrate our findings using case vignettes.

The next section discusses the prisoner's dilemma as the conceptual model. Section 3 looks at the development of institutions as the governing mechanism for collaborative innovation. Section 4 looks at the managerial implications and concludes.

2 Prisoner's Dilemma Conceptual Framework for Collaborative Innovation

One of the key areas of capability for embracing the open innovation business model is the ability to search for information to solve problems in order to innovate (Nelson and Winter 1982). However, for firms and communities to be involved jointly in such a collective problem solving initiative calls for cooperation from the stakeholders. One can look at this problem as a prisoner's dilemma game.[1] As is popularly known in game theory, the predicated outcome of the prisoner's dilemma (see Fig. 1) is for the players to defect as opposed to the optimal outcome of cooperation.[2] Playing defect is the dominant strategy for both players and is the only Nash equilibrium of the prisoner's dilemma, as there is no incentive for any of the players to change their strategies. This is analogous to the case where collaboration in an open innovation business model via a community can increase the payoff to the participants but defection by any one party (non-cooperation) could be the dominant strategy. For example, this could be the case when one of the firms or individuals once they have acquired the requisite knowledge or intellectual property decide not to continue cooperating but decide to profit from the discovery themselves. However, empirical testing of the prisoner's dilemma in laboratory experiments has shown that subjects are prone to cooperate far more often than

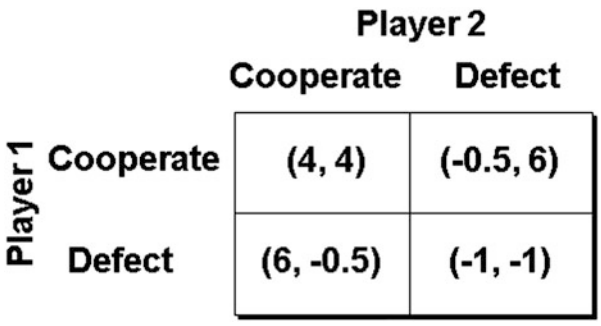


Fig. 1 Prisoner's dilemma [*Source* Adapted from Axelrod and Hamilton (1981, pp. 1392)]

[1] A public goods game is also appropriate to study the context of cooperation in this paper. A public goods game is essentially a prisoner's dilemma game with many players. However, for simplicity and tractability we use the prisoner's dilemma game as the conceptual model.

[2] The payoff to the prisoner's dilemma game is as shown in Fig. 1 where two players (1 and 2) have to decide whether to cooperate or to defect. If both players cooperate they both get a payoff of 4. However, both player 1 and player 2 could be better off by playing defect regardless of what the other player does. If player 2 chooses defect, player 2 gets 6 which is higher than 4 from playing cooperate, if player 1 chooses cooperate. On the other hand, if player 1 chooses defect as well, player 2 gets 1 by choosing defect instead of only 0.5 by choosing cooperate. The same reasoning could be applied to player 2 as well. Therefore, both players would reason that they are better of defecting and as a result end up obtaining a payoff of 1 each. Ironically this is less than the Pareto optimum of obtaining a payoff of 4 each by both cooperating.

Table 1 Type of institutions for governance

Type of institutions	Method of governance	Enforcing mechanism	Case examples
Informal Institutions	Conventions	Self-policing	Free Software Foundation (FSF) and sharing of software codes
	Moral rules	First party	IBM Philosophy of collaboration (e.g., ThinkPlace, InnovationJam, Virtual Worlds) Thomson Reuters and Hedgehogs The Sims Computer Games and User Modifications
	Social norms	Third party: Social forces, i.e. Individuals of the Group	Intel and 'Open Kimono'
Formal Institutions	Law	Third party: State	Nesta and 'Open Alchemy' Orange and the 'Air-Lock' System

Source Mantzavinos (2001, pp. 85)

game theory might lead us to predict in both one-shot games and in finitely repeated games (Axelrod 1984; Sally 1995). However, often for such a cooperation to develop one needs institutions as a mechanism for governance (Dixit 2003). How are such institutions formed in order to encourage cooperation?

In order to examine this question, we need to provide an understanding of how individuals perceive the world and connect with others. The starting premise is that individuals and firms use inferential strategy and analogy from solutions to other similar problems to solve their existing problems in order to maximize utilities or profits respectively (Mantzavinos 2001). Individuals or firms continuously test hypotheses in order to learn. Through this process of continuous testing of hypothesis, individuals and firms learn and develop a common view and form common mental models of the world (Mantzavinos 2001, pp. 67–69). If such a common mental model is formed then it is possible that individuals and firms would want to cooperate. This bias to want to cooperate is based on norms,[3] such as having experienced the benefits of cooperation, or the sanctions from not cooperating. Such norms apply to the prisoner's dilemma game whereby cooperation is observed from empirical testing of the game although this is not in line with the theoretical predictions (Sally 1995). Therefore, in order to foster such cooperation among individuals and firms, one needs an institutional framework to create and support the market (Mantzavinos 2001). These institutions can be both informal and formal institutions as shown in Table 1.

Informal institutions are conventions, moral rules and social norms whereby there is no formal external enforcer[4] (Mantzavinos 2001). The enforcing

[3] A norm is a widely held belief by a group or community about how members should behave in a particular context and hence, are expectations about behavior that are partially shared by the members (Gibbs 1981; Moch and Seashore 1981).

[4] These terms are discussed further in the following sections.

mechanism is either the individuals themselves or third party social groups. On the other hand, formal institutions require the sanction of law and third party enforcers such as the state or a large focal firm. Institutions are required to create a market—a key element for marketing scholars and practitioners. The next section looks at various institutional structures and how they develop.

3 Institutions

Institutions are normative social rules in a society that are enforced either through the law or other mechanisms that control and shape human interaction (North 1990). There are principally two reasons for the existence of institutions. First institutions often solve problems of cooperation in society by providing a platform for conflict resolution. Second, human beings have limited cognitive capacity. Hence, rather than trying to formulate rules for each social situation, institutions are able to stabilize expectations and provide a means of coping with uncertainty that individuals face when interacting with each other (DiMaggio and Powell 1991). Institutions can emerge either deliberately or spontaneously. First, in the case of deliberate action, institutions can emerge as a result of collective action on the part of society. Second, in the case of spontaneous action, institutions do not emerge out of some collective notion but as a result of action taken by individuals based on their perception of solving a particular problem. In this case, a shared mental model of the problem develops via communication between individuals which then results in a cumulative process of reaction and imitation by individuals (Mantzavinos 2001, pp. 67–72). This cumulative process of reaction and imitation contributes to a new behavior or pattern of action and hence, the development of a new institution. We next look at the informal and formal institutions respectively in the context of collaborative innovation.

3.1 Informal Institutions

Informal institutions are conventions, moral rules and social norms whereby there is no formal external enforcer. We examine in turn these informal institutions.

3.1.1 Conventions

Conventions are social rules that are primarily self-policing (Mantzavinos 2001, p. 101). Once a convention is established there is little incentive for any participant to switch from the rule that everyone else is following. It has been argued that people might play the cooperative outcome in the prisoner's dilemma even in the absence of a third party that might solve the problem externally. In Schelling's (1960) classic treatise *'The Strategy of Conflict'*, experimental evidence is used to show that people do coordinate when they cannot communicate due to the existence of contextual clues which he calls 'focal points'. Certain traditions can make a choice more salient and therefore makes it the natural focal point. Hence, although

there is no external coordination mechanism, it turns out that players will choose the coordinated outcome due to their expectation of what others will do as a matter of convention. Scholars have extended this line of reasoning to show that the history of interactions and subsequent learning of the individual could explain the development of such a focal point that leads to the development of conventions. For example, Roth and Schoumaker (1983) studied via experiments of a repeated bargaining game how a player that has been allowed to obtain consistently a larger share in the initial games than a Nash outcome would choose their actions. It turns out that such a player has every reason to continue to and does expect this outcome in subsequent games. Therefore, the players' experience and learning contributes to the development of a convention that is an important determinant of the player's expectations, which then influences the outcome of the game.

Conventions normally develop as a result of individuals or firms trying to solve a common problem. The interaction of the individuals or the firm results in the development of a common mental model of the problem. The individuals draw on their common knowledge to develop the same solution. Often they infer the best solution from utilizing such common knowledge to draw on analogical reasoning. This then gradually develops into a convention. Such a convention could be developed spontaneously or deliberately. For example a case of spontaneous development is the use of the convention of copyleft in the case of open source movement. In the early days of the development of computer operating systems in the early 1960s to early 1980s, it was common place to share basic operating code of computer programs (the source code) between programmers in different organizations (Lerner and Tirole 2002). The very early days of the development of such computer technology was based at major research universities such as Berkeley and MIT or corporate R&D labs with significant autonomy driven by an ethos of sharing. Developers made significant efforts in cooperating to develop operating systems that could run on multiple computer platforms. For example, the Unix application developed at AT&T's (a major telecoms company in the United States at that time) Bell Laboratories was freely modified and installed across institutions (Lerner and Tirole 2002, pp. 200–202). The process of sharing code was enhanced with the advent of Usenet, a computer network begun in 1979 in order to link together the Unix programming community. However, following the move by AT&T to enforce the intellectual property rights, the formation of the Free Software Foundation (FSF) promoted the convention of free sharing of software codes on cooperatively developed software. This formal process is called the General Public License or better known as 'copyleft', where users agree not to impose licensing agreements on other users. Therefore what started out as a spontaneous process had now become a deliberate process encouraged by the FSF which then developed into a convention.

3.1.2 Moral Rules

Moral rules are essential in the case where there is a conflict between community benefit and individual benefit (Mantzavinos 2001, p. 106). A prisoner's dilemma game with exit option captures this element neatly. This is because the real world

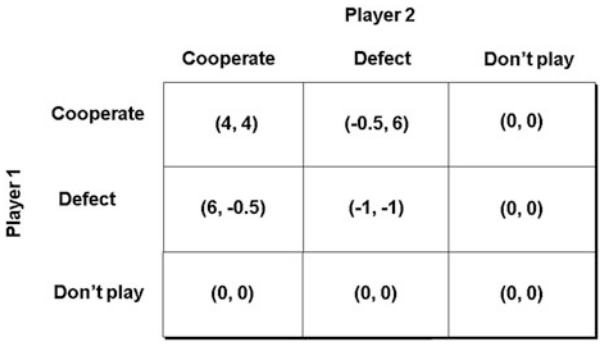


Fig. 2 The prisoner's dilemma with an exit option [*Source* Adapted from Mantzavinos (2001, pp. 85)]

often allows people not to play the game or follow the moral rules prescribed. This is shown in Fig. 2.

The principal assumption to the modified game is that payoff from the exit option is lower than mutual cooperation but higher than mutual defection. This can be related to the case where either a consumer or supplier can cooperate, defect or choose not to engage with the ecosystem at all. Vanberg and Congleton (1992) show through simulation experiments of such a prisoner's dilemma with an exit option that a viable strategy is one where one cooperates with those who have cooperated in the past and avoid those who have previously defected. This prudent moral strategy might not always yield the highest return. However, the experiments show that the prudent moral strategy is a viable strategy even when the most amoral behavior is possible among the population.

The emergence of moral rules could be supported by three streams of literature (Mantzavinos 2001, pp. 109–111). These are: morals sentiments (Mackie 1985), exchange theory (Blau 1964) and learning process from psychology (Kohlberg 1984). First, in the case of moral sentiments, it is the desire to punish wrong actions and reward good actions that contribute to the development of moral rules. This is related to the incorporation of notions of fairness into game theory, through which people help others that help them, and hurt others that hurt them (Rabin 1993). An example of the concept of fairness is IBM's (a major IT hardware and services firm) philosophy of collaboration (see Gabor 2009). IBM embraces a culture of trust and openness by redefining its mindset and workflows.[5] IBM's experience for a successful innovation ecosystem is equity within the ecosystem with mutual benefit being derived by all participants. In addition, IBM encourages active engagement from all participants, focused towards a common goal and based on trust. IBM does this through the use of various social networking systems (e.g., ThinkPlace, InnovationJam, Virtual Worlds) that encourage rapid flow of intellectual property within the firm as well as with outside partners.

Second, in the exchange based theory of sociology, the tendency for human beings to reciprocate is seen as a sociological phenomenon that enables cooperation

[5] This case vignette is based on author's own interview with a number of senior executives at IBM.

in society. Empirical studies have supported this result. For example, Berg et al. (1995) show that common history among subjects reduces social distance and leads to reciprocity. This is supported by Thomson Reuters' (Thomson Reuters is an infrastructure and information provider to the financial services industry) experiment with Hedgehogs (Barrett et al. 2011). Hedgehogs is a web based forum whereby investment professionals in the hedge fund industry can share ideas and discuss issues. Thomson Reuters is using Hedgehogs as a test bed to reduce social distance among the community of professionals in the hedge fund industry in order to promote a more collaborative innovation system. Moreover, research has shown that a strategy of generosity encourages cooperation in the prisoner's dilemma (Axelrod 1984). This is shown through Goldcorp's (Goldcorp is a major Canadian gold producer) strategy of being generous in sharing its historical mining data going back to 1948 on Goldcorp's website for anyone who is able to locate gold deposits on its mining land (Tapscott and Williams 2007). Although this was initially seen as a risky strategy, the availability of the historical mining data encouraged many specialists to analyze the data and cooperate among themselves in order to point to possible areas where gold could be mined across its 55,000 acre property. The contestants had identified 110 targets of which 50 % had not been previously identified by the company. In addition, over 80 % of the new targets yielded substantial quantities of gold which catapulted Goldcorp from a struggling company into a giant within the gold mining industry.

In addition, Gachter and Fehr (1999) have shown that approval incentives, such as rewards for cooperation, in combination with social familiarity can give rise to a significant increase in cooperation. An example of this is The Sims, a life simulation video game series considered to be one of the best-selling video game series of all time (Ederly and Mollick 2009). Players control a household of simulated people (Sims) who have human needs such as companionship, emotions and sleep. The player keeps these simulated people happy by providing for their virtual needs. The success of The Sims is attributable to the recognition for cooperation among the user community. The user community has created a variety of products for The Sims as a result of such cooperation: users have created 20,000 kinds of chair, nearly 100,000 articles of clothing and 52 different goatees (Mollick 2008). Allowing user modifications has boosted revenue and adds features at little or no incremental cost once a platform has been created. However, this means strategies beyond just making a video game and putting it out there. There needs to be a mechanism to reward community members who participate. For instance, allowing them to keep a piece of the revenue, giving them access to features or new releases, and having external forums where credit can be amply taken and given. There are formal mechanisms to listen to users, and for users to share ideas about what they want. Third, the learning process theory from psychology points to the fact that people go through moral stages where there is concrete individual perspective, to a member of society's perspective to the final stage where the values are defined in terms of self-chosen principles. In addition, empirical evidence of the prisoner's dilemma shows that similarities in terms of characteristics, such as demographic and work value, contribute to cooperation (Pruitt and Kimmel 1977). In recognizing

this type of development, IBM categorizes people participating in innovation into three groups (See footnote 5): traditionalist (born before 1964), Gen X (1964–1984), and Gen Y (1984–1994). For example, the Gen-Y'ers that grew up with technology and are more collaborative and networked compared to other categories. They exhibit different characteristics which is taken into account when formulating cooperative behavior.

All the above explanations suggest that the development of moral rules calls for three principles (Mantzavinos 2001). First, only a small number of individuals need to start the process. Second, the development of the moral rules will emerge as a result of self-interest due to learning process from observing successful cooperation and then reciprocating accordingly. Third, the retributive emotion and characteristic process combines with the learning attribute within an interacting process to provide reinforcement of each other's cooperative behavior resulting in the development of such moral rules.

3.1.3 Social Norms

Social norms exists to provide coherence and solutions to problems in which conflicting individuals or organizations interact (Mantzavinos 2001, p. 118). Social norms can be distinguished from moral rules on two fronts. First, social norms are more culture dependent than moral rules and apply to problems arising at specific times and places. Second social norms are enforced by an enforcement agency that is external to the agent and is usually the other agents in the group. Such social norms come into being as a result of individuals or organizations wanting a predictable environment to live in which increases the overall utility for all concerned. This need for a predictive environment is a weaker requirement than any feelings of duty that require moral rules (Mantzavinos 2001, pp. 122). In addition, the emergence of such a social norm could be the result of either superior bargaining power among some members of a society (Knight and Ensminger 1998) or the result of higher status and power accorded to those who conform and hence, are indirectly rewarded for their enforcing activities (Nee and Ingram 1998). Such social norms can exist when there is a tendency for sanctioning behavior from sufficiently large number of individuals within the group. In addition, research has shown that as long as there is a metanorm that guarantees the punishment of non-sactioneers of a primary behavior, the social norm will be relatively stable (Elster 1989).

The concept of power and trust is invariably evoked when large corporations embrace the ecosystem to enhance their innovative capability. An example of the application of power and trust is Intel (Intel is one of the world's largest semiconductor chipmakers) and its ecosystem of suppliers. In the case of Intel, it often uses its 'Open Kimono' principle to encourage smaller suppliers to share detailed financial models and technical information to achieve mutually advantageous benefits (Perrons 2009). In addition, Intel embraces the 'copy exactly' philosophy by setting the standards by which all suppliers have to follow the manufacturing process of the best supplier. By doing so, Intel reduces its own risk and is able to ramp up production at half the time it takes its competitors. Although this is

beneficial to Intel and its suppliers, it comes with the supplier having to invest in specific assets with all its associated risks. However, in order to compensate for cooperation provided by the suppliers, Intel often goes out of the way to help suppliers when they are unable to meet Intel's standards when technological developments force it to adopt an innovation. It does this through investment in staff, resources, time as well as cash. This trust is often reciprocated by the suppliers who are willing to invest in asset specific investments. Intel is also known to soften the blow to suppliers when it drops them from being a supplier. For example, when Intel moved from ceramic/wire bonded packing to organic/C4 packaging for microprocessors it helped one of its major suppliers, Shinto by encouraging a rival supplier to buy its technology when Intel decided to drop Shinto as a supplier (Perrons 2009, pp. 1307). The Intel example shows that the ability to enforce standards through the benevolent use of power to build trust encourages other firms to conform to the 'social norm' that is often rewarded for their enforcing activities. The next section discusses formal institutions as a basis of encouraging collaboration.

3.2 Formal Institutions

The maintenance of order without law has been shown to exist via conventions, moral rules and social norms. For example, maintenance of order has been shown to exist among the Neur, a pastoral community living in the upper Nile region and other societies (Evans-Pritchard 1940). However, these societies consisted of rather homogeneous populations with kinship ties and good information networks that helped preserve such order without formal enforcement mechanisms. A more formal external enforcing agency is needed when such homogeneous populations with good social capital and strong information networks do not exist (Jasay De 1995). Formal institutions are institutions with such formal external enforcing agency (Jasay De 1995).

Empirical evidence from the prisoner's dilemma has shown that players tend to cooperate more when the returns to cooperation increases or when the returns to defecting decreases (Sally 1995). Therefore, the role of an intermediary is often to provide these 'carrots' and 'sticks' to enable the whole ecosystem to benefit. The enforcing agency can play two roles. The first is to be the catalyst for the cooperation between firms. The specialization and cooperation in production increases output and hence, is more efficient. The second is to act as the external enforcer to effect punishment in the case of non-cooperation. The carrot approach is taken up by intermediaries like NESTA (National Endowment for Science, Technology and the Arts is an innovation charity based in the UK) by promoting innovation in the United Kingdom (Simoes-Brown 2008). NESTA is providing intermediary services to help firms create more commercially viable products by sharing the knowledge and stories around open innovation across firms. For example, NESTA provides forums like Open Alchemy whereby participating organizations meet and discuss their top ideas openly with a view of acting as the starting point for further

collaborative idea generation. In addition, NESTA conducts ethnographic studies so as to be able to disseminate stories about the benefits of collaborative innovation. NESTA's role as an intermediary is essential to help set the groundwork for working relationships that can create substantial business value. NESTA has helped form venture operations and collaboration program for large firms, for instance, Rolls Royce, McLaren Applied Technology, BBC Labs and Shell GameChanger.

One of the main issues of collaborative innovation is the issue of intellectual property rights. The role of an intermediary might help resolve these property rights issue. For example, Orange the mobile phone operator experimented with a model whereby when dealing with a third party start-up firm, both Orange and the start-up firm engages trusted third parties respectively to create a forum for discussion via an 'Air-Lock' system.[6] The 'Air-Lock' system ensures assurance that parties in the collaboration are able to share ideas freely due the presence of the trusted third-party firm who is able to mediate issues as they arise. The use of such trusted third party intermediaries helps overcome the intellectual property issue whilst capturing the benefits of collaboration. Such an approach resulted in many new mobile phone and network based innovations for Orange and its partners. An alternative use of an intermediary model is the development of mobile PC whereby lists of members contribute money to fund a defined research stream. This fund is then augmented with government funding. The research is commissioned by the third party intermediary at research centers or universities. The members then have royalty-free access to any of the intellectual property right that is generated and are free to use them as they see fit without having to inform other members what they are being used for. This example from mobile PC clearly shows the benefit of a third party intermediary such as universities and government organizations playing a role in providing both the 'carrot' and the 'stick' to develop the formal institutions to promote collaborative innovation.

4 Implications and Conclusion

There are several managerial implications that can be drawn from the conceptual framework for scholars and practitioners in marketing. In particular the paper addresses the importance of developing the institutions to support the emergence of a new market to manage multiple stakeholders in order to sustain collaborative innovation. First, the development of institutions requires the active role of management in trying to shape the governance structure. Second, empirical evidence has shown that managers need to demonstrate fairness and reciprocity to encourage cooperation. Third, managers should encourage the development of social capital to foster a cooperative culture. Fourth, managers need to recognize different stages of learning among individuals as well as demographic characteristics in developing an

[6] This case vignette is based on author's own interviews with a number of senior executives at Orange.

appropriate institutional structure for cooperation. Finally, when homogeneous populations with strong social and information networks do not exist, a formal external agency such as an intermediary is needed to encourage collaboration. In doing so, the paper contributes to the call by marketing scholars to close the marketing capabilities gap by better understanding innovation within a networked ecosystem of firms (Day 2011).

There are several theoretical implications of our study. First, our study has implications for how game theory could be used to examine ways to develop institutions in order to create new markets. Scholars need to understand more deeply the theoretical underpinnings of how new markets emerge as new technologies enable new customer value propositions and make existing markets obsolete. Experimental game theory provides a rich source to understand behavioral issues which could form the basis for developing a richer theoretical base to explore the issue above. Second, our study has implications to better understand theoretically the balance between the roles of formal versus informal institutions during the life cycle of market development. The need for formal and informal institutions could vary over the lifecycle of the market and hence our study has implications to better understand such developments. Third, our study has implications for the development of collaborative models whereby firms work within an ecosystem with multiple leaders to develop new customer value propositions. Such an ecosystem of firms lies between a centrally organized hierarchical system and a more decentralized market based model where there are multiple firms acting as decision makers depending on the decision to be made. Such a polycentric ecosystem structure provides challenges from a marketing perspective in terms of gathering intelligence on customer requirements, disseminating that intelligence through the ecosystem and responding appropriately. Our study provides some preliminary theoretical building blocks to understand the institutions needed to govern such a polycentric ecosystem of firms.

This paper develops a conceptual framework using the prisoner's dilemma game and the empirical evidence of the game to draw lessons on how to develop institutions to govern cooperation in a collaborative model for innovation. Our framework is especially useful to develop a better understanding about how markets develop in order to sustain collaboration. The framework has certain limitations which can be addressed in subsequent work. First, a deeper understanding of the criteria needed for different institutional structures to manage different collaborative business models is required. Second, we need a more nuanced understanding of how firms manage the transition from one institutional form to another over time. Finally, a deeper understanding how firms can experiment with different institutional forms before committing to a particular one needs to be further developed.

Acknowledgments The author would like to thank Jan Heide and Sriya Iyer for helpful discussions. The author would also like to thank the Editors and the anonymous reviewers for their helpful comments on earlier versions of this chapter.

References

Achrol, R. S. (1997). Changes in the theory of interorganizational relations in marketing: Toward a network paradigm. *Journal of the Academy of Marketing Science, 25*(1), 56–71.

Axelrod, R. (1984). *The evolution of cooperation*. New York, NY: Basic Books.

Axelrod, R., & Hamilton, W. D. (1981). The evolution of cooperation. *Science, 211*, 1390–1396.

Barrett, M., Velu, C., Kohli, R., Salge, O., & Simoes-Brown, D. (2011). *Making the transition to collaborative innovation: Issues of readiness, trust and governance*. Nesta Business Briefing.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity and social history. *Games and Economic Behavior, 10*, 122–142.

Blau, P. (1964). *Exchange and power in social life*. New York, NY: Wiley.

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.

Day, G. S. (2011). Closing the marketing capabilities gap. *Journal of Marketing, 75*(4), 183–195.

DiMaggio, P., & Powell, W. (1991). Introduction. In W. Powell & P. DiMaggio (Eds.), *The new institutionalism in organisational analysis* (pp. 1–38). Chicago, IL: University of Chicago Press.

Dixit, A. (2003). On the modes of governance. *Econometrica, 71*(2), 449–481.

Ederly, D., & Mollick, E. (2009). *Changing the game: How video games are transforming the future of business*. New Jersey: Pearson Education.

Elster, J. (1989). *The cement of society. A study of social order*. Cambridge, MA: Cambridge University Press.

Evans-Pritchard, E. E. (1940). *The Neur; A description of the models of livelihood and political institutions of a nilotic people*. Oxford: Clarendon.

Gabor, A. (2009). The promise (and perils) of open collaboration. *Strategy and Business, 56*, 1–7.

Gachter, S., & Fehr, E. (1999). Collective action as a social exchange. *Journal of Economic Behavior and Organization, 39*, 341–369.

Gassmann, O. (2006). Opening up the innovation process: Towards an agenda. *R&D Management, 36*(3), 223–228.

Gibbs, J. P. (1981). *Norms, deviance, and social control: Conceptual matters*. New York, NY: Elsevier.

Humphreys, A. (2010). Megamarketing: The creation of markets as a social process. *Journal of Marketing, 74*, 1–19.

Jasay De, A. (1995). Conventions: Some thoughts on the economics of ordered anarchy. In *Lectiones Jenenses, Max-Planck-Institute for Research into Economic Systems* (Vol. 3), Jena.

Knight, J., & Ensminger, J. (1998). Conflict over changing social norms: Bargaining, ideology and enforcement. In M. Brinton & V. Nee (Eds.), *The new institutionalism in sociology* (pp. 105–26). New York, NY: Russell Sage.

Kohlberg, L. (1984). *The psychology of moral development: The nature and validity of moral stages* (Essays on Moral Development, Vol. 2). San Francisco: Harper & Row.

Lerner, J., & Tirole, J. (2002). Some simple economics of open source. *The Journal of Industrial Economics, 50*(2), 197–234.

Mackie, J. (1985). *Persons and values*. Oxford: Oxford University Press.

Mantzavinos, C. (2001). *Individuals, institutions and markets*. Cambridge, MA: Cambridge University Press.

Moch, M., & Seashore, S. (1981). How norms affect behaviors in and of corporations. In P. C. Nystrom & W. H. Starbuck (Eds.), *Handbook of organizational design* (Vol. 1, pp. 210–237). New York, NY: Oxford University Press.

Mollick, E. (2008). *Presentation at the Cambridge Open Innovation Workshop on 29–30 May 2008*. University of Cambridge. http://gettogreen.blogspot.de/2008_05_01_archive.html

Nee, V., & Ingram, P. (1998). Embeddness and beyond: Institutions, exchange and social structure. In M. Brinton & V. Nee (Eds.), *The new institutionalism in sociology* (pp. 19–45). New York, NY: Russell Sage.

Nelson, R., & Winter, S. (1982). *An evolutionary theory of economic change*. Boston, MA: Harvard University Press.
North, D. (1990). *Institutions, institutional change and economic performance*. Cambridge, MA: Cambridge University Press.
Perrons, R. (2009). The open Kimono: How Intel balances trust and power to maintain platform leadership. *Research Policy, 38*, 1300–1312.
Pruitt, D., & Kimmel, M. (1977). Twenty years of experimental gaming: Critique, synthesis, and suggestions for the future. *Annual Review of Psychology, 28*, 363–392.
Rabin, M. (1993). Incorporating fairness into game theory and economics. *The American Economic Review, 83*(5), 1281–1302.
Roth, A., & Schoumaker, F. (1983). Expectations and reputations in bargaining: An experimental study. *The American Economic Review, 73*(3), 362–372.
Sally, D. (1995). Conversation and cooperation in social dilemmas. *Rationality and Society, 7*(1), 58–92.
Schelling, T. C. (1960). *The strategy of conflict*. Boston, MA: Harvard University Press.
Simoes-Brown, D. (2008). *Presentation at the Cambridge Open Innovation Workshop on 29–30 May 2008*. University of Cambridge. http://gettogreen.blogspot.de/2008_05_01_archive.html
Tapscott, D., & Williams, A. (2007). *Wikinomics: How mass collaboration changes everything*. London: Allantic Books.
Vanberg, V. J., & Congleton, R. D. (1992). Rationality, morality and exit. *American Political Science review, 86*, 418–431.
Vanhaverbeke, W., Van de Vrande, V., & Chesbrough, H. (2008). Understanding the advantages of open innovation practices in corporate venturing in terms of real options. *Creativity & Innovation Management, 17*(4), 251–258.
von Hippel, E., & von Krogh, G. (2006). Free revealing and the private-collective model for innovation incentives. *R&D Management, 36*(3), 291–302.

Organizing Open Innovation for Sustainability

Drawing Implications from a Case Study in the Agro-Food Complex in the Netherlands

Paul T.M. Ingenbleek and Gé B.C. Backus

Abstract

Literature on open innovation has thus far predominantly focused on high technology contexts. Once an industry reaches the limits of a closed innovation model, open innovation may, however, also promise opportunities for sustainable development in a low-tech environment. Because in low-tech environments open innovation is unlikely to emerge spontaneously from the spillovers of R&D, it requires institutions that actively initiate and coordinate open innovation processes. This has subsequently important consequences for marketing, because buyers and sellers may jointly embark on innovation processes that are guided by a third-party organization. Based on a case study on an organization for open innovation in the agro-food industry, this chapter identifies potential contributions and pitfalls of these organizations. Results imply an optimal level between market—and organization-based forms of governing open innovation that depends on industry characteristics such as the stage of industry lifecycle. Implications for policy, business and future research of these findings are discussed.

1 Introduction

Being locked in a technological system that is not environmentally sustainable, is a profound problem for companies in many mature industries. Even though companies may be committed to switch to sustainable technologies, their good intentions may strand when incompatible technologies and practices of supplier and

P.T.M. Ingenbleek (✉)
Marketing and Consumer Behavior Group, Wageningen University, Hollandseweg 1, 6706, Wageningen, The Netherlands
e-mail: Paul.Ingenbleek@wur.nl

Gé B.C. Backus
Connecting Agri & Food BVOostwijk 5, 5400 AM, Uden, The Netherlands

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_8

customer companies prevent them to do so. Because the development of the established technologies and practices is often path-dependent and rooted in a tradition of decades, changing to more sustainable production techniques can be virtually impossible to achieve by a single company. Also Lundvall et al. (2002, p. 225) recognize this anomaly on the level of national innovation systems and they seek solutions on the policy level: 'These contradictions in the learning economy increase the need for policy-coordination' [. . .] 'there is a need for policy learning in terms of building new kinds of institutions for policy co-ordination. Such institutions would have as strategic responsibilities to develop a common vision for how to cope up with the challenges and contradictions of the globalizing learning economy.'

Organizations that connect different players from the agro-food complex in new constellations, hold a promise to sustainable development because they can help to unlock companies from a system that is locked into production methods that are eventually not sustainable. Despite their growing impact on the food and agribusiness and the contributions that they make to knowledge development, these organizations have themselves not yet been subjected to academic research. It is important to do so, because a theoretical ground for their existence may help policy makers to understand when and how they should equip these organizations with public resources.

In this article, we will draw on open innovation theory to provide this theoretical ground. Chesbrough (2003) distinguishes *closed innovation*, in which companies' innovation policies are based on a controlled process from idea generation to product launch, from *open innovation*, in which the role of R&D extends beyond the company's boundaries. More specifically, Chesbrough (2006a, p. 1) defines open innovation as 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets of external use of innovation respectively'. Clearly, a process of knowledge inflow, outflow and acceleration holds a promiss of a way out for established industries that seek a transition towards more sustainable production techniques.

The extent to which open innovation is applicable to mature industries remains, however, a gap in the literature (Chesbrough 2006a, p. 4). This article contributes to fill this gap. The central argument is that in order to start an open innovation process in a mature, low-tech industry, a level of organization is needed. This has subsequently important consequences for marketing, because buyers and sellers may jointly embark on innovation processes that are guided by a third-party organization. We draw our argument on a case analysis of what we call an *organization for open innovation* in the agro-food industry. In recent years, several new organizations have been developed that are responsible for initiating, organizing and funding open innovation projects in low-tech industries. Transforum A&G in the Netherlands is an example of such an organization. Examples of organizations that are supported by the European Commission to strengthen innovation and competitiveness of economic sectors in the EU are the Knowledge Network for System Innovations and Transitions, Promstap Interreg, and Q-Pork-Chains. These organizations can be seen as a specific type of the institutions that Lundvall et al (2002, p. 25) talk about.

In the following, we first discuss how organizations for open innovation relate to other innovation models. This section is followed by the methods of our case study, an introduction of the target organization, and introduction of case study concepts. Subsequently, we report the results and provide a discussion, followed by a conclusion and implications.

2 Theoretical Background

Researchers increasingly seem to recognize that successful innovation calls for involvement of multiple players in the supply chain (Hakansson 1987; Gassmann et al. 2006; Roy et al. 2004; Von Hippel 1988). The work of Nelson (1959) plays a prominent role in the theoretical foundation of open innovation (Chesbrough 2006a). Nelson, addressed the 'spillovers' from R&D, meaning that firms doing basic research often generate more ideas and knowledge than they use, and that their ability to appropriate value from these spillovers is limited. As technological progress accelerates, such spill-overs are also likely to increase. Spillover effects are therefore typical for high-tech environments.

Firms that manage to generate more value from these spillovers have a competitive advantage in high-tech industries over firms to whom spillovers are only a source of inefficiency. Eventually, creating and appropriating value from spillover effects becomes a critical success factor in the industry. Hence a process of open innovation is more likely to emerge in high-tech environments than in low-tech environments: a knowledge market or network where ideas, patents and other bundles of knowledge are exchanged by firms is a typical characteristic of open innovation in high technology environments. Congruently, most empirical research on open innovation has focused on high technology markets (Chesbrough 2006a), such as software (e.g., West and Gallager 2006), pharma (e.g., Wuyts et al. 2004), and biotechnology (e.g., Vanhaverbeke and Cloodt 2006).

Although in many cases the openness of innovation processes and the technological intensity of an industry will be related, we suggest that these are in fact two dimensions. Distinguishing these two dimensions leads to four different innovation models as portrayed in Fig. 1. Open innovation in a high-tech industry is typically associated with the open innovation model in which companies exchange ideas, patents and other knowledge bundels in processes of insourcing and outsourcing knowledge (e.g., Chesbrough 2003). As such open innovation offers new sources of revenues in an environment in which the intellectual property rights of the innovation can be protected and traded. In the terminology of the resource-based view, innovation then becomes as source of sustainable competitive advantage (Barney 1991). In contrast, closed innovation in a low-tech environment is typically associated with incremental innovation to increase efficiency within the context of a dominant technology (Lundvall 1992).

Two other types of innovation are suggested by the model. Closed innovation in a high-tech environment is associated with the efforts of companies to achieve synergies from their spillovers within the boundaries of their companies.

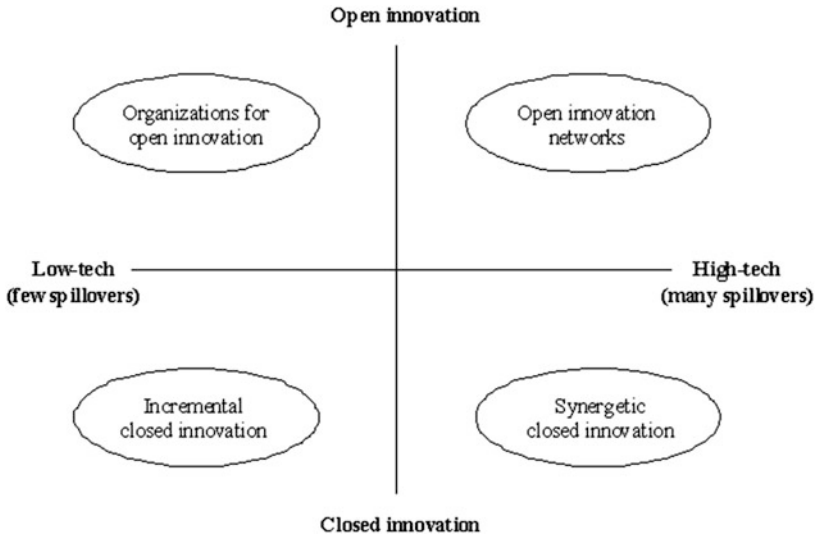


Fig. 1 Position of organizations for open innovation among other innovation models (*Source* original figure from Ingenbleek and Backus)

These companies have a portfolio of business units that allows knowledge flows from different R&D centres to the business unit that is best equipped to bring the knowledge to value. Such effects are well-described in literature on corporate strategy (e.g., Hofer and Schendel 1978).[1]

The fourth innovation model is labelled *organizations for open innovation*. Organizations for open innovation are typically associated with open innovation processes in low-tech environments. In such environments, technologies have matured and organizations strongly depend on each other and are locked into a certain technological frame. From an institutional theoretical point of view, these organizations experience external pressure to conform with the norms of their industries, leading to isomorphism (DiMaggio and Powell 1983). While on the one hand isomorphic pressures squeeze out the innovation drive from an industry, on the other hand they also push organizations toward a point where they start thinking "out of the box" of their industry and innovation increases (Heugens and Lander 2009). From that perspective, an organization for open innovation is an impulse from institutional environment for organizations to break with the established technological patterns in their industry.

Organizations for open innovation are different from the network model of open innovation in that the process of open innovation is governed by an organizational structure, rather than that it erupts spontaneously from the high level of spillovers in

[1] The existence of synergies doesn't imply that companies will not engage simultaneously in open and closed innovation. In reality, many companies are likely to apply both innovation models simultaneously.

the industry. Without this level of governance in which open innovation is organized by bringing companies, universities and other research institutes together in a joined innovation process that is organized by a third party (that we label an organization for open innovation), open innovation processes are unlikely to emerge in low-tech environments.

Organizations for open innovation are also different from the incremental closed innovation model in that multiple companies and or universities or other knowledge institutes participate in the process. The objectives of an open innovation process are therefore often likely to go beyond the short-term competitive advantage of single companies. Organizations for open innovation may typically be a solution in low-tech industries that have reached the limits of their model in terms of social and environmental sustainability. Because low-tech industries are often important engines of economic development (Lundvall et al. 2002), it is in the interest of many stakeholders to secure their long-term competitiveness. Environmental and social sustainability seem to this respect a prerequisite. Hence, organizations for open innovation can be established by public policy, industry leaders, or by any other body that has an interest in the development of the industry as a whole rather than the development of an individual company. For policy-makers specifically, organizations for open innovations are a policy instrument to guide the development of an industry in a desired direction, for example to secure employment or to protect the natural environment. We define an organization for open innovation accordingly as an organization that initiates and coordinates the inflows and outflows of knowledge from companies in order to accelerate innovation and/or to guide innovation in a desired direction.

2.1 Organizations for Open Innovation as Facilitators of Learning

Consistent with Lundvall et al. (2002), who see learning as the central process in innovation systems, we take an organizational learning approach to the organization for open innovation. In order to stimulate innovation, the literature suggests several learning concepts that we will apply to our case study material in order to understand how the organization generates open innovation.

Organizational learning literature distinguishes processes of information acquisition, distribution within the organization, interpretation, storage of knowledge in the memory of the organization, and using it in decision-making (e.g., Huber 1991). Through these processes, organizations may learn in two fundamentally different ways: exploration and exploitation (March 1991; Jansen et al. 2006). *Exploration* involves the acquisition of new knowledge by the organization that modifies the assumptions that a firm holds about its market. The process can be understood 'by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation' (March 1991, p. 71). Jansen et al. (2006) see exploration as an innovation process in which the firm explores new technologies. In our study, we see exploration as a process that should be stimulated by the organization for

open innovation and we will examine our data on how the organization does this and why it is doing it in that way.

In *exploitation* the firm does not question its long-held assumptions or beliefs. Instead, it optimizes the outcomes within the boundaries of these beliefs. As March (1991, p. 71) describes: 'Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution.' We will examine how the organization deals with existing structures, routines and procedures in the industry that may hinder technological breakthroughs.

The extent to which firms are open to new (sustainable) technologies is likely to depend on their absorptive capacity (Cohen and Levinthal 1990). Absorptive capacity suggests that the ability of companies to absorb new external knowledge depends on their levels of prior related knowledge. We will search in our data for whether and how the organization strengthens the capacity of firms in the industry to absorb and adapt to new ideas and knowledge.

Finally, organizations may learn at different levels. Sinkula (1994) describes that firms may learn first at basic levels on questions such as 'what is' and 'what has been' with regard to the organization and its environment, while at later stages of development it learns about questions like 'how things should be done' and 'how the organization actually learns, absorbs, and creates new knowledge. We will examine our data with regard to the question at which level the organization for open innovation learns itself with respect to its mission to stimulate open innovation in the industry.

3 Method

By describing *that* open innovation can be governed to a larger degree by organizational forms in low-tech industries, it does not describe *how* it is organized, i.e., which roles the organization fulfils in the open innovation process. This question can typically be answered through theory-building case study research (Eisenhardt 1989; Yin 2003). To this respect, we follow West et al. (2006) suggestion that case studies may further explore the boundaries of the open innovation debate. We therefore conduct an exploratory case study on a Dutch organization for open innovation in the agro-food industry. We seek to understand how the organization fulfils its role to generate open innovation in a low-tech industry. We present evidence on the different roles that the organization fulfils in open innovation processes (both positive and negative), the potential effects of these roles, and the essential functions underlying the different roles.

3.1 Selection of the Industry

To examine the roles fulfilled by an organization for open innovation, we conduct a holistic, theory-building case (Yin 2003). To systematically select an insightful case (Siggelkow 2007), we first select an industry and within that industry we

search for an organization on open innovation. To select a case study, we opted for a low-tech industry that is characterized by incremental, closed innovation, but at the same time warrants signals that it is about to reach the limits of this innovation model.

The agro-food industry fits these characteristics. After the Second World War, the innovation agenda in the agro-food industry was characterized by intensified production and a focus on output. These policies were motivated by a growing population and scarcity of food in the post-war years. The policy was stimulated by national investment subsidies and the EU Common Agricultural Policy (CAP) that kept market prices artificially high and provided an incentive for farmers to increase their production. Over the course of time, it became however clear that with the development of an agro-industry, also problems with over production were created and that the burden on the environment became too high. This raised ethical issues. The shift to mass production systems required, for example, farm animals to become adapted to the system, rather than that systems were adapted to the needs of animals.

Meanwhile European agriculture produced more output than necessary, resulting in excessive budgetary costs of the CAP. Moreover, the subsidized export of EU products blocked the development of agriculture in developing countries. In addition, the agro-industry shifted only slowly away from broadly defined commodities to products with differentiated characteristics that add value. Over the last two decades societal pressure groups call for change, and the industry is challenged by 'back to the nature' forms of agriculture, such as organic farming. Because all actors were in fact locked-in to the production oriented system, it was for individual companies virtually impossible to break through the existing limits in which they operated. The agro-food industry, therefore currently struggles to initiate a transition from a production-oriented system to a demand-oriented system in which the levels of mutual dependency increase between the different stages of the chains (e.g., Boehlje 1999).

These developments are particularly profound in countries where food and agriculture constitute a significant sector of economic development. The Netherlands is the second largest exporter of agricultural products in the world (Silvis and Leenstra 2009). Most of its sectors are strongly institutionalized and governmental organizations had a strong influence on their strategies, policies and processes (Klerkx and Leeuwis 2009).

3.2 Selection of the Organization

Within this industry we searched for an organization for open innovation that (1) exists long enough to draw insights from its experience (hence Transforum A&G was excluded), and (2), that was located in Western Europe (for practical reasons) and willing to provide access to its records and archives. The latter cannot be taken for granted because organizations for open innovation may work with a large number of companies on sensitive, competitive processes. We excluded

organizations active in biotechnology as this particular branch of the food industry is high-tech rather than low-tech (Vanhaverbeke and Cloodt 2006). Based on desk research and discussions with two industry experts, we developed a list of several organizations that matched our criteria. The organization on top of the list agreed to participate and thus became the focal organization in our case study.

The target organization was founded in 1994 in the Netherlands to organize open innovation in supply chains within the agro-food industry. Established in the first half of the 1990s, the organization is probably one of the first of its kind. To this respect, it has accumulated experience on the organization of more than 100 open innovation projects. It seized to exist in 2007, after an evaluation committee questioned how the organization accounted for its contribution to society. The organization introduced itself at its website as:

> The Government withdraws from public life and puts responsibility more and more in hands of the business community and citizens. Societal themes like sustainable development, obesity, food quality and safety, use of space, are put on the desk of companies. The national Government also gives more responsibility to district and community Governments. New competencies are demanded from all parties in order to jointly set the agenda for knowledge and innovation. Companies need this agenda to make focused investments in new developments. The Government can use this agenda to facilitate and to allocate resources. This interplay offers Dutch agribusiness the opportunity to continue to differentiate and improve itself. [This organization] directs this interplay to a success.

More specifically, the mission of the organization was described as putting perspectives on (open) innovation to practice by connecting potential partners and by bundling investments of companies, public policy and research to realize innovation.

The organization was founded in 1994 by a 30 million guilders (approximately 13.6 million Euros) investment project to strengthen the Dutch knowledge infrastructure over the period 1994–1998. The Dutch Ministry of Agriculture added another 30 million guilders to organize support from universities and research institutes and a total of 30 million guilders was demanded of the companies that would participate in the projects. The annual report of 1997 reported that the organization would continue applying for new funds, thereby giving the organization a more permanent status. These programs that run for approximately 5 years. Within these programs, partnerships of companies and knowledge institutes may apply for funding to specific projects. In an evaluation document the organization reported that after 1 year, already 275 companies (including farms) participated in projects, half of them collaborating for the first time with research institutes (including universities).

Every project consisted of at least two companies (from at least two different stages in the supply chain) and a minimum of two different research institutes. Each project has a project leader from one of the participating companies or knowledge institutes, and a steering committee consisting of several stakeholders. The organization supported the project by involving an experienced project director who guides the innovation process from a neutral position between chain members.

The project directors represented the core of the organization. They are supported by a staff and a chief executive.

The projects often served multiple, complementary objectives at one time, varying between efficiency, product development and improvement, increasing the scale of operations, risk reduction and quality management, sharing costs and benefits, market entry and sustainable development. Crucial in each project is the involvement of universities and other knowledge institutes. Several types of knowledge may be used in the project varying from technology to process knowledge and market research. Some examples of projects are included in Table 1.

3.3 Data Collection

Data are collected from relevant stakeholders in the organization for open innovation, including companies, universities and other research institutes, public bodies, and the management and staff of the organization itself. According to Yin (2003), gathering data from these different stakeholders may help to generate a holistic view on the topic.

To ensure reliability and validity of case study data, triangulation was used: data were gathered from desk research and interviews. Desk research involved a review of publications by and about the target organization, annual reports, project reports, policy documents, websites, and evaluation reports. Desk research is necessary to substantiate the outcomes of the interviews and establish a consistent trend of issues and events in retrospective (Yin 2003), which helps to identify the role of the organization in open innovation processes.

In addition to desk research, 17 interviews were held with the institute's general manager, one of its founders, 6 project directors, 3 managers of large agro-food companies (over 100 employees and fulfilling a leading international role in their sector) and 4 researchers of well-established research institutes focusing on the agro-food sectors, that were involved in the projects. Furthermore, two policy makers were interviewed and one general manager of a research institute that was frequently involved in the projects. Al respondents agreed to participate in the interview when they were approached. A case study protocol was prepared and topic lists on issues to be discussed were prepared in advance of each interview. Advance preparation of the protocol minimized omission errors, ensured consistency in data collection, and enhanced research reliability (Yin 2003). Although for each interview a specific protocol was developed, interviews started in general with a description of study objectives before specific issues were discussed on the roles that the organization plays and the positive and negative consequences of these roles. Interviews and discussions were transcribed and issues requiring clarification were verified on repeat visits or email and/or telephone conversation.

Table 1 Descriptions of selected open innovation projects

Main objective	Description	Participants
Efficiency	The project aims to decrease fresh food losses from the supermarket shelves by improved logistic planning and ordering management based sales figures. Chain optimization models and data sharing had to improve efficiency.	Supermarket chains Logistics company Trading company Agro and food technology institute
Product development/ improvement	The objective was to commercialize pumpkins by developing a new product, i.e., pumpkins stuffed with meat. Market research was used to assess the market for such a product. Food safety knowledge was used to assess the technical feasibility, in terms of food safety requirements.	Pumpkin growers Supermarket chain Agricultural economics research institute Risk analysis institute
Increasing scale	This project intended to increase the scale of organic flowers. Especially in export markets there is considerable demand for organic flowers, but the supply-side operates on a scale that is too small to meet the demand. Organic growing techniques for new types of flowers had to be developed in order to make bouquets, and logistic processes had to be expanded and coordinated.	Organic flower growers Flower trading company Organic trading company Plant science institute Agro and food technology institute
Risk reduction/ quality management	The project intends to improve quality and storage of a specific fruit chain. Specifically it had to lead to fewer losses and a year round rather than seasonal availability of fruits. Technological innovations should lead to changes in growing, harvesting, storing and distributing fruit.	Fruit auction Individual fruit growers Sector organization of fruit growers Agro and food technology institute Plant science institute
Sharing costs and benefits	The organic pork chain had the objective to increase its market share. These efforts were however hindered by the absence of a fair price mechanism. An economic model on sharing costs and profits had to be developed and the technical consequences for the chain of such a system had to be assessed.	Organic hog farmers Organic slaughters and traders Supermarket chain Agro and food technology institute Agricultural economics research institute
Market entry	The objective was for tomato growers to enter export markets. In order to do so successfully, tomatoes had to be adjusted to foreign taste. Technological knowledge on the growing process was used to develop new tomatoes, that were subsequently tested in consumer research.	Supermarkets on export markets Tomato trading company Tomato growers Plant science institute Agro and Food Technology Institute

(continued)

Table 1 (continued)

Main objective	Description	Participants
Sustainable development	In order to improve its sustainability image, a large holiday parks company wants to source its potatoes and vegetables from certified sources. A super market joined the initiative, and together they aimed to motivate their suppliers to increase their production of environmental friendly grown products, and develop methods for year-round production.	Holiday parks company Supermarket chain Potato and vegetable farmers Environmental quality label organization Agricultural economics research institute Plant science institute

3.4 Data Analysis

On the basis of the interviews and information retrieved from desk research and transcription of the interviews, an iterative process was followed to unravel the contribution of the target organization to processes of open innovation in the Dutch agro-food industry. First, a conceptualization of its different contributions to open innovation was made. Next, we returned to the data to re-examine how the theory matched the empirical findings (Eisenhardt 1989). We will discuss these results after having introduced the focal organization of our case study.

4 Results and Discussion

The investigation of the roles played by the organization for open innovation, reveals three basic roles of the organization, i.e., (1) compensating for a lack of absorptive capacity, (2) initiating a continuous learning process in the industry, and (3) higher-order learning on open innovation. These roles appear to have both positive and three negative effects on open innovation in the industry. These results are summarized in Table 2. We discuss them in more detail below.

4.1 Compensating a Lack of Absorptive Capacity

In a low-tech industry, in which closed innovation is the dominant innovation model, the different external sources underlying open innovation projects (Von Hippel 1988) are not easily detected by firms. The organization for open innovation fulfils a role as match-maker between the companies and the sources of innovation. The data reveal that the organization has always been very active in networking in the industry. A group of four or five persons (the organization's general manager and project directors) established new contacts with firms and experts in research institutes.

Table 2 Summary of findings

Essential functions in the industry	Positive roles	Negative roles	Effects
Compensating a lack of absorptive capacity	Match-making between companies within and beyond the supply chain as well as between companies and experts in universities and other research institutes	Competitive tensions emerging from organizational rules and legislation	Stimulating innovation through collaboration
Initiating continuous learning processes	Providing a platform for the exchange and development of ideas	High administrative burden as a consequence of the need for accountability	Organizational change in companies Research agendas in research institutes
Higher-order learning on open innovation	Policy instrument	Organizational misfit	System transition

In addition to their own network, they could rely on the networks of the organization's board members, who are generally senior people from major stakeholders, like industry and government. Contacts are informally shared at the office and included in a database with contact details of people involved in one or more projects and other stakeholders. To increase its visibility, it also invested in a logo, a website, a newsletter, annual reports, other publications, and conferences where the results of key projects were presented. The match-making role was deployed in three ways.

First, the organization for open innovation brings firms closer together that used to do business at arm's length. As the industry used to be centred around commodity markets for raw materials, suppliers and customers were sometimes hidden between spot market-like institutions, like auctions. Although part of the same supply chain, they were not used to join forces in dealing with common problems.

Second, the organization brings companies together that were not collaborating before, resulting in the exploration of new markets and channels. Several projects pursue market entry objectives. Typically, chain partners seek collaboration with retailers in foreign countries or in new channels (like extending their portfolios of channels from super market to food service). The organization fulfils a role as a broker that can match companies to explore new market entries. Generally, entrepreneurs come up with ideas of new market entries and the organization seeks in its network for traders, exporters or retailers that have the appropriate capabilities and could be willing to participate in such a project. In one case, the project director knew, for example, that a manager of a food service company had a personal affection for organic agriculture. When a food service company was needed in one of the projects, the attempt to involve the company through this manager was successful. These findings are in line with the literature on strategic

alliances, suggesting that firms with complementary resources can create new ways of building competitive advantage (Dyer and Singh 1998; Eisenhardt and Schoonhoven 1996).

Third, the role of match-maker is also performed in the relation between companies and research institutes. Match-making between companies and research institutes (including universities) may be important as several streams of literature have emphasized the importance of universities in innovation processes, like regional competitiveness (Porter 1990), national innovation systems (Lundvall et al. 2002) and university-industry-government relationships (Etkowitz and Leydesdorff 1997). Establishing and maintaining contacts with research organizations, the organization for open innovation, is capable to identify and select research institutes in general and qualified researchers in particular, and establish the contact with representatives of companies.

This was not a common practice in the industry, as half of the companies that participated in the first round of projects reported. In the annual report of 1995 it is mentioned that the lack of experience on both sides (companies and research institutes) to collaborate contributed to a somewhat slow start. As one of the founders of the organization formulates:

> At the start of the project, companies often show little respect for the researchers' specific competencies. But over time, they start to recognize the importance of the specific skills of the researcher.

The general manager of one of the participating research institute explains however that part of the friction is caused by researchers themselves:

> Researchers position themselves often as too general. Being part of a co-innovation project, working with companies, researchers need to develop solutions to the specific problems of companies. This requires a deeper insight in the practical situation than just applying theories that work in general.

Over time it became easier for the organization to involve the appropriate experts, because researchers gained more experience in working with companies and research institutes hired new employees that were capable of managing processes with stakeholders, rather than building an academic track record in a single discipline. In several cases, researchers that were involved in the initial projects coordinated by the organization for open innovation were promoted to more senior functions from which they could connect new researchers with specific expertise to the organization.

On a more fundamental level, the lack of experience in dealing with strategic alliances and contacts with universities and research institutes, may be interpreted as a lack of absorptive capacity (Cohen and Levinthal 1990). Firms in an industry that are locked in a closed innovation model for decades, have limited capacity to absorb new ideas and technologies from outside the organization. Thus, even if firms decide to engage in an open innovation project, they lack the capacity to find and select the appropriate partners. An organization for open innovation may compensate for this lack of absorptive capacity by developing knowledge on the

network in the industry.[2] The organization builds knowledge on which firms and institutes have which resources and how open to innovation they are.

As a consequence of the public funding, the organization does not operate only under the logic of efficiency. What also matters is how it achieve its goals. The logic of accountability implies that formal rules and procedures cannot be avoided. A project organized by the organization, requires for example, companies from three stages of the supply chain. Such rules may function not only as a guarantee to policy-makers that the funds intended for open innovation are allocated in the right way, but also may put restrictions to the process. Several projects required participants that are not strictly necessary to develop and implement the innovation, but that were necessary to meet the standards for funding. Such projects may witness competitive tensions between companies. Project directors, for example, referred to projects in which one or more companies remained reluctant to share information over the entire course of the project. There are also cases described in which companies were suspected to entering the project enabling them to observe what the others were doing, without the intention to turn the project into a success. Overcoming a lack of absorptive capacity by providing a match-making organization, comes at a price.

An important spin-off of the organization's efforts in match-making is that in several projects, the collaboration did not end after the project had ended. Project directors provided several examples of projects in which the collaboration between players in the supply chain have led to follow-up projects. These projects sometimes even emerged if the initial innovation project had failed or if no organizational and financial support from the organization was available. This continued collaboration between companies and between companies and research institutes, lays the foundation for the second essential function of the organization for open innovation, which is to initiate a continuous learning process in the industry.

4.2 Initiating a Continuous Learning Process in the Industry

The organization for open innovation fulfils an essential function of initiating a continuous learning process in the industry. Especially, the early projects initiated by the organization involved companies that thus far were not collaborating or, at best, were doing business at arm's length. By starting an open innovation project, a process is set in motion by which firms become aware of their own role in the chain and the contribution of others, learn about each other's competitive positions, and find means to innovate at the benefit of both partners. Comparable ideas are brought forward by studies that emphasize that firms in a supply chain may learn from each other when relationships become closer (Lukas et al. 1996; Roy et al. 2004). Our results add to this that an organization for open innovation may start such a mutual

[2] It has to be recognized that succeeding in match making finally results in the organization becoming redundant.

learning process by initiating an open innovation project. One of the project directors for example noted:

> In the first stages of a project, firms are sometimes a bit reluctant to tell others what their interest is in the project. But over time, you often see that people get to know each other and that they more easily share information. They start trusting each other. When they gain better insight in each other's position in the chain, the collaboration often continues after the project has ended.

Next to gaining a better insight in their supply chain, firms may also increase insight in their broader external environment during an innovation project. They may discover new opportunities and generate new ideas for subsequent projects. These findings are in line with studies on organizational learning from markets (Sinkula 1994; Slater and Narver 1995). It seems that the focal organization of our study fulfils a comparable role in the process of open innovation by connecting firms to new information sources and by making them part of experiences from which they detect new opportunities. Von Hippel (1988) pointed to this respect to customers and competitors as information sources for innovation. Lundvall et al. (2002) see learning as the driving force behind national innovation systems. Comparably, its role as initiator of learning, can be seen as an essential function of the organization for open innovation.

In a more visible way, the organization provides a platform for bringing ideas within the industry into the next phase of development. Entrepreneurs with innovative ideas can turn to the organization and find support for their ideas in the form of organizational support to bring all business and research parties together and to financially support the formulation of a project proposal. Formerly, it was much more difficult to share innovative ideas with others. As one of the interviewees noted:

> Over time you could tell that several persons with a typical entrepreneurial spirit, knew how they could projects get started. These projects build on very clear ideas of the entrepreneurs and they were often very successful.

At the same time, organizing such a platform requires rules and legislation, and thus administrative burden that often contradicts with the entrepreneurial spirit. Being a public policy supported program, the projects also bring substantial administrative burdens to the participants, because transparency is required in the spending of public budgets. In one case, a project that aimed to develop a new consumer product, the involved companies abandoned the project because they perceived the administrative burden as too high. An interviewee explained:

> From there onwards, it was beyond our scope. But 1 year later, we saw the product in the supermarket shelves. Thus, we figured that the project has been continued by someone who wanted to get rid of the administrative burden and rules. Instead, he continued with those partners that were really critical to the development of the product. When we saw the product there in front of us, we believed the project was successful after all.

The learning process that is initiated has consequences for the internal organization at both companies in the industry and universities and other research institutes.

In the absence of a market for knowledge exchange, firms are internally organized for incremental, closed innovation processes. Although we found no examples in which companies made changes in their organizational structures as a direct consequence of participating in one or more open innovation projects, it certainly had an effect on the mind set of employers and employees in several companies. One respondent noted that over time, fewer projects coped with the problem of isolation, meaning that the project was not really embedded in the firms but 'just a toy of one of the firm's employees that received no follow up in the rest of the firm.' Concrete examples of the changing mind sets in the participating firms were that a company eventually hired one of the involved researchers as a quality director, and that a company's employee was employed by another organization for open innovation. In its role of initiating a learning process, the organization for open innovation therefore has an impact on the openness of firms in the industry. The limited use of external innovation is an important topic in the open innovation literature (Chesbrough 2006b). Katz and Allen (1985) reported for example on the Not Invented Here syndrome that seems present in agro-food industry, like it was present in other companies with deep vertical integration of R&D from economies for scale and scope.

Two specific stimuli to get projects started are the public funding and the skills offered by the organization, which can be used to involve companies that initially have more skeptic attitudes towards open innovation. Subsidies lower the financial risk for firms to get involved with external partners in innovation processes. Our case thus provides evidence that subsidies are used to reduce the financial risk of an open innovation project, which is offered by Chesbrough (2006b) as a rational reason for companies to avoid external knowledge in their projects. The findings, however, also suggest that chances on success may increase, because the organization offers its skills to the project. The project directors, for example, fulfil an important role in keeping parties together during the course of an innovation project. The continuation of the project may, for example, be at stake if a project partner turns out not to have the appropriate capabilities. If no appropriate replacement is found, the project should be quitted. Similarly, changes of corporate representatives that are involved in the project may be a threat to the continuity of the project. Such threats can be overcome by the continuous presence of a project director, because the project director has the knowledge and responsibility to quickly acquaint new participants with the history of the project. He or she would also know why a specific participant would no longer fit the project and which specific skills are required from a new participant to turn the project eventually to a success. This decreases the risk that funds will be wasted on project failures.

The learning process also causes changes at universities and research institutes, because the projects influence their research agendas. In its annual report of 1998, the organization claims that:

> . . .the fundaments are placed for the realization of a sustainable knowledge infrastructure. This enabled the business community to make better use of the knowledge potential of the infrastructure. It influences the research agenda, for example, in an early stage of chain knowledge development.

Researchers and the general manager of the research institute confirm that they used the project (among others) as an indicator to assess and improve the practical relevance of their strategic research agendas. By collaborating in these projects, they gain insight in the type of problems that firms cope with and how the capabilities of their institute may fill these gaps of knowledge. As such, the organization influences also the policies of research institutes and potentially contributes to a better match between the business and research communities at large. To this respect our case suggests that organizations for open innovation may play a role in the process that connects universities and other research institutes more strongly to industry (e.g., Etkowitz and Leydesdorff 1997).

4.3 Higher-Order Learning on Open-Innovation

The organization can be used as an instrument to achieve policy objectives. By fulfilling its role as an initiator of continuous learning in the industry, the organization for open innovation becomes an important instrument for policy makers because it can influence the strategic focus of the industry. This may be helpful in achieving policy objectives like long-term competitiveness (and thus employment) of an industry, and matching the technologies and size of an industry with the ecosystem on which it relies. To this respect, an organization for open innovation can be an institute to which Lundvall et al. (2002, p. 225) refer to as policy-coordination 'to cope up with the challenges and contradictions of the globalizing learning economy'.

An important benefit of attractive subsidies for projects organized by the organization for open innovation is that projects are centralized. This way, the organization can keep track of industry developments and learns all the essential lessons on how open innovation processes in the industry are shaped. To this respect, the organization states that it has a 'multi-client structure'. The firm has not only responsibility for effective spending of public funds, but it also requires an investment of the participating firms of about one third of the project budget. By doing so, the funding system requires financial commitment from firms, rather than providing direct subsidies to the companies. An organization for open innovation is therefore potentially an efficient policy instrument to allocate public funds for economic vitality.

The essential underlying function of the instrumental role of organizations for open innovation, is that such organizations become knowledgeable institutions on open innovation. In other words: by being involved in numerous and diverse open innovation projects, the organization develops capabilities on how open innovation can be done in a successful manner. It may learn more on a higher order level how open innovation can be generated and it thus can support other organizations. Other open innovation institutions indeed start to make use of the organization's experience in open innovation, by outsourcing organizational tasks to the organization. The organization played for example an important role in the management and development in a taskforce for organic agriculture. The organization thus becomes

a body of knowledge on open innovation itself and it is leveraged in other policy programs.

Meanwhile the organization itself, may become increasingly redundant. The organizational structure, procedures and routines may hinder new, more market-based forms to govern the open innovation process. Remarkably, a policy-maker stressed during an interview that he became increasingly interested in other projects that were done by firms. He felt that the organization for open innovation was losing its grip on the process and that policy-makers had to think of additional instruments if they wanted to influence the open innovation process in the industry:

> Firm are of course also doing all kinds of projects themselves that we as policy-makers are not even aware of. To shape our policy, more insight in these projects would be very helpful. Building our entire innovation policy on [the organization for open innovation] is no longer sufficient.

Apparently, projects that were going beyond the boundaries of firms were no longer rare in the industry. By bringing firms together and matching them with research institutes, a learning process had started in the industry that eventually grew above the head of the organization itself. Such a process may eventually bring about systemic changes in the industry, in which new and increasingly radical technologies could spread across the different stages of the supply chain. In addition, the findings suggest an optimal balance between market and organization in governing open innovation. This balance may be unique to every industry and shift over time from more organizational (to initiate learning and compensate a lack of absorptive capacity) to more market-based (to provide more freedom to actors, meanwhile not losing control). Governance of open innovation is therefore contingent on industry characteristics including its lifecycle.

5 Conclusion and Implications

Organizations for open innovation may be helpful in initiating open innovation in mature industries. These industries are usually far in their technological life cycle, meaning that innovation intensity is low, margins small, that companies are locked into a certain technological frame and that the path-dependency may have created a working modus that is not ecologically sustainable. This context offers an important and interesting setting to extent the thinking on open innovation. In the absence of a market on which ideas, knowledge and technologies are traded, open innovation is unlikely to emerge spontaneously in low-tech industries. In order to develop these industries beyond the constraints of a closed innovation model, a process of open innovation can be initiated by an organization of open innovation. To this respect our case study presents evidence that open innovation is not restricted to high-tech industries. In fact, mature and low-tech industries may be locked into technologies that are eventually not sustainable because they are not in balance with the ecosystem on which the industry relies. In these events, open innovation promises to be an important part of the solution. Although our study offers some theoretical

generalizability that may be helpful to understand how innovation can be fostered in other mature industries, we should keep in mind that the empirical evidence constitutes a single case study. Developing a more complete body of knowledge on the topic requires more research, for which we give directions later on in this section.

The focal organization in our case study, fulfils a role as match-maker between firms and their current and potential trading partners, as well as between firms and research institutes. By doing so, it compensates for the lack of absorptive capacity in the industry and it initiates a continuous learning process in the industry by providing a platform for ideas. Providing subsidies and process knowledge to the participating firms and research institutes, the organization fulfils a central role in open innovation in the industry and develops higher-order knowledge on open innovation in the industry.

However, at the same time the organization confronts the participants in open innovation projects with requirements regarding the number and characteristics of participants, and with administrative burdens. At some point in time, these negative side effects no longer balance with the benefits that the organization can offer. Firms have reached a stage at which they have an alternative, i.e., developing the project on their own. Because the organization had decreased the gap between buyers and sellers in the chain, customer relationships have strengthened and are now strong enough to jointly embark in an innovation project. The strict organization that was required to initiate the process of open innovation in the industry, is no longer required to continue the process of open innovation in the industry. This suggests that the difference between mature and emerging industries is in reality more fluent. There seems to be an optimum in the governance of open innovation on the range between market and organization that is contingent on industry characteristics like stage of the industry lifecycle.

5.1 Implications for Policy

Public policy-makers should be aware of the benefits that organizations for open innovation can offer, i.e., match-making between firms and their current and potential trading partners as well as research institutes, providing a platform for innovative ideas in the industry, and their role as policy instrument through which policy-makers can influence the strategic orientation of an industry. Policy-makers can make use of these roles in developing policies to enhance open innovation and achieve multiple objectives by establishing or supporting such organizations. They should however also be aware of potential disadvantages, i.e., administrative burden and competitive issues rising from projects containing partners sharing competitive rather than collaborative interests.

Our findings also call for an organizational model on a permanent basis. This way, experience on the open innovation process is accumulated and can be applied in subsequent programs. Moreover, other institutions for open innovation that operate on a temporary basis, can tap from this experience by outsourcing activities

to a more permanent organization. A critical task to this respect is to ensure that the organization is sufficiently flexible in that it finds a new role in the process of open innovation, after it has initiated the process in the industry.

5.2 Implications for Business

Managers responsible for innovation in companies can also benefit from establishing a relationship with an organization for open innovation. Marketing should therefore not only be customer-focussed but increased to other stakeholders. The organization of open innovation becomes in that respect an important stakeholders to build relationships with, thus changing the marketing policies of the company. The benefits may be of a financial (government support), relational (stronger ties with suppliers, customers and/or other stakeholders), informational (new insights and experiences), and organizational (initiation and coordination of the project) nature. These benefits may be obtained when the firm becomes part of the web in which the organization of open innovation is the spider. Firms with a strong entrepreneurial drive find in the organization a platform to expose their ideas and turn these ideas into concrete projects. For more reactive firms 'being available to be found' is critical in innovation processes directed by an organization for open innovation. Finally, by participating in projects coordinated by the organization for open innovation, firms may learn over time to initiate and direct their own projects, which may turn eventually into a competitive advantage.

5.3 Directions for Future Research

In drawing a research agenda for open innovation, West et al. (2006) define five different levels for analysis: individual, organizational, value network, industry/sector and national institutions. Studies on organizations for open innovation may be relevant to all of these levels.

First, on the individual level future research may examine how individual entrepreneurs use organizations for open innovation to realize their innovative ideas. Whereas the organization provides the resources that enable the individual to develop and carry out a project, it is the entrepreneur that has the vision to come up with path breaking ideas that may eventually change the foundation of an entire industry. To researchers, organizations for open innovation may be an interesting context to study the role of individual entrepreneurs in open innovation and to gain more insight in the question why they immediately share their ideas with others rather than to protect them.

Second, on the level of the organization, future research should focus on the organization for open innovation itself, or more generally on governance of open innovation. When is the level of organizing optimal under different conditions of industry development? How can such organizations develop hand in hand with the industry, so that the knowledge they develop can be maintained without developing

organizational misfit? In other words: how to keep the memory of the organization once their role as initiator of open innovation has become redundant? These are some key questions that need to be answered at this level.

Third, with respect to the value network, future research may study the value networks that are created in projects organized by the organization for open innovation. In particular, it would be interesting to examine the key success factors of projects. Are the success factors of projects coordinated by organizations for open innovation in low-tech industries different from those that emerge more spontaneously in a high-tech context? What are the consequences of these projects: under which conditions do they contribute to an on-going process of learning and collaboration? An answer to such questions may be of help to policy-makers and business managers that aim to give open innovation in their industry an impulse, but are uncertain about the effectiveness of their actions. Another topic that deserves more attention is the role of universities and other research institutes in these projects and how the projects contribute to a stronger integration of these institutes in the value network.

Fourth, on the level of the industry/sector, the key question is whether the organization for open innovation really contributes to system transitions and how. The challenge for researchers is here to find insightful cases in which system changes have taken place and to evaluate the role of the organization for open innovation in this process. Another approach is to develop simulation models that provide insight in adoption of new technologies in an industry with and without an organization for open innovation.

Fifth, at the level of national innovation systems, the instrumental role of organizations for open innovation deserves more attention. Here, a broader approach that compares different industries and countries would be of interest: How and for which purposes are organizations for open innovation applied in different countries? Are there performance differences between organizations, or how can these performance differences be explained?

In general, the phenomenon of organizations for open innovation that coordinate the open innovation process in low-tech environments is an extension of the debate on open innovation that has its origins in high-tech contexts. Understanding how industries that are locked-in to technologies that are eventually not sustainable, can engage in open innovation is sufficiently important to society to deserve close attention from researchers.

Acknowledgements The authors thank Woody Maijers and an anonymous reviewer for helpful comments on an earlier version of this article, the KB5 Program of Wageningen University and Research Centre for supporting this research, and Arianne van Dijk and Linda Puister for research assistance.

References

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120.

Boehlje, M. (1999). Structural changes in the agricultural industries: How do we measure, analyze and understand them? *American Journal of Agricultural Economics, 81*(December), 1028–1041.

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.

Chesbrough, H. (2006a). Open innovation: A new paradigm for understanding industrial innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1–12). New York, NY: Oxford University Press.

Chesbrough, H. (2006b). New puzzles and new findings. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 15–34). New York, NY: Oxford University Press.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–52.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*, 147–160.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *The Academy of Management Review, 23*(4), 660–679.

Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532–550.

Eisenhardt, K. M., & Schoonhoven, C. B. (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science, 7*(2), 136–150.

Etkowitz, H., & Leydesdorff, L. (Eds.). (1997). *Universities and the global knowledge economy; A tripple helix of university-industry-government relations*. London: Pinter.

Gassmann, O., Sandmeier, P., & Wecht, C. (2006). Extreme customer innovation at the front end. *International Journal of Technology Management, 33*(1), 46–66.

Hakansson, H. (1987). *Industrial technological development: A network approach*. Kent: Croom Helm.

Heugens, P. M. A. R., & Lander, M. W. (2009). Structure! agency! (and other quarrels): A meta-analysis of institutional theories of organization. *Academy of Manangement Journal, 52*(1), 61–85.

Hofer, C. W., & Schendel, D. E. (1978). *Strategy formulation: Analytical concepts*. St. Paul, MN: West Publishing.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 2*(1), 88–115.

Jansen, J., Van Den Bosch, F., & Volberda, H. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science, 52*(11), 1661–1674.

Katz, R., & Allen, T. (1985). Organizational issues in the introduction of new technologies. In P. Kleindorfer (Ed.), *The management of productivity and technology in manufacturing*. New York, NY: Plenum.

Klerkx, L., & Leeuwis, C. (2009). The emergence and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. *Technological Forecasting and Social Change , 76*(6), 849–860.

Lukas, B. A., Hult, G. T. M., & Ferrell, O. C. (1996). A theoretical perspective of the antecedents and consequences of organizational learning in marketing channels. *Journal of Business Research, 36*, 233–244.

Lundvall, B. Å. (Ed.). (1992). *National systems of innovation*. London: Pinter.

Lundvall, B. Å., Johnson, B., et al. (2002). National systems of production, innovation, and competence building. *Research Policy, 31*, 213–231.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87.

Nelson, R. R. (1959). The simple economics of basic scientific research. *Journal of Political Economy, 67*(3), 297–306.

Porter, M. (1990). *The competitive advantage of nations*. New York, NY: Basic Books.

Roy, S., Sivakumar, K., & Wilkinson, I. F. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science, 32*(1), 61–79.

Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal, 50*(1), 20–24.

Silvis, H. J., & Leenstra, F. (Eds.). (2009). *Prospects for the agricultural sector in the Netherlands; Economic and technological explorations*. The Hague: LEI Wageningen UR.

Sinkula, J. M. (1994). Market information processing and organizational learning. *Journal of Marketing, 58*(January), 35–45.

Slater, S. F., & Narver, J. C. (1995). Market orientation and the learning organization. *Journal of Marketing, 59*(July), 63–74.

Vanhaverbeke, W., & Cloodt, M. (2006). Open innovation in value networks. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 258–281). New York, NY: Oxford University Press.

Von Hippel, E. (1988). *The sources of innovation*. New York, NY: Oxford University Press.

West, J., & Gallager, S. (2006). Patterns of open innovation in open source software. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 82–106). New York, NY: Oxford University Press.

West, J., Vanhaverbeke, W., & Chesbrough, H. (2006). Open innovation: A research agenda. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 285–307). New York, NY: Oxford University Press.

Wuyts, S., Dutta, S., & Stremersch, S. (2004). Portfolios of interfirm agreements in technology-intensive markets: Consequences for innovation and profitability. *Journal of Marketing, 68*(2), 88–100.

Yin, R. K. (2003). *Case study research design and methods* (Applied social research methods series, Vol. 5). Thousand Oaks, CA: Sage.

Vision and Radical Innovation: A Typology

Susan E. Reid

Abstract

In this chapter, we investigate the nature of vision and its potential evolution pathways, in the case of radical innovation. To set the stage, radical innovation and its importance are discussed. Given the importance of vision for firm success in the radical innovation context, vision is deconstructed in order to better understand its three core components—the goal, the passion underlying it and the clarity of the vision. The composition of vision tends to change and become more elaborated over time, depending on its nature, how it begins and who is involved. Given this, a typology is created which is made up of four characteristic combinations of 'who' and 'where' a radically innovative vision may exist in time and place. As such, four types of vision are characterized which play an essential role in the front-end of radical innovation: value-driven vision, technology vision, bottom-up market vision and top-down market vision.

1 Radical Innovation and its Importance

If you had a choice to make something new for the market, would you try to do something radically different from others, or would you try to imitate or do something similar to what others have done in the past? In fact, we know from a great deal of research over the last several decades that the total percentage of innovations which are considered to be 'radical' falls at approximately 10 % and this number has remained fairly consistent over time (Griffin 1997; Booz, Allen & Hamilton, Inc. 1982).

S.E. Reid (✉)
Department of Marketing, Williams School of Business, Bishop's University, Lennoxville, QC J1M 1Z7, Canada
e-mail: sreid@ubishops.ca

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_9

So, what is radical innovation? Why do fewer individuals and firms pursue this type of innovation and why is it of interest to us? To answer these questions, first let's look at a simple and illustrative definition of overall innovation and then we will look more carefully at what radical innovation is and why it is important. According to Roberts (1988, p. 13): "Innovation = Invention + Exploitation". So, in effect, the way that innovation is distinct from mere ideation or invention is related to the necessity that inventive ideas need to be used or meet the market in order to be innovative, and not just sit on a shelf or in someone's mind. It is this distinction which requires having a set of initial goals to create a technology or idea and then another set of goals related to use of the invention and/or bringing the idea to the market. In particular, since radical innovations involve products that are new to the firm and marketplace (Ansoff 1957) they tend to involve "dramatic departures from existent products or their logical extensions" (Veryzer 1998, p. 306). As a result, the tasks of both achieving the invention and exploitation components of radical innovation are much more involved than those with incremental innovations, thereby necessitating firms to build new technical and commercial skills and infrastructures (Colarelli O'Connor 1998; Garcia and Calantone 2002; Song and Montoya-Weiss1998), and to employ new problem-solving approaches (Burns and Stalker 1961; Tushman and Anderson 1986).

Colarelli O'Connor and Veryzer (2001) have operationalized these relationships by suggesting that radical innovation projects are those which either give a 5- to 10-fold improvement in their performance or a 30 % reduction in cost. Also, in the most recent PDMA Comparative Performance Assessment study (Markham and Lee 2013), those firms considered to be the "best" had a significantly higher base of profits coming from radical innovation projects. Clearly, there is much to be gained by taking on radical innovation; the problem is that inherent in the nature of developing products of a radical nature, is a higher level of risk and uncertainty and therefore the tendency for firms to focus on incremental innovation (Cooper 2011). Part of the uncertainty in radical scenarios for firms is related to the high level of involvement of individuals working on unstructured problems and with limited contextualized information, often doing this work without being on the radar of upper management and the firms they work for (Reid and de Brentani 2004). It seems therefore that opening the black box of what goes on with the decision processes and actions of such key individuals working in these situations can provide important clues for organizations as to how to reduce the uncertainty of the front-end of new product development. This will help to better understand and manage the role of individuals in recognizing new technological and market opportunities and to bring these ideas to the attention of the firm in the case of radical innovation (Burgelman and Sayles 1986; Colarelli O'Connor and Rice 2013; Crossan et al. 1999; Reid and de Brentani 2004).

2 The Importance of the Relationship Between Radical Innovation and Vision

As we come to understand more about success with innovation—and of particular interest in this case, success with 'radical innovation'—we know that vision, or an image of a desired future, plays an important role in ensuring such success (Reid and de Brentani 2010; Reid and Roberts 2011). Visioning is an important part of this process and enables risk reduction through offering different points of convergence around technology development goals and specific market goals. As such, underlying every great radical innovation lies not one, but several visions which help bring it to fruition (Reid and de Brentani 2010; Sarpong and Maclean 2012). Not only are there several visions involved with a given radical innovation, but there are also several different types of underlying vision, and they tend to occur at different times during the trajectory of a radical innovation. So, this begs a few key questions:

1. How are visions related to radical innovation born? In other words, do they all come about as a result of a similar process or can the visioning process be a result of different stimuli and processes? Are these processes linked in any way and what different types of vision are important at different times during the trajectory of a radical innovation?
2. Given the interplay between individuals and larger groups or organizations which bring about radical innovations, does vision differ in the way it looks from an individual's perspective versus from an organization's perspective?
3. Are the basic elements of vision similar under different levels of contextualization in the environment? In other words, what happens to vision as it moves closer towards specific product/markets and becomes more contextualized for specific applications?

A Short (and Mythological) Historical Case Study Related to Generic Vision

They say a face can launch a 1,000 ships. . .perhaps you have heard the tale of the abduction of Helen of Troy and the great Menelaus, who initiated a deployment across the Aegean Sea from Greece to Asia Minor with the vision of rescuing his wife from Paris? Notably in this tale, there were a 1,000 ships—some owned by Odysseus, others by Ajax, and so on. Some of the Greeks had the vision of being suitors to Helen. Some had the vision of a war against Troy. Some had the vision of travelling to a foreign land and the potential fortunes that may lay there. Some were just along for the ride. While the Trojan horse was seemingly filled with men with one vision, we know that the reality was likely otherwise. The short-term goal and mission was of course to vanquish the Trojans, but the longer-term vision of each Greek which brought them to Troy in the first place could not be further from the short-term goal and mission.

(continued)

In short, the mythological story of the Trojan War is one which is a story of paradox. Yet, it is a story which most of us can relate to. We often find ourselves temporarily bound with others in order to perform short-term and sometimes longer-term 'organizational or group missions' in order to pursue our own goals and visions. A mission statement asks "What business are we in?" while a vision asks "What business should we be in?" In other words, those goals with a longer term focus which we are passionate about and which we have a clear focus on are what we refer to when we think about vision.

3 Generic Vision

Let's take a step back and look first at the basic building blocks which all visions have in common. Researchers have focused on vision under specific contexts [for example, organizational vision (Collins and Porras 1991, 1995; Hamel and Prahalad 1994), project vision (Lynn and Akgün 2001), market visioning (Colarelli O'Connor and Veryzer 2001), market vision (Reid and de Brentani 2010), technology vision (Reid and Roberts 2011), and peripheral vision (Day and Schoemaker 2005)], however there appear to be three core dimensions common to most of these types of vision. In terms of the most straight-forward definition for vision which incorporates these three aspects that all generic visions share in common, we can define it as follows:

Broad Definition of Vision: Vision is "an image of a desired future" (Stokes 1991, p. 118).

The basic dimensions which all generic visions share are summarized here and in Fig. 1:

1. A goal or target (future): First, each vision inherently has a goal or target which it is aimed towards. In effect, a vision is a mental image or mental model of how we see ourselves or something we are interested by in a future state that we are moving towards. Vision goals involve hopes and dreams, projected into the future. There are two aspects involved with such a future goal—the first is the 'form' of the vision itself, or in other words, what the mental map is actually comprised of and the second is the 'scope' basically comprising the size and impact of the goal.
2. Passion (desired): Second, visions by their nature are imbued with some level of passion. They are attractive or magnetic most importantly for the individual person who first creates the vision, and potentially for others with whom they share the vision. Vision magnetism is an aspect of vision which involves both attractiveness and importance and is require to overcome the natural inertia that individuals have when moving towards a goal. Not only does passion help overcome inertia, but it helps to speed up the process. The higher the level of

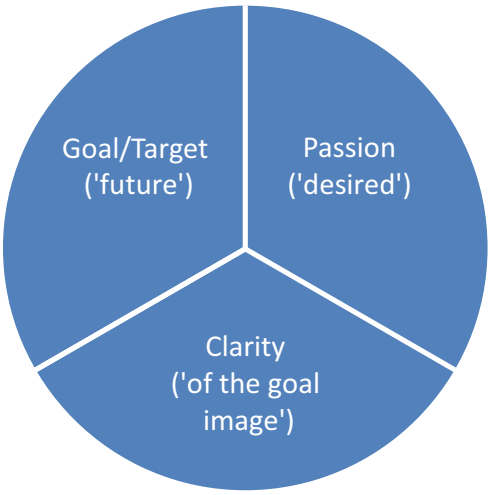


Fig. 1 The basic building blocks of vision (figure by author)

passion, the more energy that will be put into the effort to move towards the target. Hegel (1770–1831) suggested that passions are highly energetic and required to reach the highest level of achievement. There is a wonderful old story which illustrates this principle well. Three brick layers are working on a building and when each is asked what they are doing, they respond in turn: "Laying bricks", "Building a wall" and finally, "Erecting a great cathedral". There is no question that the brick layer working on erecting a great cathedral will work quickly and with the most diligence to do a quality job.

Source Image: Licensed from Shutterstock and downloaded on May 5, 2013. http://thumb1.shutterstock.com/thumb_large/948592/119155630/stock-photo-siena-aerial-sunset-panoramic-view-cathedral-duomo-landmark-tuscany-italy-119155630.jpgmage

3. Clarity (of the goal image): Third, visions hold a certain level of clarity—and the best are those which are very clear and also tangible. Clarity is important because it is required to help zoom in on the future desired state in a focused way. The more clear the goal state, the higher the likelihood of achieving it. This is because clarity embues meaning for people and without clear meaning, and with higher levels of variance in understanding, not only is it difficult for the individual to pursue the goal, but it also becomes more difficult to share and build further meaning with others.

4 Early Stages of Radical Innovation

Now that we have a good understanding of the three basic building blocks involved with any type of vision, let's looks specifically at how they are influenced by involvement over time with radical innovation. First, then, we need to develop a clear understanding of what radical innovation is. As noted previously, the traditional definition of radical innovation, as developed by Ansoff (1957) is seen from the product perspective and that it involves newness from the perspective of the firm and the marketplace. While such definitions are useful when specific products and markets are involved, they leave out a large stage of the much earlier development, sometimes referred to as the" fuzzy front-end" (Smith and Reinertsen 1991; Reid and de Brentani 2004), much of which may occur prior to any product development, and market or technical focus, and often without any level of firm involvement in the case of university-based research, entrepreneurial ventures or in the case of early stage 'intrapreneurial' (Pinchot and Pinchot 1978) ventures. Garcia and Calantone (2002) distinguish what they define as "really new" innovations—those requiring market discontinuities or technological discontinuities, but not both, from "radical" innovations—i.e., those requiring changes to both technological and marketing infrastructures—to show that there are some really new innovations which are purely market change driven, and some which are purely technology change driven and depending on their provenance may not end up in an economic world or in a science world. Their definition, however, shows that radical innovations require both elements, market and technical discontinuity. So, in other words, there are a variety of potential pathways down which an innovation can travel and only some of these will result in all three: technological involvement, firm-level involvement and market involvement, and those radical innovations are the ones we are particularly interested in. Additionally, as noted in Reid and Roberts (2011, p. 427), "since innovation itself is a process rather than just a product, an important component of radical innovation concerns the key individuals involved in this process and the paradigm shifts required in their underlying mental models regarding 'what the firm does' (Reid and de Brentani 2004; Tidd et al. 2005)." In other words, the individual is another key component for understanding radical innovation and how it is married with the firm, and this is part of the goal of this chapter—to put some light on this individual-level component.

As mentioned previously, researchers have studied several types of vision involved with final delivery of products to the marketplace and that they share three core dimensions: form, clarity and magnetism. What distinguishes different types of vision, however, is when they tend to occur over the course of time over the diffusion of a product to the marketplace. In general, the closer such visions move toward product delivery to the market, the more elaborate the market vision aspect becomes and the more well-shared and understood they become with and by others. In order to get a better understanding of this progressive sequence, it helps to look at the way information and ideas are shared over time related to a specific core idea—whether it begins as a technologically based idea or one based from the broader realm of arts or society. So, for example, a technology vision might be to develop a very strong cable made from nanotubes and later on a market vision may be created for such a cable to make the world's first space elevator. The market vision in this case would likely come only once the technology vision was fairly clear. Generally speaking therefore, the core idea and visions attached to it become more clear and refined over time.

Radical innovations typically run along a trajectory known as an 's-curve'. So, we will first explain the relationship between radical innovation and the s-curve and then look at visions born along these trajectories and their inter-relationships. 'S-curves' were first described by Sahal (1981) who showed empirically that as technologies are better understood and progressively exploited, and as their potential becomes more clear over time, there is a typical pattern which unfolds, and this is known as the 'technology s-curve'. Sahal performed this research over several different industries and found that this pattern was fairly consistent over several different types of technology within these industries. Essentially, as described by this research, the s-curve begins at the bottom of the "s" with invention, generic science, or a basic research period where the overall potential of the technology is still fairly low or unknown, the potential contexts are not well understood and the technology has not been exploited. As the curve moves into the slope or middle of the "s", development and exploitation begin to take place, usually along many trajectories, and this is where the level of potential for the technology is at its highest—based on a high number of applications under development. So, for example, a generic core technology such as recombinant DNA in the field of biotechnology would be at the base of the s-curve and then many applications from this base would spring forth as many different companies would put their product spin on the core technology. Finally, the top of the "s" represents a mature technology where the potential for the technology begins to peter out and the number of applications begin to slow down. It is important to note that the curve is not a measure of sales growth, because sales may continue to grow into the final maturity stage of this curve; rather, the s-curve represents the rate of technological progress or as Christensen (1992) notes, the s-curve captures the potential for improvement in a technology's performance resulting from a certain level of engineering effort. As noted in Reid (2005, pp. 7–8), "Whereas at the beginning of the technology life cycle (or bottom of the S-curve) the potential for technology performance improvement is quite great, at the end of the life cycle, further

increased engineering effort leads to diminishing returns in the performance of the technology. That is, the technology is approaching some natural or physical limit as it matures, in terms of the number of potential applications it may be utilized in or the ability to deliver additional benefits."

The distinction between applications and benefits is an important one, because it allows for the fact that innovation may initiate not only from a technological innovation, but it may also issue from a societal innovation, based in the broader realm of art or society. For example, social entrepreneurship is a relatively new core social idea, which many individuals are currently pursuing in terms of their specific ideas as to how to apply social entrepreneurship. Therefore, we can think of 'technology s-curves' as put forth by Sahal and Christensen, and we can think of 'social s-curves' where the improvements and returns in performance are more value-driven and related to society. These two curves may be independent or they may be related as noted above in the case of radical innovation. In the case where they work together, the social s-curve interestingly initiates the technology s-curve, and then tends to be the result of the technology s-curves associated with it (or an overlay) as can be seen in Fig. 2.

The technology life cycle, or technology s-curve, is initiated when there is a period of time during which individuals are beginning to think about social problems from a "solving" perspective and/or from a lead user perspective (von Hippel 1986) where they are trying to solve technical problems or questions they are having themselves. Some of these individuals will work on these problems in isolation, in the lab or in very small groups and some will attempt to bring them into firms or, if they are already working for a firm, to the firm's attention—particularly if they see a potential market context. On the other hand, such individuals may not pursue a market avenue, particularly if they are really just interested in the technology on its own merits.

Utilizing the concepts developed here, we can therefore propose a typology of how visions are born, as follows.

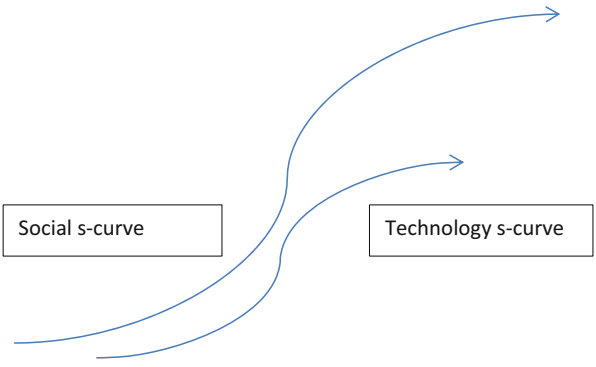


Fig. 2 Social s-curve: begins earlier and overlays the tech s-curve (figure by author)

5 How Visions Are Born

Past research confirms that the way that visions are 'born' indeed do come about as a result of different processes and at different periods of time. In order to better understand the different birth routes, one way to organize some of the key processes involved with vision initiation is to understand 'who' is initiating the vision and a second way is to understand 'where' in the overall process of the s-curve, or how close to the eventual target market, the radical innovation is—in other words, is there what I will call a 'low market context' or a 'high market context' for the innovation? These two axes, one related to 'who' and one related to 'where', give us some idea of the location and reasoning behind the initiation point and final target point (or 'exploitation point') of the radical innovation. We can also think of this as a sort of vector which will have a directionality and a speed behind it.

So, utilizing these two axes, 'initiation point' and 'exploitation point' we can create a 2×2 matrix to better understand the various potential birth routes (initiation points) and reaching 'maturity' (target points), if you will. First, in terms of the 'who' or 'initiation point', it is well known with radical innovation, that usually either entrepreneurs, artists or individual 'problem solvers' are engaged in the very early-stage pattern recognition with radical innovation. Additionally, firms or groups can sometimes initiate the drive to seek out ideas and innovations to solve world or market problems, however, on the overall these usually contribute more incrementally to the early stage ideation of any given innovation. We can think of this axis then as running along a spectrum from 'High Individual Focus' to 'High Organizational or Group Focus'. Second, in terms of the 'where' or 'exploitation point', it is also known that with radical innovation there can be a wide spectrum in terms of initial understanding or realization about the eventual market context which will be pursued with a given innovation. Additionally, many firms will ping a variety of potential markets, sometimes known as 'patsy markets' (Lynn 1993) before settling in on the one or ones they will pursue. This means that firms may pursue more than one market vision, either simultaneously or in parallel, depending on their resources. As such, we can think of this axis in terms of running from 'Low Market Context' to 'High Market Context'. If we put these two axes together, what we see emerge is a typology made up of four characteristic combinations of 'who' and 'where' a radically innovative vision may exist in time and place, as follows and shown below in Fig. 3:

1. Value-Driven Vision (high individual focus/low market context)
2. Technology-Enabled Vision (high organization focus/low market context)
3. Bottom-up Market Vision (low organization focus/high market context)
4. Top-Down Market Vision (high organization focus/high market context)

Specifically, Quadrant 1 (Q1), or 'Value-Driven Vision' and related innovation is likely to occur first. This is the heart and place where all radical innovation is truly born and is related primarily to the social s-curve and possibly some very early stage technology s-curves, as denoted above. This is the world of Leonardo da Vinci

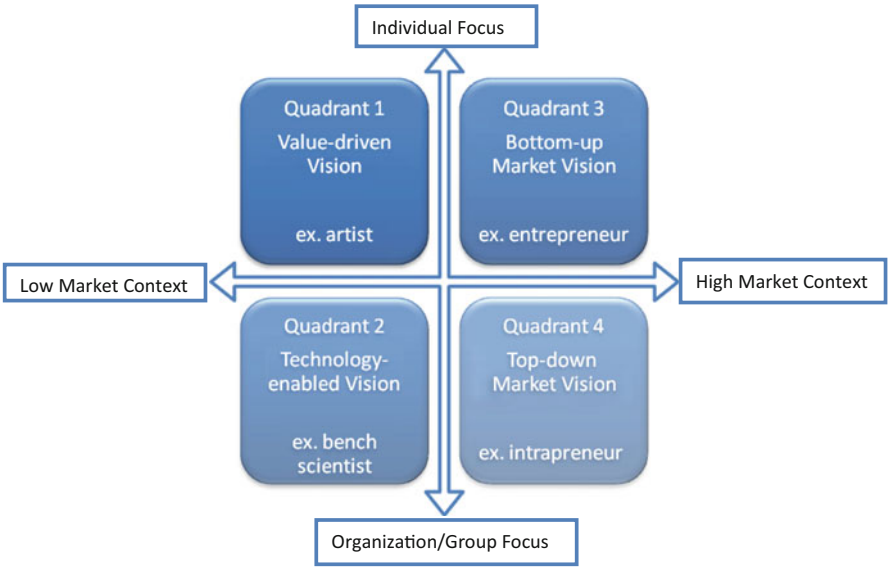


Fig. 3 Vision typology (figure by author)

and Nicholas Tesla. Only with true leaps of inspiration, sometimes based on pattern recognition, sometimes from inspiration or intuition or spirit, can radical innovation take root. As Carl Jung said, "Your vision will become clear only when you can look into your own heart. . .who looks outside dreams; who looks inside awakes." This is the realm of the artist, the poet, the tinkerer, the futurist. This can also be a place where scientists play, but only those who have made substantial leaps in their art or the understanding of science through framing shifts really belong to this quadrant. For example, the 'birth' of 'nanotechnology' is sometimes credited to Richard P. Feynman's famous 1959 "There's plenty of Room at the Bottom" presentation at Caltech. This speech was made years prior to the coining of the term in 1974 by Norio Taniguchi or the development of the scanning tunneling microscope in 1981 which would ultimately enable some of the first major developments in the field such as the invention of Buckeyballs in 1985 by Richard Smalley and his colleagues. Another way that the leap can happen, beyond the inspiration discussed above, is through the convergence of two relatively distinct arenas or industries through what has been coined a 'structural hole' (Burt 1992). If we turn to world of art and music, we can see decades roll by involving certain genres and it really takes a leap to move into a new s curve. So, for example, the birth of 80s new-wave music was really an orchestrated collision of the music worlds of reggae and punk rock and many credit this to the genius of Joe Jackson. Jackson started creating these combined sounds in the early 1970s, long before other artists would begin working in the new wave scene.

Image: Sid Vicious and the Sex Pistols live in concert, Norway 1977.
Source: Riksarkivet, National Archives of Norway, Photographer: Billedbladet NÅ/Arne S. Nielsen, Arkivreferanse: Riksarkivet, PA-797, Billedbladet NÅ, mappe 8935, downloaded from Flickr December 15, 2014 (no known copyright restrictions).
https://www.flickr.com/photos/national_archives_of_norway/6263353228/in/photolist-axtjGL-2zjWu-7HEza3-6andYe-6ND3MQ-5ANkyT-4jViEk-62jEVP-hLYw87-5NBXZn-5kyaoc-5ASALW-eJxgU-ddgRVG-axqCm6-aL5BCT-cetHWU-9kS9ez-921Fgb-2ZpNTA-6oRuLE-7Cvs2h-nUh5A-5fY29i-9kYa1C-6KybHa-7bW27x-booVVe-5JAa44-96M7VT-a3rhGC-85KZuk-bDo5Cj-brq2eL-5GZ5fT-aUTxA-8rFwK9-KVZ8L-4jZkM3-e1bECQ-ib573-7G8b7L-btkhoV-4vdtmz-5ANmpv-96M7MT-5NbMdi-5ANmhk-dVCYST-dPRCem

Image: Bob Marley, live in concert in Dalymount Park on 6 July 1980.
Source: Wikimedia Commons, public domain. CC BY 2.0.
https://commons.wikimedia.org/w/index.php?search=Bob+Marley+live+in+concert+in+Dalymount+Park&title=Special%3ASearch&go=Go&uselang=en-ca

Image: Joe Jackson, El Macombo, Toronto, May 21, 1979.
Source: Wikimedia Commons, public domain. CC BY SA 2.0.
https://commons.wikimedia.org/wiki/File:Joe_Jackson2.jpg?uselang=en-ca

The second quadrant, 2, involves the tidy march of most scientists, sometimes working on their own, but usually within an institutional context, either university or within a firm, and with a group—particularly in this day and age where granting agencies are looking to fund larger, inter-disciplinary and inter-institutional programs and projects. It is common knowledge that most scientific exploits only contribute incrementally to this progression, although each would have their own technology vision or tech-defined problem they are trying to solve. This aspect is important, however, because it creates the multitude of technology application spins put on the root generic technology and over time, possibly creates the most market potential (i.e. in the middle of the technological s-curve). So, while we have key scientific discoveries of the likes of Herbert Boyer or Watson and Crick (Quadrant 1 types) laying the foundation for the recombinant DNA as a generic

technology to be used across many applications, there have been a myriad of technological applications developed since their time. The basic elements of Technology Vision, the type of vision driving Quadrant 2, are laid out in Exhibit 1 and a scale developed to measure Technology Vision is given in Exhibit 3.

At some point, Q2 morphs into Q3 (entrepreneurs who start their own firms) or Q4 (intrapreneurs who prefer to start their ideas within extant firms) and the direction which this moves in is truly related to the original location of the individuals involved, and the individual motivations and nature of the person or people involved at Q2. If the person desires to continue working towards a market application on their own, then they are likely to follow the entrepreneurial approach outlined in Q3. If the person already works for a firm and desires to stay, takes the idea to a firm or requires working with others to bring the idea to market (i.e. based on a high required level of complexity of combined technologies or lack of market-related competencies), then they are more likely to follow the intrapreneurial route (Pinchot and Pinchot 1978) outlined in Q4. The elements of Market Vision, the type of vision driving Quadrant 3 and Quadrant 4, are laid out in Exhibit 2 and a scale for measuring Market Vision is outlined in Exhibit 4.

If we look at these quadrants and how they are potentially related through a longer-term lens, it seems that over time and with a certain set of technologies and/or core ideas at hand and depending on the nature of the various visions, innovation may travel through these four quadrants, in a variety of ways and through different key individuals and organizations. The resources, capabilities and sets of skills required to capitalize on these different pathways will differ depending on the flow. Here are three examples of typical paths:

Example 1: Some ideas and information may begin in Quadrant 1, but travel not much further through the exploitation processes offered in Quadrants 2 through 4, and not result in new products in the market. An example of this would be an artist who has painted a large canvas and keeps it hanging in her own living room with no intention to sell it. Another example would be a brilliant mechanic who tinkers with old motors in his garage, even coming up with new ideas for new motors that would benefit society, but with no intentions to follow through on these and no attempts at commercialization.

Example 2: Really new innovations, as described by Garcia and Calantone will involve either Quadrant 2 (technology-enabled vision) or Quadrant 3 (bottom-up market vision), but not both, and may result in a pursuant movement to Quadrant 4. An example of a technology-enabled vision of this nature, stemming from Q2, would be the development of intermittent windshield wipers by Robert Kearns. His idea was developed and commercialized by Ford and Chrysler, and this story was the subject of a famous patent dispute. While the technology could be considered discontinuous, there were limited market discontinuities involved (i.e. no new market channels were required, no major changes to the usage habits of customers, etc.), although the invention certainly provided new benefits to users.

Example 3: Radical Innovation involves the movement of ideas and vision through Q1, Q2 and then either or both Q3 and Q4. A classic example of this is the story of the first elevator used for movement of people, and not freight. The overarching value driven vision (Q1) came about in response to the need to enable the movement of people up a larger number of floors, concomitant with the birth of the skyscraper (Tamilia and Reid 2007). While several underlying technologies and firms contributed to the technological developments required for vertical transportation of this nature (Q2), it was the Otis Elevator corporation through the entrepreneurial efforts of Elisha G. Otis (Q3), which built the first passenger lift for an urban structure in New York's Haughwout Department Store on Broadway in 1857 (Hitchcock 1968).

6 Summary

In sum, radical innovation is key to long-term firm success and survival, however, only a small percentage of firms venture onto this playing field. Part of the key to successfully playing in this space is to better understand how the very early stages of the fuzzy front-end of innovation tend to unfold under different initiation point and exploitation scenarios and to develop tools to help better manage these. One key focal point is to better understand the nature of the individuals involved in these early stages, how they set forth goals for themselves which are important components of vision, the relative timing and nature of the decisions they make and how they move information and ideas through the process. Using a long-term lens for viewing radical innovation over the entire progression of the social s-curve, we come to understand that many technology curves, related applied technologies and resultant products will issue forward from the visioning efforts of such individuals. We also understand that not all of the ideas that stem from a given social curve will result in products in the marketplace and those that do not, will not participate in the full process of radical innovation. There are four types of vision which play an essential role in the front-end of radical innovation: value-driven vision, technology vision, bottom-up market vision and top-down market vision. They tend to evolve in this sequence through time and since radical innovation involves both technological and market discontinuities, it is necessary that all four types are involved. Tools are provided in this chapter in order to help firms to get a handle on their technology vision and market vision in a way that should help them to better benchmark these key outcomes as a way to serve as a focal point, and therefore help to reduce the uncertainty and risk inherent in the front-end of radical innovation.

Exhibit 1: The Elements of Technology Vision

Reid and Roberts (2011) have defined Technology Vision as 'a mental image held by individual organizational members regarding technical goals related to developing a new technology.' They further empirically tested the elements of Technology Vision and found there to be five dimensions involved: a Benefits Goal, An Efficiency Goal, Magnetism, Specificity and Infrastructure Clarity. The specific items used to measure these and their loadings are found in Exhibit 3.

1. *Technology Vision Benefits Goal* is related to how to improve benefits for customers and employees. The benefits goals related to developing a specific technology have three main foci in terms of helping potential customers or employees: making things easier, making things more convenient and making things more user-friendly.
2. *Technology Vision Efficiency Goal* is related to a desire to solving design economics issues in the following three ways: how to most cheaply incorporate the technology into potential products, how to apply the technology more cheaply than the competition and how to solve the economics behind the science.
3. *Technology Vision Magnetism* is related to the desirability of the goal to the inventor. It requires the same underlying components as will be seen for market vision magnetism. The vision needs to be desirable, attractive and important enough to the vision holder(s) to motivate them to move towards the vision and break the inertia around that movement (i.e. it needs to be something the vision holders are truly passionate about).
4. *Technology Vision Specificity* is related to the tangibility of the technology vision in that it needs to be tangible, clear, specific and provide direction to others. According to Reid and Roberts (2011), the ability to build clarity into the technical solutions in terms of the goals set and directions for people to follow is essential. Building a picture of 'what might be', making the vision tangible through simple descriptions, diagrams and the use of concepts helps to build clarity and convince people of the technology's potential in lieu of other supporting evidence at this early stage.
5. *Technology Vision Infrastructure Clarity* is related to the clarity of the processes and infrastructure required. Specifically, it is related to the facilities required to enact it, the human resources required to enact it and the cost to develop it. This may require the adoption of new and novel routines and competences from ones which support ongoing research.

Exhibit 2: The Elements of Market Vision

Reid and de Brentani (2010) have empirically tested the elements of Market Vision and found there were five dimensions involved: Market Vision Form, Market Vision Scope, Market Vision Magnetism, Market Vision Clarity and Market Vision

Specificity. The specific items used to measure these and their loadings are found in Exhibit 4.

1. *Market Vision Form*: The image of how the product system will actually be applied or used in the marketplace. For example, the types of questions which need to be considered include the following:
   – "Product Concept" is the relationship between anticipated product features (form or technology) and consumer benefits.
   – "Product-in-Use" involves what the system of interaction will look like and what the overall system of use will look like:
     • What is the overall system of use? i.e. what else needs to happen or be present for it to work? What complementary products and/or services need to be in place for it to work?
     • What is the use environment? i.e. where does it need to happen?
     • What is the timing of the use or application? i.e. by when does it need to happen or do you want it to happen?
   – "Product Design" involves the design and potential for standardizing or leveraging the idea or vision (ripple effect).

Image Source : Licensed from Shutterstock and downloaded on May 5, 2013. http://thumb10.shutterstock.com/thumb_large/4842/108317453/stock-photo-farnborough-uk-july-the-futuristic-virgin-galactic-reuseable-sub-orbital-spacecraft-on-108317453.jpg

2. *Market Vision Scope*: The size and market target impact of the product system. Market Vision Scope has two main components which need to be considered: Target Magnitude and the Target Market itself:
   – Target Magnitude involves the scope of the envisioned market; markets of good potential size offer better outcomes:
     • How much does it have the potential to enhance the future for society?
     • How many people will it apply to?
     • What is the potential to profit or create value from the vision?
   – The Target Market provides the direction for the development path:

- Who does the vision apply to in the marketplace (i.e. who is the target market?)
- Has important implications involving product design and type, technologies incorporated, end user groups and activities

Image Source: author: S. Balaban, an American Male, wearing Google Glass on July 16, 2013, downloaded February 28, 2014. *Source*: Wikimedia Commons, public domain, CC BY SA 3.0. https://commons.wikimedia.org/wiki/File:Stephen_Balaban_wearing_Google_Glass_on_July_16th,_2013.png?uselang=en-ca

3. *Market Vision Magnetism*: the vision needs to be desirable, attractive and important enough to the vision holder(s) to motivate them to move towards the vision and break the inertia around that movement (i.e. it needs to be something the vision holders are truly passionate about).
   – How desirable is the vision?
   – How attractive is the vision?
   – How important is the vision?

Image Source: Licensed from Shutterstock and downloaded on May 5, 2013. http://thumb1.shutterstock.com/thumb_large/348181/105928628/stock-photo-social-engineering-concepthorseshoe-magnet-capturing-crowd-of-color-human-figures-isolated-on-105928628.jpg

4. *Market Vision Clarity*: Understanding clearly the who, what, why and by when underlying the vision. The specifics of the 'how' or 'action plan' can be built in after the vision itself is clearly understood. In other words, what are the specific building blocks that are required to build the vision? The more clear the vision, the more easily we can see how to build a path towards it.

Image Source: Licensed from Shutterstock and downloaded on May 5, 2013. http://thumb7.shutterstock.com/thumb_large/489979/119434465/stock-photo-luxury-diamond-isolated-on-white-background-with-clipping-path-119434465.jpg

5. *Market Vision Specificity*: in order for a vision to be clear it needs to be tangible and this requires something known as specificity. Specificity can occur when a vision is operationally meaningful or contextualized and has a tangible form.

Image Source: Yazoo City, MS, April 29, 2010—At the Mississippi Emergency Management Operations Center FEMA Federal Coordinating Officer Micheal Bolch conducts a planning session regarding FEMA's response to the deadly tornado of April 24. George Armstrong/FEMA. *Source*: By George Armstrong (This image is from the FEMA Photo Library.) [Public domain], via Wikimedia Commons, CC AS. https://commons.wikimedia.org/wiki/File%3AFEMA_-_44036_-_FEMA_FCO_Meeting_at_MEMA_Emergency_Operations_Center_Yazoo_City.jpg

Exhibit 3: Scale Items to Measure Technology Vision (Reid and Roberts 2011)

Benefits goal ($\alpha = 0.95$)	The early functional goal of our technology development was about. . . . . .how to make things more convenient for customers and employees . . .how to make things easier for our customers and employees . . .how to make things more user friendly for customers and/or employees
Efficiency goal ($\alpha = 0.73$)	The early efficiency goal of our technology development was about. . . . . .how to most cheaply incorporate the technology into potential products . . .how to apply the technology more cheaply than the competition . . .how to solve the economics behind the science
Magnetism ($\alpha = 0.80$)	The goal of the technology was attractive The goal of the technology was desirable The goal of the technology was compelling
Specificity ($\alpha = 0.89$)	In the very early stages of this technology's development. . . . . .the technology vision was tangible (e.g., easy to visualize) . . .the technology vision was clear . . .the technology vision was specific . . .the technology vision was able to provide direction to others in the organization
Infrastructure ($\alpha = 0.82$)	In the very early stages of this technology's development, it was clear. . . . . .what facilities would be needed . . .what human resources would be needed . . .how much it would cost to develop

Exhibit 4: Scale Items to Measure Market Vision Items (Reid and de Brentani 2010)

Factor name	Items preamble: "In the very early stages of this technology's development (in our firm)..."
Market vision form ($\alpha = 0.74$)	...we spent most of our time thinking and talking about how end-users would ultimately interact with and use the product ...we spent most of our time thinking and talking about how the product would fit into an overall system of use for potential customers ...we spent most of our time thinking and talking about the product's relationship to the customer use environment ...we spent most of our time thinking and talking about the potential for standardizing the design
Market vision scope ($\alpha = 0.86$)	...we spent most of our time thinking and talking about what the most profitable target market would be ...we spent most of our time thinking and talking about what the largest target market would be ...we spent most of our time thinking and talking about what the most important target market would be
Market vision magnetism ($\alpha = 0.78$)	...the market vision was desirable ...the market vision was attractive ...the market vision was important
Market vision clarity ($\alpha = 0.88$)	...it was clear how the product would be used ...it was clear who the target market (user) would be ...it was clear what target market customers' needs would be
Market vision specificity ($\alpha = 0.89$)	...the market vision was clear ...the market vision was tangible ...the market vision was very specific ...the market vision was able to provide direction to others in the organization

References

Ansoff, H. I. (1957). Strategies for diversification. *Harvard Business Review, 35*(5), 113–124.

Booz, Allen & Hamilton, Inc. (1982). *New product management for the 1980s*. New York, NY: BAH.

Burgelman, R. A., & Sayles, L. R. (1986). *Inside corporate innovation: Strategy, structure, and managerial skills*. New York, NY: The Free Press.

Burns, T., & Stalker, G. M. (1961). *The management of innovation*. London: Tavistock.

Burt, R. S. (1992). *Structural holes: The social structure of competition*. Cambridge: Harvard University Press.

Christensen, C. M. (1992). Exploring the limits of the technology S-curve.*Production and Operations Management, 1*(4), 334–366.
Colarelli O'Connor, G. (1998). Market learning and radical innovation: A cross case comparison of eight radical innovation projects. *Journal of Product Innovation Management, 15*, 151–166.
Colarelli O'Connor, G., & Rice, M. P. (2013). New market creation for breakthrough innovations: Enabling and constraining mechanisms. *Journal of Product Innovation Management, 30*(2), 209–227.
Colarelli O'Connor, G., & Veryzer, R. (2001). The nature of market visioning for technology-based radical innovation. *Journal of Product Innovation Management, 18*(4), 231–246.
Collins, J. C., & Porras, J. I. (1991). Organizational vision and visionary organizations. *California Management Review, 34*(1), 30–52.
Collins, J. C., & Porras, J. I. (1995). Building a visionary company. *California Management Review, 37*(2), 80–100.
Cooper, R. (2011). The innovation dilemma: How to innovate when the market is mature. *Journal of Product Innovation Management, 28*(s1), 2–27.
Crossan, M. M., Lane, H. W., & White, R. E. (1999). An organizational learning framework: From intuition to institution. *The Academy of Management Review, 24*(3), 522–537.
Day, G. S., & Schoemaker, P. J. H. (2005). Scanning the periphery. *Harvard Business Review, 83*(11), 135–149.
Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management, 19*(2), 110–132.
Griffin, A. (1997). PDMA research on new product development practices: Updating trends and benchmarking best practices. *Journal of Product Innovation Management, 14*(6), 429–458.
Hamel, G., & Prahalad, C. K. (1994). *Competing for the future*. Boston, MA: HBS Press.
Hitchcock, H. R. (1968). *Architecture: Nineteenth and twentieth centuries* (3rd ed.). Baltimore, MD: Penguin.
Lynn, G. (1993). *Understanding products and markets for radical innovation*. Ph.D. dissertation, Faculty of the Graduate School of Rensselaer Polytechnic Institute, Troy, NY. UMI Proquest Digital Dissertations.
Lynn, G., & Akgün, A. E. (2001). Project visioning: Its components and impact on new product success. *The Journal of Product Innovation Management, 18*(6), 374–387.
Markham, S. K., & Lee, H. (2013). Product development and management association's 2012 comparative performance assessment study. *Journal of Product Innovation Management, 30*(3), 408–429.
Pinchot, G., & Pinchot, E. (1978). *Intra-corporate entrepreneurship*. Tarrytown, NY: The School for Entrepreneurs.
Reid, S. (2005). *Market vision for radically-new, high-tech products*. Dissertation, Concordia University, Montréal.
Reid, S. E., & de Brentani, U. (2004). The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *The Journal of Product Innovation Management, 21*(3), 170–184.
Reid, S. E., & de Brentani, U. (2010). Market vision and market visioning competence. *The Journal of Product Innovation Management, 27*(4), 500–518.
Reid, S. E., & Roberts, D. L. (2011). Technology vision: A scale development. *R&D Management, 41*(5), 442–472.
Roberts, E. B. (1988). Managing invention and innovation. *Research-Technology Management (Jan-Feb), 31*, 11–29.
Sahal, D. (1981). *Patterns of technological innovation*. Reading, MA: Addison-Wesley.
Sarpong, D., & Maclean, M. (2012). Mobilising differential visions for new product innovation. *Technovation, 32*(12), 694–702.
Smith, P. G., & Reinertsen, D. G. (1991). *Developing products in half the time*. New York, NY: Van Nostrand Reinhold.

Song, M. X., & Montoya-Weiss, M. M. (1998). Critical development activities for really new versus incremental products. *Journal of Product Innovation Management, 15*(2), 124–135.

Stokes, S. L., Jr. (1991). *Controlling the future: Managing technology-driven change*. Boston, MA: QED.

Tamilia, R. D., & Reid, S. E. (2007). Technological innovation and the rise of the department store in the 19th century. *International Journal of Technology Marketing, 2*(2), 119–139.

Tidd, J., Bessant, J., & Pavitt, K. (2005). *Managing innovation: Integrating technological, market and organizational change* (2nd ed.). Chichester, UK: Wiley.

Tushman, M., & Anderson, P. (1986). Technological discontinuities and organizational environments. *Administrative Science Quarterly, 31*(3), 434–465.

Veryzer, R. W., Jr. (1998). Discontinuous innovation and the new product development process. *Journal of Product Innovation Management, 15*(4), 304–321.

Von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science, 32*(7), 791–805.

Innovating the Business Model: The Case of Space

Alessandra Vecchi and Louis Brennan

Abstract

The paper provides insights on the dynamics of the space industry which despite its remarkable potential tends to remain an under-studied sector within the field of business studies. By drawing on our existing work on the space industry this paper investigates the leveraging of innovative business models in the industry utilizing three case studies. From the findings it emerges that all the three companies Virgin Galactic, Mars One and Unilever with the Axe/Lynx Apollo campaign have extensively relied on business model innovation by leveraging specific design elements—content, structure, and governance. Our findings highlight that business model innovation is an imperative to operate successfully in the space industry. Furthermore, a wide variety of private actors appear to be particularly resourceful in adopting novel business models that address the involvement of non-space actors and rely on non-space revenues.

1 Introduction

During times of economic downturn, firms often make substantial efforts to innovate their processes and products to achieve revenue growth and to maintain or to improve their profit margins. Innovations to improve processes and products are however often expensive and time-consuming. They require considerable investments ranging from R&D to specialized resources, new assets and often entire new business units. Even so, future returns on the up-front investments are always uncertain. Nonetheless innovation is particularly important during times of

A. Vecchi (✉)
Department of Management, University of Bologna, Bologna, Italy
e-mail: alessandra.vecchi@unibo.it

L. Brennan
School of Business, Trinity College Dublin, Dublin, Ireland

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_10

economic downturn, when faced with declining revenues and severe pressure on profit margins, many firms resort to drastic cost-cutting in order to survive. As part of these broad cost-cutting measures, many investments in product and process innovation and into market expansion can be significantly reduced or even eliminated. This is often accompanied by labour-cutting measures to improve organizational efficiency by reducing labour costs. While such cost-cutting efforts are often necessary and understandable as they can put firms on a more solid economic footing, they often cause considerable anxiety among employees, thereby reducing employee motivation, commitment, and productivity, and may even hinder the long-term competitiveness of some firms.

While there is a very vast literature explaining technological innovation adoption (Vecchi et al. 2010a, b) from both an individual (Fishbein 1980; Davis 1989; Lutz 1991; Bagozzi et al. 1992; Shih and Fang 2004) and an organisational perspective (Compeau et al. 1999; Bolt et al. 2001; Pincus 2004; Venkatesh et al. 2007), business model innovation has received considerably less attention. Within this context, Zott and Amit (2010) suggest that there is a way for managers to innovate in their existing markets with their existing products by utilizing their existing resources and capabilities. Firms can extract more value from their firms' existing resources, without having to make significant investments in plant, property and equipment or in R&D. In other words, firms can do more with the resources and capabilities they have by simply designing a new, or modifying the firm's extant activity system—a process to which Zott and Amit refer to as *business model innovation* (Vecchi and Brennan 2014).

Zott and Amit's framework (2010) can provide many invaluable insights into the most innovative business models that currently proliferate in the space industry as the result of the decrease of military and government spending and the idiosyncratic boom of its commercial sector (Vecchi and Brennan 2014). In particular, this type of industrial setting is particularly interesting for several reasons. First, fully reaping the benefits of future space innovations should be a concern for society at large (OECD 2011). A growing number of nations now express interest in space for strategic as well as commercial reasons. While their efforts can help to foster the development of new applications, they can also lead to overcrowding in key segments by thus heightening the overall competitive pressure in the industry. Second, although space technology has many potential uses, it has proved very difficult to develop financially viable applications. In particular, the transition from publicly funded activities to applications relying largely on private resources has been hindered by a deep-seated culture of risk aversion (Space Foundation 2013). Third, as the range of commercial applications increases and as ever more countries become active in space, there is a growing need, at both national and international levels, for an institutional and regulatory environment that fully takes account of the sector's expanding commercial component and that fully supports its growth. This situation is leading a number of countries that are already active in space to reassess their overall space strategy. Many are facing difficult choices in terms of the overall level of effort that should be devoted to space activities, how that effort should be allocated and the role that the private sector might play. Overall, these

developments have led firms in the industry to fundamentally change the ways they "do business", in particular, the ways they organize and conduct exchanges and activities across the firm and the industry with customers, vendors, partners and other stakeholders (Brennan and Vecchi 2011). In this very dynamic context, it becomes an imperative for managers in the industry to introduce innovative business models by utilizing their existing resources and capabilities. As such, the space industry provides a valuable opportunity to conduct further research on business model innovation (Zott and Amit 2010) and the most innovative business models within the industry (Vecchi and Brennan 2014).

By drawing on our existing work on the space industry (Vecchi and Brennan 2010; Brennan and Vecchi 2011; Vecchi and Brennan 2014) this paper investigates the most innovative business models utilizing several case studies. It comprises of seven sections. The second section outlines the main features characterising the space industry. The third section provides a review of the literature on technological innovation adoption. The fourth section reviews the literature on business model innovation and introduces the theoretical framework adopted for this research. While the fifth section outlines the methodology, the sixth section presents three case studies. The final section provides the conclusion, the managerial implications stemming from the findings as well as directions for further research.

2 The Space Industry

Ever since the dawn of the space age, spectacular missions such as the launching of Sputnik in 1957, the landing on the Moon in 1969 and the first images from Mars Pathfinder in 1997, have all ignited the imagination of billions of people around the world. At the same time, disasters such as the loss of the space shuttle Columbia have made headlines while cost overruns, delays in meeting stated objectives and unfulfilled promises have raised questions about the value of space programmes, their direction and, more generally, the benefits of space ventures for humanity at large (Suzuki 2007). However, space is not just a showroom for nations to demonstrate their technical proficiency. The deployment of space technology has contributed to an unprecedented increase in our understanding of the universe we live in, and the strategic value of space as an asset is increasingly recognised (Brennan and Vecchi 2011). Indeed, the development of civil and commercial applications has had a growing impact on the lives of hundreds of millions of individuals. Lives and property have been saved through the use of satellite-based meteorological and emergency services, tens of millions of households worldwide are able to enjoy a broad choice of television offerings beamed by satellite broadcasting operators directly to their homes, whether they live in urban, rural or remote areas, and a growing number of businesses and individuals have come to rely on space-based positioning and navigation systems. As further progress is made over a broad range of space-related technologies in the coming decades, the body of potential civil space applications, both public and private, is likely to increase substantially. If properly harnessed, these advances can have a major impact

worldwide, in terms both of stimulating economic growth and of responding to social and environmental needs (OECD 2011).

However, fully reaping the benefits of future space innovations will not be easy. States are still the major players at the time of writing, however, and continue to cooperate, the most prominent example being the International Space Station. During the 1990s, the commercial space industry began to flourish, and ties to the military lessened. In particular, the space market has expanded into new niche sectors: space tourism and travel, mining of resources, manufacturing opportunities, satellite technology all representing a shift toward privatization of the sphere. The new century is an important time in the history of space, not just for science, but in the opportunities it offers for space firms and for the commercialization of space products and services.

According to Suzuki (2007), during the twentieth century investment in space technology was at the infant stage and needed to be boosted by enthusiasm. Dreams and visions helped people to support a significant amount of investment. However, twenty-first century space activity will be quite different from what it was before, and must align with society's new social values. The social values of the twenty-first century are not just environmental and humanitarian; they also include efficiency of investment or, in other words, 'value for money'. In today's world, the financing of space business is quite different from that of 1957. Private actors are beginning to invest in space and wealthy individuals are paying for their tickets to travel into space, while national governments face severe constraints on their spending policies. According to the 2013 edition of The Space Report, the world space economy has grown to over $304 billion, up 6.7 % from the year before and 37 % since 2007. Of that total, nearly three quarters consisted of non-government commercial enterprises, which grew by 6.5 % for commercial space products and services and 11 % for commercial space infrastructure and support industries. Government spending worldwide in that year grew only by 1.3 % (Space Report 2013).

On the one hand, the globalization of financial markets, the introduction of the single currency in Europe, and neo-liberal market-oriented policies have imposed a very narrow choice of policies on governments wanting to spend their budget. On the other hand, it is no longer necessary for a person with a dream of going into space to be a 'national' astronaut; these days, s/he needs to be a millionaire. Also, private actors are investing in satellite systems through Public–Private Partnership (PPP) schemes in Europe (Brocklebank et al. 2000), and in the transportation system through the Commercial Orbital Transportation System (COTS) framework in the USA (Sawamura et al. 1992). The role of states and national space agencies is to adapt to this new social value of the efficiency of investment. It is not the state that responds to people's dreams, but the market and private capital. Investment in space therefore needs to be more responsive to social needs because it needs to return benefits to taxpayers. Today, not all taxpayers appreciate the 'progress' and 'dream' aspects of space flight, but almost all taxpayers benefit from a better environment and safer navigation. Thus, according to Suzuki (2007) it is imperative for everyone involved in the space industry to recognize and understand that the

name of the game has changed. Space activities need to adjust to the values of the twenty-first century, including 'value for money'. Those who are keen to go into space and believe in 'progress' can no longer depend on state-sponsored space activity. After all, many of the latest technologies and progressive ideas have been realized through market interactions. Space is becoming one of them.

Before the twenty-first century, manned spaceflight was the preserve of government agencies and their contractors in what used to be called 'the military'. As the US aerospace journalist Michael Belfiore recounts in his book, *Rocketeers*, 'a motley crew of business adventurers are investing hundreds of millions of dollars in private spacecraft' (Foust 2003). The frontrunner among the private entrepreneurs was Burt Rutan, a designer of innovative aircraft since the 1960s. On 21 June 2004, his SpaceShipOne became the first privately funded craft to enter space. Many space entrepreneurs grew up at a time when it seemed reasonable for boys to assume that manned flights to the moon and beyond would be routine by the twenty-first century. They feel cheated by the way things have turned out and now wish to use their wealth to make space tourism viable while they are still around to enjoy it. As Rutan says, private enterprise, not government funding, will conquer the final frontier (Rutan 2006). Entrepreneurs are thus currently embodying the great pioneers who enable humankind to advance. Many of them are persuaded by Rutan's words. They fund prizes to stimulate research. The most progressive of these companies, such as SpaceX, Virgin Galactic, Bigelow Aerospace, and Blue Origin, are largely self-funded efforts. Many of the business models these space start-ups are proposing are not new, and most of their business models have been considered for many years in the space community (Stratford 2013). However, in the last several years, we have seen the rise of many new space companies offering a wide range of services ranging from short suborbital hops (e.g. Virgin Galactic, Zero G Corporation, XCore Aerospace, Blue Origin, Armadillo Aerospace), orbital flights (Space Adventures) new commercial satellite services (e.g. Telesat launch of its commercial service) to one-way trips to Mars (MarsOne Foundation), orbital hotels (e.g. the Barcelona-based firm Galactic Suite Limited), and lunar tourism (the British-based firm Excalibur Almaz). Some have quite near term and practical plans, such as development of new propulsion or space vehicle designs (e.g. Boeing, SpaceX, Blue Origin and Sierra Nevada are developing and testing vehicles and launch systems as part of NASA's Commercial Crew Development Program), while others propose more complex and speculative revenue models like sales of media rights (e.g. Mars One, the Dutch-based venture seeks to send people to Mars permanently, in the hopes of establishing a permanent settlement whose initial missions would be funded, in part, by selling media rights and with an astronaut selection process for a reality television show), asteroid mining (e.g. Deep Space Industries and Planetary Resources), low cost missions (e.g. India's first mission to Mars), or crowdfunding (e.g. STAR Systems or Hyper-V).

Overall, these private firms have formed a wealth of very fascinating ideas from asteroid detection and mining operations to human exploration and settlement of the Moon and Mars. The picture that emerges for successful new space ventures follows similar patterns of being self-funded, serving real or closely emerging

markets, and providing diverse products and services sometimes not even related to space (e.g. the three companies under the Elon Musk banner of Tesla Motors, SolarCity, and SpaceX, or Blue Origin and Amazon owned by Jeff Bezos). Non-space businesses can provide revenue support and ongoing capital injections for new space businesses. Within this extremely dynamic context, characterised by a new range of actors and new strategies it becomes crucial to gain a fuller understanding of the most innovative business models implemented by the industry.

3 Technological Innovation Adoption Theories

Explaining technological innovation adoption has been described as one of the most mature research areas in contemporary information system literature (Gallivan 2003; Venkatesh et al. 2007). Existing theoretical frameworks mostly investigate technological innovation adoption by considering two levels of analysis (Vecchi et al. 2010a, b). These are namely the individual drivers and the organisational drivers.

3.1 Individual Drivers

Understanding why individuals choose to accept or reject new technology is proving to be one of the most challenging research questions in the field (Pare and Elam 1995). Within this area of enquiry there have been several streams of research.

With its foundation is social psychology, the "Theory of Reasoned Action" (TRA) for example employs four constructs to explain technology use or adoption behaviour—behavioural attitude, subjective norm, intention to use and actual use (Shih and Fang 2004). Significant advances in the research of attitude were made by Fishbein and Ajzen in 1975. In an extension of Fishbein's earlier learning theory, Fishbein (1980) developed a theory of the relationship between attitude and behaviour. The TRA was developed to explain how a customer attitudinal belief and normative belief lead to a certain perception and behaviour (Fishbein 1980). The theory asserts that attitude toward acceptance and subjective norm are the antecedents of the adoption of technology. The two antecedents (attitude and subjective norm) influence the customer perception and behaviour additively, although a conceptual argument was developed earlier leading to an interaction as well as a direct cumulative effect (Ryan and Bonfield 1975). Ryan and Bonfield (1975) for instance report that operational measures of the constructs have been shown to have separate effects on the adoption of the technology. If the cumulative effect of attitude and subjective norm assumption can be supported, their analysis has implications for marketing strategies as a means of ascertaining whether intention to use and actual use are primarily under attitudinal or social influence control. Lutz (1991) offered two important propositions underlying the TRA. First, to predict acceptance behaviour, it is necessary to measure a person's attitude toward performing that behaviour, not just the general attitude toward the object

around which the adoption behaviour is. For example, although a person's attitude toward using a mobile phone is favourable, yet the person may never use any mobile phone. Second, in addition to the attitude toward the behaviour, TRA includes a second determinant of overt behaviour: the subjective norm which is intended to measure the social influences on a person's behaviour (i.e. family members' expectations, society expectations, cultural expectations). We can recognize that there may be some situations where behaviour is simply not under the attitudinal control of individuals; rather, the expectation of relevant others (i.e. national culture) may be a major factor in ultimate behavioural performances. The TRA is different from the traditional attitude theories in that it introduces normative influences into the overall model and a causal relationship between the two antecedents and intention to use the technology.

The Theory of Planned Behaviour (TPB) is an extension of TRA which includes an additional concept, a perceived behavioural control (Schifter and Ajzen 1985). This includes "perceptions of internal and external constraints of behaviour" (Taylor and Todd 1995, p. 149). By using TPB, Liaw (2008) also highlights the importance of social influences when predicting technology acceptance. Findings from his study indicate that perceived satisfaction of using search engines as an information retrieval tool and sharing search experience and information are all contributors that influence consumers' intention to use the technology.

In a different fashion the "Technology Acceptance Model" (TAM) places more emphasis on the perceived usefulness of the technology and the perceived ease of use to explain usage behaviour (Bagozzi et al. 1992). In an attempt to better understand users' acceptance, Davis and his colleagues (Davis 1989, 1993; Davis et al. 1989a, b) developed the TAM, which is considered the most comprehensive attempt to articulate the core psychological aspects associated with technology use (Henderson and Divett 2003). Based on the generic model of the TRA (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975), the model has proved a robust and valuable framework when considering both technology acceptance and uptake (Mathieson 1991; Taylor and Todd 1995). In short, Davis and his colleagues (1989a, b) and Davis (1993) postulated that users' attitudes toward using a technology consisted of a cognitive appraisal of the design features and an affective attitudinal response to the technology. In turn, this attitude influences actual use, or acceptance of the technology. The two major design features outlined by these researchers included the perceived usefulness of the technology (operating as an extrinsic motivator), and its perceived ease of use (operating as an intrinsic motivator) (Davis 1989, 1993; Davis et al. 1989a, b). Perceived usefulness was defined as the "degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis 1993, p. 477). Perceived ease of use was defined as the "degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis 1993, p. 477). It was argued that these two features formed the users' attitude toward using the technology, which in turn impacted upon actual use. Thus, the more positive the perceived ease of use and perceived usefulness of the technology, the higher the probability of actually using the technology. Furthermore, Davis et al. (1989a, b) and Davis

(1993) also postulated that perceived ease of use had a direct impact upon perceived usefulness, but not vice versa. TAM was developed initially to explain information system evaluation and adoption in organisational settings. However its applicability has been extended to consumer settings (Gao 2005; Vijayasarathy 2004).

3.2 Organisational Drivers

A significant body of research in psychology has supported general motivation theory as an explanation for technology acceptance and usage (Venkatesh et al. 2007). Motivational Models (MM) have been applied mostly to organisational settings and have focused predominantly on instrumental beliefs as drivers of individual usage intentions (Venkatesh et al. 2007). Venkatesh et al. (2003) in an attempt to integrate the main competing user acceptance models and thus improve the predictability of technology acceptance, formulated the "Unified Theory of Acceptance and Use of Technology" (UTAUT). This model aims to explain a user's intention to use an information system and to define the user's subsequent behaviour. The main thrust of the theory is that four key constructs (facilitating conditions, social influence, effort expectancy and performance expectancy) and four key moderating variables (experience, voluntariness, gender and age) will directly determine acceptance and technology usage. This theory was developed by consolidating elements across the previous models (i.e. TRA, TPB, TAM, MM) used to predict and explain technology acceptance and usage.

Overall, technology acceptance became a central issue in information system research after Davies developed the TAM. A review of the technology acceptance models shows that research in this area has mainly focussed on explaining and predicting technology acceptance of employees within organisations. While much work has been done to determine user acceptance and adoption of technology, there has been relatively little scholarly research (except for TAM) on technological innovation adoption from an organisational perspective (Vecchi et al. 2010a, b).

Social cognitive theory is built upon the foundations of individual and group psychological behavior, and is often referred to as social learning theory (Pincus 2004). Social cognitive theory is a widely accepted model of individual behavior (Chan and Lu 2004) as it examines the reasons why individuals adopt certain behaviors (Bandura 1986). It proposes that behavior is evaluated through an individual's expectation of the outcome of their behavior, expectation of their direct experience and can be mediated through the observations of others (La Rose and Eastin 2004). Thus, the major premise of social cognitive theory is that individuals can influence their actions (McCormick and Martinko 2004). Social cognitive theory has been utilized in a number of disciplines due to its dynamic nature as it considers human behavior to constantly change (Kock 2004). It has been applied in business through the analysis of organizational management (Wood and Bandura 1989), task complexity (Bolt et al. 2001) and technological innovation adoption at organisational level (Compeau et al. 1999).

The rapid changing technological environment characterising the space industry has meant that social cognitive theory is a useful theoretical framework to understand human behaviour (Ratten and Ratten 2007). Social cognitive theory emphasizes that the adoption process of technology involves encouraging individuals to ensure that they will have the requisite skills and confidence to use a new or existing technology (Compeau et al. 1999). Overall, while there is a relatively vast literature explaining technological innovation adoption from an individual and to lessor extent, an organisational perspective and within this context business model innovation has received considerably less attention.

4 The Increasing Importance of Business Model Innovation

Scholars have conceptualized business models in different ways and viewed them from various theoretical angles (Vecchi and Brennan 2015). Chesbrough and Rosenbloom (2002) link the business model to the technology management literature by emphasizing its role in linking technology to market outcomes. Consistent with this perspective, Casadesus-Masanell and Ricart (2010) argue that one important component of business models are the choices made by management concerning how the organization operates in terms of compensation practices, procurement contracts, location of facilities, or regarding the assets employed. Another component of business models, according to this view, relates to the consequences of these choices, such as low cost or the culture of frugality, which tend to describe the logic of the firm.

Other scholars have promoted a more parsimonious view of the business model. McGrath (2010), for example, suggests thinking about business models by using two core ideas concerning managerial choices: units of business (i.e., what you are selling that someone is prepared to pay for), and the set of activities employed to sell those units. Indeed, the idea of business models as boundary-spanning systems of transactions and activities has been developed in a series of articles by Zott and Amit to capture the essence of how firms do business (Zott and Amit 2010).[1] These researchers have begun to describe the business model as a source of innovation, for example, when it connects previously unconnected parties, links transaction participants in new ways, or introduces new transaction mechanisms. Business model innovation thus conceived may complement innovation in products and services, methods of production, distribution or marketing, and markets. An innovative business model can either create a new market or allow the firm to create and exploit new opportunities in existing markets. More precisely, Zott and

[1] According to this view, the overall objective of a firm's business model is to satisfy a perceived need in order to create value for the focal firm and its partners. That objective is called "the value-creating insight on which the firm turns," and it is reflected in the customer value proposition. A focal firm's business model is defined as an activity system that is designed and enabled by a focal firm, but which transcends the focal firm and spans its boundaries. It encompasses activities that are conducted either by the focal firm or by its partners, customers, or vendors.

Amit defined the business model as "*the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities*." Transaction content refers to what is being exchanged, transaction structure refers to how the exchanges are linked, and transaction governance refers to issues of control.

Much of the prior research on business model innovation, moreover, has considered the extent to which business models are novel, i.e., *new to the state-of-the-art*, and not just new to the firm (Birkinshaw et al. 2008). Nidumolu et al. (2009) view the development of new business models as a key step in their five-stage model of corporate transformation to become environmentally sustainable. They support the idea that the main challenge is "*to find novel ways of delivering and capturing value, which will change the basis of competition*" (2009, p. 60). According to the authors, opportunities for business model innovation lie in developing new delivery technologies that change the value chain, in combining digital and physical infrastructures, or in turning products into services. Similarly, Johnson et al. focus on novel business models, based on the belief that there is "*no point in instituting a new business model unless it is not only new to the company, but in some way game-changing to the industry or market*" (2008, p. 58). However, according to Zott and Amit (2010), changes to business model design can be subtle; they may not have the potential to disrupt an industry, but could still yield important benefits to the innovator. Other firms might wish to change their business models in similar incremental ways, or follow a business model innovator in their industry in order to achieve competitive parity.

Some scholars have suggested very broad domains for business model innovation, in line with their corresponding definitions of the business model concept. Mitchell and Coles (2003), for example, propose that business model innovation involves modifications in the "who," "what," "when," "why," "where," "how," or "how much" involved in providing products and services to customers. Similarly, Johnson et al.'s (2008) notion of business model innovation involves the firm's value proposition, target customers, product and service offering, resources, revenue model, cost structure, processes, rules and norms. Although such broad views of the domain of business model innovation can have their merits, Zott and Amit (2010) define a business model as the bundle of specific activities that are conducted to satisfy the perceived needs of the market, along with the specification of the parties that conduct these activities (i.e., the focal firm and/or its partners), and how these activities are linked to each other. This definition captures the essence of the business model concept, namely: a focus on the *how* of doing business, as opposed to the what, when or where; A *holistic* perspective on how business is conducted, rather than a focus on any particular function such as product market strategy, marketing, or operations; An emphasis on *value creation* for all business model participants, as opposed to an exclusive focus on value capture; and a recognition that *partners* can help the focal firm conduct essential activities within its business model.

According to Zott and Amit (2010), interdependencies exist when activities, taken together, have a different impact on an objective function (e.g., performance)

Table 1 Business model innovation's design elements

Design element	
The content	The content of an activity system refers to the selection of activities to be performed. These activities could be beyond typical once the firm identifies new market needs. The structure needs to be reconfigured to perform the new activities.
The structure	The structure of an activity system describes how the activities are linked (e.g., the sequencing of activities and the exchange mechanisms among the linked activities). Changing structure implies changes in the way in which parties interact or by which products and services are sold.
The governance	The governance of an activity system refers to who performs the activities. Changing governance implies engaging in new forms of cooperation.

Source Zott and Amit (2010)

than each of the activities considered in isolation. Interdependencies are created by entrepreneurs or managers in several ways: when they choose the set of organizational activities they consider relevant to satisfying a perceived market need; when they design the links that weave activities together into a system; and when they shape the governance mechanisms that hold the system together. The business model thus captures how the focal firm through its activity system is embedded in its "ecology," which is its multiple networks of suppliers, partners and customers. The business model also defines who are the firm's potential suppliers, partners and customers (and competitors). These important consequences of a firm's business model design choice have obvious ramifications on its ability to create and capture value. The stronger the competition implied by the choice of the business model, for instance, the more difficult value creation becomes. Important design elements that characterize an activity system are its *content, structure*, and *governance* as depicted in Table 1.

These three elements can be leveraged—individually as well as jointly—to engender business model innovation. According to Zott and Amit (2010), there are two types of interdependencies within the business model innovation. On the one hand, there are interdependencies among business model design elements. These three business model design elements (content, structure and governance) can be highly interdependent. Accordingly, managers can innovate on all three business model design elements (i.e. content, structure, and governance) individually as well as jointly (Vecchi and Brennan 2014). On the other hand, there are the interdependencies between the business and revenue model. The revenue model refers to the specific ways a business model enables revenue generation for the focal firm. It is the way in which the focal firm appropriates some of the value that is created by the business model for all its stakeholders. A revenue model complements a business model design, just as a pricing strategy complements a product design. Although the concepts of business and revenue model may be quite closely related and are sometimes even inextricably intertwined, a business model is geared toward total value creation for all parties involved. It lays the foundations

for the focal firm's value capture by co-defining (along with the firm's products and services) the overall "size of the value pie," which can be considered an upper limit to the firm's value capture. The business model also co-determines the focal firm's bargaining power. The greater the total value created, and the greater the focal firm's bargaining power, the greater the amount of value that the focal firm can appropriate. How much of the possible total value is actually captured, however, depends on its pricing strategy or its revenue model.

5 Methodology

In line with the exploratory nature of the study, the current research relied on comparative case study research to critically assess the business model innovation of three space ventures. "*Case studies represent a methodology that is ideally suited to creating managerially relevant knowledge*" (Gibbert and Ruigrok 2010). They are considered the most appropriate as tools in the critical, early phases of a new management theory, when key variables and their relationships are being explored (Eisenhardt 1989; Yin 2008). Therefore case study research is particularly useful at the early stages of theory development, in which key themes and categories have yet to be empirically isolated (Eisenhardt 1989; Yin 2008). Although we acknowledge the richness of adopting a single case study, multiple case studies provide a more solid basis for generalization and can provide substantial opportunities for theory-building (Dyer and Wilkins 1991). As illustrated in Table 2, we purposefully selected three case studies of different space ventures to illustrate some emblematic examples of the most innovative business models implemented within the space industry.

These space ventures were chosen to reflect the wide variety of business initiatives and models undertaken by privately funded firms (Brennan and Vecchi 2011). They all operate in radically different segments of the industry. Virgin Galactic operates in the business travel segment of the industry, Mars one is planning to establish the first human settlements on Mars and plan to broadcast the mission in the form of a reality TV show, the Axe/Lynx Apollo partnership is a collaborative project amongst Unilever, a non-space actor, and several space firms (US company XCOR Aerospace and the tourism firm Space Expedition Curacao). In the light of both the exploratory nature of the study and the wide variety of the actors within the space industry, three case-studies were deemed as adequate to provide rich and in-depth insights in the business model innovation in the space industry. The industry was deemed as an ideal industry setting since it is characterized by very interesting dynamics involving a wide range of space (and non-space) actors that tend to rely on very innovative business models as the result of the drastic decrease of military spending and the idiosyncratic boom of its commercial sector (Brennan and Vecchi 2011). In order to produce three robust case studies we relied on a wide variety of secondary sources such as newspapers, industry reports and grey literature. In order to contextualize the space actor we collected information about the space actor's business model and its background on

Table 2 Case studies' overview

Company	Short description
Virgin Galactic	Virgin Galactic is a company within Richard Branson's Virgin Group which plans to provide sub-orbital spaceflights to the paying public, along with suborbital space science missions and orbital launches of small satellites. Further into the future Virgin Galactic hopes to offer orbital human spaceflights as well.
Mars One	Mars One is a non-profit organization that plans to establish a permanent human colony on Mars by 2025. The private spaceflight project is led by Bas Lansdorp, who announced plans for the Mars One mission in May 2012. In 2024, Mars One intends launching four carefully selected applicants in a Mars-bound spaceflight to become the first residents on Mars. Every step of the crew's journey will be documented for a reality television program that will broadcast for its entire duration.
Axe/Lynx Apollo	The men's personal care product company AXE/Lynx has teamed up with Buzz Aldrin to send 22 people into space. On January 9th 2013 the company launched its new AXE Apollo Space Academy, an online contest that promises to send 22 winners to a suborbital flight aboard a private spaceship. The winning space travelers will launch aboard a suborbital Lynx space plane built by the US company XCOR Aerospace and operated by the tourism firm Space Expedition Curacao.

the basis of the publically available data. This study dimension was investigated by mostly consulting secondary sources such as news and industry reports and grey literature.

6 Case Studies

6.1 Virgin Galactic

An example of an innovative business model in terms of *innovative content* has been adopted by Virgin Galactic. By capitalising on the extensive experience of Virgin Atlantic in the airline industry, Virgin Galactic is a company within Richard Branson's Virgin Group which plans to provide suborbital spaceflights to space tourists, suborbital launches for space science missions, and orbital launches of small satellites. Further in the future, Virgin Galactic hopes to offer orbital human spaceflights as well but also to eventually offer point-to-point rocket travel around the globe, as well as to space hotels, and trips to the Moon (David 2006).

Virgin Galactic's spacecraft is launched from a large aeroplane, giving the spacecraft more initial speed and altitude than if it were launched from the ground. Built from lightweight carbon composite materials and powered by a hybrid rocket motor, SpaceShipTwo (SS2) is based on the Ansari X PRIZE—winning SpaceShipOne (SS1) concept built by Scale Composites—a rocket plane that is lifted initially by a carrier vehicle before blasting skywards. SS1 became the world's first private spaceship with a series of high-altitude flights in 2004. Rutan presented his vision in an interview given on 24 February 2006: "*Entrepreneurs*

have always driven our technical progress—and, as a result, our economy. They tend to be more innovative, more willing to take risks, and more excited about solving difficult problems. They seek breakthroughs, they have the courage to fly them, and they know how to market them. They will now provide the solutions and the hardware needed to enable human spaceflight with an acceptable risk—at least as safe as the early airliners" (Rutan 2006).

The Ansari X PRIZE was a space competition in which the foundation offered a US$10,000,000 prize for the first non-government organization to launch a reusable manned spacecraft into space twice within 2 weeks. It was modeled after early twentieth-century aviation prizes, and aimed to spur development of low-cost spaceflight. For example, the Orteig Prize was a US$25,000 reward offered on 19 May 1919, by New York hotel owner, to the first allied aviator(s) to fly non-stop from New York City to Paris or vice-versa. On offer for 5 years, it attracted no participants. Orteig renewed the offer for another 5 years in 1924, when the state of aviation technology had advanced to the point where numerous competitors vied for the prize. The Ansari prize was won on 4 October 2004, the 47th anniversary of the Sputnik 1 launch, by the Tier One project designed by Burt Rutan and financed by Microsoft co-founder Paul Allen, using the experimental space plane SS1. US $10 million was awarded to the winner, but more than US$100 million was invested in new technologies in pursuit of the prize. The fourth X PRIZE was announced in September 2007. Google founders, Sergey Brin and Larry Page, are using company money to fund this, the fourth X-PRIZE, to create a private race to the moon. The challenge calls for privately funded teams to compete in successfully launching, landing, and then traveling across the surface of the moon while sending back to Earth specified photo and other data. The X PRIZE will award US$20 million to the first team to land a robot on the moon that travels more than 500 m and transmits back high-definition images and video. The X PRIZE US$20 million first-place prize was on offer until 31 December 2012; thereafter offers US$15 million until 31 December 2014. NASA has started to award prizes under its Centennial Challenges scheme to spur technological development to enable lunar exploration, while in the same vein the Northrop Grumman Lunar Lander Challenge has been running since 2006.

The successor of SS1 is twice as large, measuring 18 m (60 ft) in length. Whereas SS1 only had a single pilot, SS2 will have a crew of two and room for six passengers. The company's founder, entered into a partnership in 2005 with Scale Composites creating The Spaceship Company to build a fleet of commercial suborbital spaceships and launch aircraft The White Knight Two that is a special aeroplane that functions as the mother ship and launch-platform for the spacecraft SS2. The mother ship is a large fixed-wing aircraft with two hulls linked together by a central wing. Sir Branson unveiled the rocket plane on December 7, 2009. SS2 has being undergoing testing since before taking ticketed individuals on short-hop trips just above the atmosphere.

More than 400 people were reported to have signed up for a flight as of early 2011, at a ticket price of $200,000 per person with a $20,000 deposit. The ticket price was raised to $250,000 in early May 2013, and is slated to remain at that price

until at least 1,000 passengers have signed up (Wall 2013). It was announced on June 17, 2013 that the 600th ticket had been sold to fly with Virgin Galactic (Branson 2013) and that 640 had signed up by August 2013. Tickets are available from more than 140 "space agents" worldwide.[2] Each passenger will experience approximately 6 min of weightlessness during what will be a 2-h end-to-end flight.

It may be at least a year before Virgin Galactic's future passengers fly to suborbital space, but some of them recently got a chance to experience weightlessness on a ZERO-G flight. Officials at Zero Gravity Corporation said 80 Virgin Galactic customers flew on chartered trips aboard their G-FORCE ONE plane during two flights on September 26 and one on September 27 in Burbank, California (Gannon 2013). The ZERO-G flights coincided with a gathering of Virgin Galactic's paying space tourists on September 25 in the Mojave Desert. Over 300 of the prospective passengers gathered to see SS2. The most important event of the day was supposed to be a test flight of the SS2 a take-off from the Mojave runway and a climb, glide and landing. However, the test flight was cancelled due to high desert winds (Kluger 2013).[3]

Sir Branson intends to run the first flights out of New Mexico before extending operations around the globe (Branson 2013). Lofting six passengers and two pilots up to the edge of space means putting safety in the front seat and a rigorous testing and shakeout program of hardware is envisioned. The fundamental requirement is producing the safest, best-performing ship. Then an operational structure must be put in place. Facilities are required to handle early operations in Mojave, California and at Spaceport America in New Mexico. A team of exceptionally competent and skilled personnel to operate the spaceliners are also needed. There will be a Virgin Galactic cadre of spaceliner pilots. They are being drawn from Virgin's network of airlines (Branson 2013). Virgin aims to attract some of the best pilots with those selected for space travel duty picked after a meticulous training and preparation course.

Hundreds of spaceships might be needed to handle passionate passengers from around the world that hunger for space travel. If this is the case, once the case for safety and turnaround time is established with the SS2, beyond the New Mexico spaceport semi-permanent facilities, even local municipal airports, could handle space travel operations. It is clearly a goal of Virgin Galactic of being a spaceline operator, not just for same-point-to-same-point space tourism but to go point-to-point on the planet. Getting cheap access to low Earth orbit will be leveraged from the ability to globally hop about. This is where the company see the real market (David 2006).

[2] Passengers who have already submitted their deposit include Stephen Hawking, Tom Hanks, Ashton Kutcher, Katy Perry, Brad Pitt, and Angelina Jolie. The business plan is for 50,000 people to visit space over a 10 year time period (David 2006).

[3] The flight test was then successfully conducted on December 11th.

6.2 Mars One

An example of an innovative business model in relation to introducing an *innovative structure* has been implemented by Mars One. Mars One is a non-profit organization that plans to establish a permanent human colony on Mars by 2025. The private spaceflight project is led by Dutch entrepreneur Bas Lansdorp, who announced plans for the Mars One mission in May 2012 (Moskvitch 2013). He worked for 5 years at Delft University of Technology and in 2008 founded Ampyx Power in order to develop a new, viable method of generating wind energy. In 2011, he sold part of his shares in Ampyx in order to launch Mars One. Bas Lansdorp came up with the idea of establishing the first permanent human colony on Mars during his studies at the University of Twente. His primary focus was not on overcoming the technological challenges, rather the business model. Until 2013, he financed almost the entire project himself (Mars One 2013).

In 2024, Mars One intends launching four carefully selected applicants in a Mars-bound spaceflight to become the first residents on Mars. Every step of the crew's journey will be documented for a reality television program that will broadcast for its entire duration (Moskvitch 2013). As depicted in Table 3, the organization has mapped out the next several years in order to highlight major plans and goals for the mission.

Mars One plans to establish the first human settlement on Mars. According to their schedule, the first crew of four astronauts would arrive on Mars in 2025, after a 7-month journey from Earth. Further teams would join their settlement every 2 years, with the intention that by 2033 there would be over 20 people living and working on Mars. The astronaut selection process began on April 22nd, 2013. The project is endorsed by Nobel Prize-winning physicist Gerardt Hooft (Mars One 2013).

Applications were open from April 22, 2013 to August 31, 2013. In April 2013, the Astronaut Selection Program was launched at press conferences in New York and Shanghai. Round 1 is an online application open to all nationalities. The selection program proceeds with three additional rounds over the course of 2 years. The application consists of applicant's general information, a motivational letter, a résumé and a video. Mars One plans to hold several other application periods in the future.[4]

Selected candidates must then provide a medical statement of good health from a physician. Medically cleared candidates will then be interviewed by one of the 300 regional selection committees who will select applicants to continue to the next

[4] Anyone over the age of 18 may apply, as long as the application is submitted in one of the 11 most used languages on the Internet: English, Spanish, Portuguese, French, German, Russian, Arabic, Indonesian, Mandarin Chinese, Japanese, or Korean. Applicants are judged on resiliency, adaptability, curiosity, ability to trust, and creativity. By 19th December 2013, 200,000 applicants had paid their registration fee and submitted public videos in which they made their case for going to Mars in 2023. The application fee varies from US$5 to US$75 (the amount depending on the country).

Table 3 Mars One's mission plan

Year	Milestone
2011	Mars One began planning of Mars One in 2011. The company researched the feasibility of the idea with specialists and expert organizations, and discussed the financial, psychological and ethical aspects of it.
2013	In December 2013, mission concept studies for a 2018 Mars mission were contracted with Lockheed Martin and Surrey Satellite Technology for a 2018 demonstration mission to provide proof of concept for a subset of the key technologies for a later permanent human settlement on Mars. A replica of the settlement is being built for training purposes.
2015	By July the astronaut selection process will be completed; six teams of four.
2018	The original concept plans called for a supply mission to be launched in January (arriving in October) with 2,500 kg (5,500 lb) of food in a 5-m (16 ft) diameter variant of the SpaceX Dragon. The fallback if this is not ready in time is either to use a 3.8-m (12 ft) Dragon or to delay by 2 years. The first communication satellite will be produced. An exploration vehicle was projected to launch to assist in selecting the location of the settlement.
2020	In 2020, a settlement rover will explore the terrain of Mars in search of the ideal location for humans to reside.
2021	Six additional Dragon capsules and another rover will launch with two living units, two life support units and two supply units.
2022	In 2022, the rovers will prepare to assemble the landing of six separate units to sustain human life. Two living units, two life support units, another supply unit, and a third rover will all arrive in this year. A SpaceX Falcon Heavy will launch with the first group of colonists.
2024	By 2024, the first Mars One team, consisting of four carefully selected applicants, will be launched where they will become the first expected residents of the Red Planet in 2025.
2025	The first colonists will arrive on Mars in a modified Dragon capsule.
2026	By 2026, a new four-person Mars One crew will be sent for residency.
2027	A second group of four colonists will arrive. Every 2 years, an additional group of four colonists will arrive.
2033	The colony will reach 20 settlers.

Source Mars One (2013)

step. The regional selection could be broadcast on TV and Internet in countries around the world. In each region, 20–40 applicants will participate in challenges that demonstrate their suitability to become one of the first humans on Mars. The audience will select one winner per region, and the experts can select additional participants, if needed, to continue to the international level. This international event will be broadcast throughout the world. The Mars One selection committee will create international groups from the individual candidates. The groups will receive their first short-term training in a replica of the Mars outpost to be constructed on Earth for technology testing and training purposes. Whole teams and individuals might be deselected during training when they prove not to be suitable for the mission. Mars inhabitants will be prepared for the mission by a full-time extensive training program. The ability to cope with the difficult living

environment on Mars will be an important selection criterion. The astronauts will be initially chosen for their inherent ability to cope with these environments, and will receive training on most effectively dealing with them. By 2015, six to ten teams of four people each will be selected for 7 years of full-time training. The selected people will become full-time employees of the Mars One astronaut corps. Given the extraordinary symbolic and historic significance of this issue, the selection process will involve a democratic decision where "The people of Earth will have a vote on which group of four will be the first Earth ambassadors to Mars" (Mars One 2013). A one-way trip, excluding the cost of maintaining four astronauts on Mars until they die, is claimed to cost approximately 6 billion USD (Moskvitch 2013).

Mars One, the not-for-profit foundation, is the controlling stockholder of the for-profit Interplanetary Media Group. A global reality-TV media event is intended to provide most of the funds to finance the expedition. It should begin with the astronaut selection process (with some public participation) and continue on through the first years of living on Mars (Mars One 2013).

On 31 August 2012, company officials announced that funding from its first sponsors had been received. Corporate sponsorship money will be used mostly to fund the conceptual design studies provided by the aerospace suppliers. Sponsors and contributors for Mars One include a wide variety of actors from the space industry. Since December 2012 and the official announcement of their conversion to a Stichting, Mars One has been accepting one off and regular monthly donations through their website. As of December 20, 2013, Mars One has received $183,870 in donations and merchandise sales, the majority of this contribution comes from the U.S.A. (Mars One 2013).

On December 10, 2013, Mars One set up a crowdfunding campaign on Indiegogo to fund their 2018 demonstration mission. The 2018 mission includes a lander and communications satellite, and aims to prove several mission critical technologies in addition to launch and landing. The campaign goal is to raise US $400,000 by January 25, 2014 (Indiegogo 2013). In the first 24 h of their campaign they had already raised $34,720.[5] Mars One has stated that it will retain ownership of technology developed for its mission, and that subsequent licensing fees from this technology will help fund future missions.

The business model has been criticised for being unrealistic. Chris Welch, director of Masters Programs at the International Space University, for instance has argued that ignoring the potential mismatch between the project income and its costs and questions about its longer-term viability, the Mars One proposal does not demonstrate a sufficiently deep understanding of the problems to give real confidence that the project would be able to meet its very ambitious schedule (BBC News 2012). Some have been critical of the project's high-profile call for astronauts willing to accept a one-way mission, saying that it is an unethical and unnecessary measure that is incompatible with modern values. Others simply criticise their

[5] By December 20th they have raised $77,789 (Indiegogo 2013).

schedule and funding plans, claiming that the Mars One foundation cannot possibly do what it claims with the time, talent, and money it has available.

On December 13, 2013 the venerable Lockheed Martin came on board. Lockheed is no stranger to collaborating on Mars missions, they have fathered MAVEN, a probe sent to study the Martian atmosphere. For about $250,000, the aerospace giant will provide its talent, but perhaps more importantly its name behind the fledgling space program (Templeton 2013). Lockheed's services will come in the form of a "mission concept study" to help design and plan the unmanned mission slated for 2018. The mission plan will have to incorporate elements of both missions, as the first unmanned venture will function as both reconnaissance and early set-up for the manned one to follow. Being so inextricably linked, the two missions must be treated with equal, or near-equal, gravitas. A further $80,000 is going to a British company called Surrey Satellite Technology, which will go to designing a geosynchronous satellite for relaying communications from the lander to Earth and back again. That is an essential part of lander design, as the practical limitations on transmission power and line of sight make direct communication with Earth impossible.

Mars One knows it will be forced to turn to private philanthropists and other charitable sources to meet its projected $6 billion goal for the manned mission (Mars One 2013). Even then, though, many analysts have scoffed at this figure, saying it is off by more than an order of magnitude; various researchers and professionals have taken their own stabs at estimating a final mission cost, which some say could top $1 trillion (Templeton 2013).

6.3 Axe/Lynx Apollo

An example of an innovative business model concerning *innovative governance* is the collaboration established by Unilever, XCOR Aerospace and Space Expedition Curacao around the promotion of Axe/Lynx Apollo branded products. Axe (also known as Lynx in the United Kingdom, the Republic of Ireland, Australia and New Zealand[6]) is a brand of male grooming products, owned by the British–Dutch company Unilever and marketed towards the young male demographic.

The men's personal care product company AXE has teamed up with Buzz Aldrin, who became the second person ever to walk on the moon during NASA's 1969 Apollo 11 mission in 1969, to send 22 people into space. On January 9th 2013 the company launched its new AXE Apollo Space Academy, an online contest that promises to send 22 winners on a suborbital flight aboard a private spaceship. Officials with the company asked people across the globe to enter via social media. Hopeful spaceflyers built campaigns around themselves, asking people visiting the website to help them win the chance for a coveted ticket by voting for them.

[6] Unilever were unable to use the name Axe in the United Kingdom and Ireland due to trademark problems so it was launched as Lynx.

Other space fans used unique codes found on AXE products to enter the contest (Kramer 2013). The contest has been open to men and women in more than 60 countries who signed up on the AXE Apollo Space Academy website (AXEApollo.com) and write about why they should be chosen to fly in space, while others will vote on the entries. The winning space travellers will launch aboard a suborbital Lynx space plane built by the US company XCOR Aerospace and operated by the tourism firm Space Expedition Curacao.

Winning space travellers will fly, one at a time, aboard Lynx space planes once Space Expedition Curacao begins operational flights. The reusable space planes are designed to fly two people—one pilot and a passenger to an altitude of 62 miles (100 km) during suborbital flights. The rocket plane is built to take off and land horizontally on a runway. Space Expedition Curacao will oversee commercial Lynx flights from the Caribbean island of Curacao. Tickets for a flight are set at $95,000. XCOR Aerospace is expected to begin the first test flights of a high-altitude Lynx design sometime later this year. The first passenger flights could begin in 2014.

> The AXE Apollo launch is the biggest and most ambitious in the AXE brand's 30-year history, AXE's global vice president Tomas Marcenaro said. For the first time, we're simultaneously launching one global competition in over 60 countries offering millions of people the opportunity to win the most epic prize on Earth. A trip to space—yes, actual space (Kramer 2013)

Since December 1st, more than 100 participants from over 60 countries around the world have taken part in mental aptitude tests, combat training in a fighter jet and zero-gravity flights to distinguish themselves as the most worthy ones for one of the coveted tickets to space. Two women and 20 more men from 21 different countries—including Canada, South Africa, Thailand and China—also won tickets to fly aboard Lynx. Four women competed in the space academy alongside 105 men. While recruits from some countries were in direct competition with one another, other nations had different metrics for choosing their winner (Kramer 2013).

The space competition has been designed with the idea of enhancing Axe brand visibility as the brand has experienced several marketing controversies in recent times. Adverse publicity has been generated by the product's advertisements with claims that they encouraged sexual promiscuity and sexism. The campaign for a Commercial-Free Childhood claimed that Bartle Bogle Hegarty's work on Axe "*epitomizes the sexist and degrading marketing that can undermine girls' healthy development*" (Harris 2006). Additionally, on January 12, 2008 12-year old Daniel Hurley from Derbyshire, England died in a hospital 5 days after collapsing at his home. The medical coroner ruled that he had suffered from cardiac arrhythmia and died from heart failure as a result of spraying large amounts of Lynx in a confined space. Videos on social networking sites depicted teens lighting themselves on fire. The trend resulted in multiple injuries (Dolan 2008). After these incidents occurred, the company created two ads, one against the use of Axe as an inhalant, and the other warning of its flammability. Now to regain its popularity, the brand has launched the space competition.

6.4 Cross Case Analysis

Table 4 highlights the design elements that were leveraged by the three companies and provides a short description on how such leverage happened in practice.

As we can see from Table 4, managers can individually innovate on all three business model design elements—content, structure, and governance—as well as jointly.

7 Conclusion

7.1 Theoretical Contribution

The original contribution of the paper is twofold. First, building on prior work (Vecchi and Brennan 2010; Brennan and Vecchi 2011) the paper further provides insights on the dynamics of the space industry which despite its remarkable potential tends to remain a under-studied sector within the field of business studies. Second, by relying on Zott and Amit's framework (2010), the paper outlines the crucial importance of business model innovation by providing some anecdotal evidence from the space industry. In particular, from the findings it emerges that

Table 4 Business model innovations

Design element	Case study
The content	Capitalising on the growing thirst for space tourism and by relying on the extensive experience of Virgin Atlantic, Virgin Galactic decided to provide sub-orbital spaceflights to paying customers along with suborbital space science missions and orbital launches of small satellites. In the future Virgin Galactic hopes to offer orbital human spaceflights as well. These activities tend to be beyond typical as space travel previously was confined to military missions and space exploration. In order for the firm to deliver the content, the structure had to be also reconfigured and an operational structure put in place. Facilities are required to handle early operations in Mojave, California and at Spaceport America in New Mexico. A team of exceptionally competent and skilled personnel to operate the spaceliners are also needed. There will be a Virgin Galactic cadre of spaceliner pilots. They are being drawn from Virgin's network of airlines.
The structure	Mars One is a non-profit organization that plans to establish a permanent human colony on Mars by 2025. In 2024, Mars One intends launching four carefully selected applicants in a Mars-bound spaceflight to become the first residents on Mars. Every step of the crew's journey will be documented for a reality television program that will broadcast for its entire duration. The mission plan illustrated in Sect. 6.2 outlines how the sequencing of the different activities are linked and how the organization intends to monetise the TV rights associated with the production of the reality show.
The governance	The partnership established by Unilever, XCOR Aerospace and Space Expedition Curacao around the promotion of Axe/Lynx Apollo branded products by means of a competition to win a ticket for a suborbital flight.

all the three companies Virgin Galactic, Mars One and Unilever with the Axe/Lynx Apollo campaign have extensively relied on business model innovation by leveraging specific design elements.

7.2 Managerial Contributions

From the findings it emerges that managers can individually innovate on all three business model design elements—content, structure, and governance—as well as jointly.

For example, consider again Mars One and the recent involvement of Lockheed Martin to strengthen the credibility of the project. Initially, Mars One has mostly leveraged the structure of its business model by introducing very creative revenue streams (the selection process where applicants have to pay a fees, by resorting on philanthropists and sponsorships, by setting up a crowdfunding campaign) to support the core mission of establishing a permanent human colony on Mars. Within this context the interdependency between the business model adopted by the company and its revenue model is particularly visible since these two seem to be inextricably intertwined.

More recently, the company has resorted to the establishment of a partnership with Lockheed Martin to gain public consensus and enhance the credibility of the project which was undermined by much criticism. The partnership also co-determines Mars One's bargaining power. The greater the total value created, and the greater the focal firm's bargaining power, the greater the amount of value that the Mars One can appropriate. How much of the possible total value is actually captured, however, depends on its pricing strategy and by its revenue model. However within this context, it becomes particularly difficult to make accurate forecast of the costs. The timeframe for the completion of the project is quite vast (from 2011 to 2035) and it inevitably entails many costly uncertainties. This is particularly evident by assessing the gap between Mars One's own estimate (6 billions) and the estimate made by other professionals in the field (1 trillion).

Nonetheless, from the findings it emerges that Zott and Amit's theoretical framework (2010) is particularly valuable to provide in-depth insights on the space industry. Within this context, our findings support the idea that business model innovation becomes an imperative to operate successfully in the space industry and a wide variety of private actors seem to be particularly resourceful in adopting novel business models that begin to see the involvement of non-space actors (as in the case of Unilever) and rely on non-space revenues (as in the case of the sales of the Axe/Lynx Apollo male grooming products). As such, there is a very valuable opportunity both for firms within the same industry and for firms from different industries to gain some useful lessons on the importance of business model innovation and to learn about the most innovative business models within the industry. In this sense, the space industry can pave the way for the application of innovative business models that could be adequately modified to work either in relation to different sectors of the industry as well as in other industries.

Space related opportunities abound for both actors within and outside the space sector and space-related innovation can lead to the giants of the future and to the future success of those societies that have the capacity to grasp the opportunities (Brennan 2013). The challenge in capitalizing on those opportunities is twofold: firstly in developing innovative business and secondly in establishing the associated revenue streams. In relation to the former challenge, this paper has demonstrated that Zott and Amit's theoretical framework (2010) provides a useful conceptual basis that can assist in the development of innovative business models. Further research on innovative business models can contribute to ensuring that space related actors can capitalize on space related opportunities by providing them with frameworks and tools directed towards the development and implementation of viable business models for space.

References

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. New Jersey: Prentice-Hall.

Bagozzi, R. P., Davis, F. D., & Warshaw, P. R. (1992). Development and test of a theory of technological learning and usage. *Human Relations, 45*(7), 660–686.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

BBC News. (2012, June 20). *Can the Dutch do reality TV in space?* Available at: http://www.bbc.co.uk/news/world-europe-18506033

Birkinshaw, J., Hamel, G., & Mol, M. (2008). Management innovation. *Academy of Management Review, 33*(4), 825–845.

Bolt, M., Killough, L., & Koh, H. (2001). Testing the interaction effects of task complexity in computer training using the social cognitive model. *Decision Sciences, 32*(1), 1–19.

Branson, R. (2013, July 2). *The next generation of women in space*. Retrieved from http://www.virgin.com/richard-branson/the-next-generation-of-women-in-space

Brennan, L. (2013, January 12). Space exploration is a necessity for the human species. *Financial Times*.

Brennan, L., & Vecchi, A. (2011). *The business of space: The next frontier of international competition*. Basingstoke: Palgrave Macmillan.

Brocklebank, D., Spiller, J., & Tapsell, T. (2000). Institutional aspects of a global navigation satellite system. *The Journal of Navigation, 53*(2), 261–271.

Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and on to tactics. *Long Range Planning, Special Issue on Business Models, 43*(2–3), 195–215.

Chan, S., & Lu, M. (2004). Understanding internet banking adoption and use behavior: A Hong Kong perspective. *Journal of Global Information Management, 12*(3), 21–43.

Chesbrough, H., & Rosenbloom, R. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spinoff companies. *Industrial and Corporate Change, 11*(3), 533–534.

Compeau, D., Higgins, C., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly, 23*(2), 145–158.

David, L. (2006, November 10). *Virgin galactic: Anatomy of a business model*. Available at http://www.space.com/3097-virgin-galactic-anatomy-business-model.html

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *Management Information System Quarterly, 13*(3), 319–340.

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioural impacts. *International Journal of Man–Machine Studies, 38*(3), 475–487.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989a). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Psychology, 22*(14), 1111–1132.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989b). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.
Dolan, A. (2008, November 20). *Boy, 12 collapsed and died after using too much Lynx deodorant*. Available at: http://www.dailymail.co.uk/news/article-1087772/Boy-12-collapsed-died-using-Lynx-deodorant.html
Dyer, W. G., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review, 16*(3), 613–619.
Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532–550.
Fishbein, M. (1980). A theory of reasoned action: Some application and implications. In H. Howe & M. Page (Eds.), *Nebraska symposium on motivation* (pp. 65–116). Lincoln, NE: University of Nebraska Press.
Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
Foust, J. (2003). *The space review: What is the "space industry"?* Available at: http://www.thespacereview.com/article/34/1
Gallivan, M. (2003). The influence of software developers' creative style on their attitudes to and assimilation of a software process of innovation. *Information and Management, 40*(5), 443–465.
Gannon, M. (2013, October 8). *Virgin Galactic's private spaceship passengers' taste weightlessness on Zero-G flight*. Available at: http://www.space.com/23117-virgin-galactic-zero-gravity-flight.html
Gao, Y. (2005). Applying the technology acceptance model (TAM) to educational hypermedia: A field study. *Journal of Educational Multimedia and Hypermedia, 14*(3), 237–247.
Gibbert, M., & Ruigrok, W. (2010). The "what" and "how" of case study rigor: Three strategies based on published work. *Organizational Research Methods, 13*(4), 710–737.
Harris, P. (2006, July 9). *The Menaissance. The American male is learning to flex his muscles again*. Available at: http://www.theguardian.com/world/2006/jul/09/paulharris.theobserver
Henderson, R., & Divett, M. J. (2003). Perceived usefulness, ease of use and electronic supermarket use. *International Journal of Human-Computer Studies, 59*(3), 383–395.
Indiegogo. (2013). Available at: http://www.indiegogo.com/projects/mars-one-first-private-mars-mission-in-2018
Johnson, M., Christensen, C., & Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review, 86*(12), 58.
Kluger, J. (2013, September 25). *The hour is nigh for tourists in space*. Available at: http://science.time.com/2013/09/25/virgin-galactic-the-hour-is-nigh-for-tourists-in-space/
Kock, N. (2004). The psychobiological model: Towards a new theory of computer-mediated communication based on Darwinian evolution. *Organization Science, 15*(3), 327–348.
Kramer, M. (2013, December 3). *Astronaut hopefuls face off for Apollo's free trip to space this week*. Available at: http://www.space.com/23816-axe-apollo-space-academy-astronaut-training.html
Kramer, M. (2013, December 5). *Suiting up for the AXE Apollo Space Academy*. Available at: http://www.space.com/23845-apollo-space-academy-flight-suit.html
Kramer, M. (2013, December 8). *Axe Apollo fans with the right stuff win free space trips*. Available at: http://www.space.com/23866-axe-apollo-space-academy-spaceflight-winners.html

LaRose, R., & Eastin, M. S. (2004). A social cognitive theory of internet uses and gratifications: Toward a new model of media attendance. *Journal of Broadcasting & Electronic Media, 48*(3), 358–372.

Liaw, S. S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the blackboard system. *Computers & Education, 51*(2), 864–873.

Lutz, R. J. (1991). The role of attitude theory in marketing. In H. H. Kassarjian & T. S. Robertson (Eds.), *Perspectives in customer behavior* (pp. 317–339). Englewood Cliffs, NJ: Prentice-Hall.

Mars One. (2013). Available at: http://www.mars-one.com/en/

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behaviour. *Information Systems Research, 2*(3), 173–191.

McCormick, M. J., & Martinko, M. J. (2004). Identifying leader social cognitions: Integrating the causal reasoning perspective into social cognitive theory. *Journal of Leadership and Organizational Studies, 10*(4), 2–11.

McGrath, R. G. (2010). Business models: A discovery driven approach. *Long Range Planning, Special Issue on Business Models, 43*(2–3), 247–261.

Mitchell, D., & Coles, C. (2003). The ultimate competitive advantage of continuing business model innovation. *Journal of Business Strategy, 24*(5), 15–21.

Moskvitch, C. (2013, December 4). *Life on Mars: How a one-way Martian colony project could work*. Available at: http://www.space.com/23838-mars-one-colony-martian-volunteers.html

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review, 87*(9), 57–64.

OECD. (2011). *The space economy at a glance*. Available at: http://www.oecd.org/sti/futures/space/48301203.pdf

Pare, G., & Elam, J. J. (1995). Discretionary use of personal computers by knowledge workers: Testing of a social psychological theoretical model. *Behaviour and Information Technology, 14*(4), 215–228.

Pincus, J. (2004). The consequences of unmet needs: The evolving role of motivation in consumer research. *Journal of Consumer Behavior, 3*(4), 375–387.

Ratten, V., & Ratten, H. (2007). Social cognitive theory in technological innovations. *European Journal of Innovation Management, 10*(1), 90–108.

Rutan, B. (2006). *Why space needs you*. Available at: http://money.cnn.com/magazines/business2/business2_archive/2006/03/01/8370591/index.htm

Ryan, M. J., & Bonfield, E. H. (1975). The Fishbein extended model and customer behaviour. *Journal of Customer Research, 2*, 118–136.

Sawamura, B., & Radke, K. (1992). Future manned systems advanced avionics study COTS for space. In *Proceedings of the IEEE/AIAA 11th digital avionics systems conference, 1992* (pp. 514–522). Seattle, WA: IEEE.

Schifter, D., & Ajzen, I. (1985). Intention, perceived control, and weight loss: An application of the theory of planned behaviour. *Journal of Personality and Social Psychology, 49*(3), 843–851.

Shih, Y., & Fang, K. (2004). The use of a decomposed theory of planned behaviour to study internet banking in Taiwan. *Internet Research, 14*(3), 213–223.

Space Foundation. (2013). *The space report 2013*. Available at: http://www.spacefoundation.org/programs/research-and-analysis/space-report

Stratford, F. (2013, April 22). *The business of space travel*. Available at: http://www.thespacereview.com/article/2281/1

Suzuki, K. (2007). Space and modernity: 50 years on. *Space Policy, 23*(3), 144–146.

Taylor, S., & Todd, P. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(2), 144–177.

Templeton, G. (2013, December 13). *Lockheed Martin receives $250,000 from ambitious Mars project*. Available at: http://www.geek.com/science/lockheed-martin-receives-250000-in-ambitious-mars-one-project-1579513/

Vecchi, A., & Brennan, L. (2010). Conceptualising the business of space: A globalisation perspective. In *Proceedings of the academy of international business 37th conference (UK–Ireland)*. New York, NY: Academic.

Vecchi, A., & Brennan, L. (2014). Leveraging business model innovation in the international space industry. In B. Christiansen (Ed.), *Handbook of research on global business opportunities*. Hershey, PA: IGI Global.

Vecchi, A., & Brennan, L. (2015). Leveraging business model innovation in the international space industry. In B. Christiansen (Ed.), *Handbook of research on global business opportunities*. Hershey, PA: IGI Global.

Vecchi, A., Brennan, L., & Theotokis, A. (2010a). RFID acceptance amongst customers: A cross-cultural framework based on Hofstede. *International Journal of Electronic Customer Relations Management, 4*(3), 228–251.

Vecchi, A., Brennan, L., & Theotokis, A. (2010b). Customers' acceptance of new service technologies: The case of RFID. In A. Gunasekaran & M. Sanduh (Eds.), *The handbook on business information systems*. Singapore: World Scientific.

Venkatesh, V., Davies, F., & Morris, M. (2007). Dead or alive? The evolution trajectory, and the future of technology adoption research. *Journal of the Association for Information System, 18* (4), 267–286.

Venkatesh, V., Morris, M., Gordon, B., & Davies, F. (2003). User acceptance of information technology: Toward a different unified view. *Management Information System Quarterly, 27* (3), 115–139.

Vijayasarathy, L. (2004). Predicting consumer intentions to use on-line shopping: The case for an augmented technology acceptance model. *Information Management, 41*(6), 747–762.

Wall, M. (2013, April 30). *Ticket price for private spaceflights on Virgin Galactic's SpaceShipTwo going up*. Available at: http://www.space.com/20886-virgin-galactic-spaceshiptwo-ticket-prices.html

Wood, R., & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review, 14*(3), 363–384.

Yin, R. K. (2008). *Applications of case study research* (Applied social research methods, Vol. 34). Newbury Park: Sage.

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning, 43*(2), 216–226.

Real Options Reasoning and Innovative Performance in the Context of Dynamic Capabilities

Asghar Afshar Jahanshahi and Stephen X. Zhang

Abstract

Innovation has always been along with great uncertainty, and companies that are seeking to develop new products or services should be flexible in their resources to cope with uncertainty. Presenting new goods, commodities or services mostly requires the expenditure of huge amount of both financial and human resources which, in turn, can endanger the company's status in the market if it fails to fulfill the product requirements. In this way, firms increasingly realize that a flexible workforce helps mitigate downside risks and offers opportunities for achieving superior and innovative performance. Therefore, considering flexible investing plan such as real options reasoning can be regarded as one of top priority for innovative firms. In this regard, the primary and major question of the study will be whether real options reasoning or thinking as a strategy for uncertainty reduction matter when innovative firms are looking to increase their rate of radical and incremental innovative performance in rapidly changing and unpredictable environments? Through a comprehensive literature review, we will attempt to find out whether adaptive capability exercises a mediating role between real options reasoning and innovative performance? Also, the capacity of firms to create and exploit new knowledge is critical for innovative outputs. In other words, a firm's innovation performance is an outcome of increases in its knowledge base and the success of real options thinking mostly depends on organizational ability to evaluate and utilize outside information and knowledge. Thus we will investigate the moderate effects of absorptive capacity on the relationship between real options thinking and innovative performance.

A.A. Jahanshahi (✉) • S.X. Zhang
Department of Industrial & Systems Engineering, Pontificia Universidad Catolica de Chile, Avenida Vicuna Mackenna 4860, Macul, Santiago, Chile
e-mail: Asghar@ing.puc.cl

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_11

1 Introduction

As competition intensifies and the pace of change accelerates, firms need to renew themselves by improving present products and services or by introducing new things continuously to keep up with customers' expectations. Widespread agreement exists among researchers that an organization's capability to innovate is closely tied to its ability to utilize its knowledge resources (Subramaniam and Youndt 2005). In other words, the introduction of new products and services to marketplace is a function of a firm's ability to manage, maintain and create knowledge (Cohen and Levinthal 1990; Smith et al. 2005). In addition, the value of knowledge mostly depends on its transfer and integration within the firm (Coff and Laverty 2001; Dutton and Ashford 1993). In this fashion, firms draw from absorptive capacity to create explicit knowledge (Bergh and Lim 2008) that can be developed, codified, and applied to improve decision making process (Lane and Lubatkin 1998) and then reduce the innovation failure rate.

Innovation (more specially radical innovation) has always been associated with great uncertainty (Oke et al. 2012) which should be properly identified, systematically analyzed, evaluated and effectively controlled. These uncertainties arise from issues such as: whether these new products and services closely match current and future needs of customers? What is the reaction of main competitors? Whether the quality of new products and services are enough to satisfy the customers? Since developing new products or presenting new services requires huge investment of a company in managerial time and other resources, the ability to manage uncertainty and risks is increasingly considered to be of vital importance in this process. A real options portfolio presents a method of insurance against the uncertainty (McGrath and Nerkar 2004) that may strengthen the success of innovative activities.

Therefore, in first phase it is necessary to understand which strategy or capabilities enable innovative firms to create, accumulate and utilize their information and knowledge in changing marketplace and apply them to commercial ends. In the second phase it is important to know how innovative firms can manage uncertainties that come from new products or services. In line with this logic, we posit that in highly uncertain and dynamic conditions, investing on the base of real options approach provide a condition for innovative firms to learn more about market and reduce uncertainty, beside absorptive capacity allow them to promptly acquire important information from market place, transfer, and integrate it within firms and finally adaptive capability enables them to reconfigure resources and coordinate processes effectively to meet rapid environmental changes.

In the other words, innovative performance is a function of various firms' capabilities, which collaborate together in dynamic environment. It seems reasonable to assume that while a capability may have tremendous potential value to enhance firms' innovative performance; its value can be maximized when it is combined with a relevant capability.

2 Theoretical Background

2.1 Why Innovation?

Improving innovative performance has become an important top management concern (Cassiman and Veugelers 2006) in most firms. According to previous studies, innovation is the main contributor to competitive advantage (Prajogo and Ahmed 2006) and survival of firms (Banbury and Mitchell 1995; Lahiri and Narayanan 2013) in certain and uncertain environmental conditions. It is a critically important competitive factor that can create "isolation mechanisms" (Lavie 2006) which protects profit margins and allows benefits to be gained for companies. Consequently it can act as a competitive weapon to attain and maintain superior performance. Especially if firms introduce new product that differentiate their products from existing products (Duncan 1972) which enable them to create and sustain superior performance.

Laursen and Salter (2006) distinguish between radical (advancement in knowledge and consequent development of new products and processes) and incremental (ongoing improvement to product, process, and service) innovative performance. Radical innovative performance is the fraction of the firm's turnover relating to products new to the world market. Incremental innovative performance is the fraction of the firm's turnover pertaining to products new to the firm and the fraction of the firm's turnover pertaining to products significantly improved. According to Freeman and Soete (1997) innovative performance refers to results for companies in terms of the degree to which they actually introduce inventions onto the market, i.e. their rate of introduction of new products, new process systems or new devices.

Introducing new products or processes are more important especially in environments characterized by high levels of change, uncertainty and competitive interactions. Dynamic environments are likely to provide a richer source of innovation opportunity than stable ones (Utterback 1971). In this respect, Prajogo and Ahmed (2006) also found that ability to develop new products is even more important when the environment is changing constantly and rapidly.

2.2 What Is Real Options Reasoning

Finance and management scholars study the real options theme from three main perspectives: real options valuation (Miller and Shapira 2004), real options reasoning (McGrath and Nerkar 2004) and real options as a capability (Kogut and Kulatilaka 1994, 2001). Real options valuation is more related to resource allocation processes (McGrath et al. 2004) and covering aspects of quantitative decision-making (Driouchi and Bennett 2012). Real options reasoning or real options thinking focuses on value creation and resource reconfiguration (McGrath 1999) and can be used as a specific planning technique (McGrath et al. 2004) or an intuitive decision-making metaphor. The last approach towards real options decision-making (Driouchi and Bennett 2012) is considering real options as a

dynamic capability which can act as platforms for organizational learning (Li and Rajagopalan 2008; Majd and Pindyck 1987) and enable firms to reverse their organizational inertia (Kogut and Kulatilaka 2001), create value and sustain competitive advantage (Bowman and Hurry 1993). These three streams of research fit under the general umbrella of real options theory (Driouchi and Bennett 2012). Real options provide firms with the right but not the obligation to pursue certain actions (e.g., deferring, staging, expanding, switching, or abandoning) in the future (Miller and Folta 2002).

2.3 Real Options Reasoning Supporting Capability Development

Real options give firms an excellent opportunity to appropriately exploit their resources in order to build firm-specific capabilities. In other words, real options thinking presents the organization with a greater variety of future opportunities to alter existing capabilities (Sirmon et al. 2007) or to create new ones while containing the downside risk. In this line of reasoning, real options make a connection between firms' tangible and intangible resources (internal) and its external environment and empower firms to link their stages of evolution in the face of uncertainty (Kogut and Kulatilaka 2001).

Real options offer flexibility in choices (Barnett 2007) and present a dynamic framework to firms to modify their tangible and intangible resources in terms of market, technology and environment changes in order to develop new capabilities. Real options reasoning as way of thinking (Krychowski and Quélin 2010), concern firms' strategic choices (McGrath et al. 2004) and downside risk reduction (Reuer and Leiblein 2000). Flexibility in choices means that firms can take variety of actions (defer, delay, scale up or down, abandon, and switch or change direction) (McGrath et al. 2004) rather than focus on a given path in different conditions. This flexibility in actions empowers firms to seize upside opportunities over time and provide a flexible condition for firms to change their operating directions according to market and business circumstances.

Through real options, firms look to improve the financial performance (Bloom and Van Reenen 2002; Podoynitsyna et al. 2013) and innovative performance (Verdu et al. 2012) under different levels of environmental uncertainty.

A real option is any decision that creates the right, without obligation, to pursue a subsequent decision in specific time. Since its introduction by Black and Scholes (1973) and Merton (1973), real options received notable attentions in the context of entrepreneurship (McGrath 1999; Miller and Folta 2002), innovation (McGrath and Nerkar 2004), supply chain (Hult et al. 2010), information technology (Tiwana and Keil 2006; Fichman et al. 2005) and international business (Tong et al. 2008).

Previous studies in the context of real options consider it as a prerequisite to resource accumulation and capability development (Maritan and Alessandri 2007; Pandza et al. 2003). We pick up three special form of organizational capabilities (absorptive, adoptive and learning capabilities) in order to provide a conceptual base for this interesting issue (Maritan and Alessandri 2007; Pandza et al. 2003).

2.4 Real Options Reasoning and Innovative Performance

Real options reasoning, as a timely and effective managerial decision making (Barnett 2008) utilize in conceptual manner (McGrath et al. 2004) and attribute to the innovative management philosophy (Hartmann and Hassan 2006) that aims to provide a more holistic analysis of the project features from an option's perspective. The inherent relation between real options reasoning and innovative performance is based upon the logic that any new investment option already assumes some innovation, insofar as it assumes performing something new, at least for that firm. Any new investment options contain variety of opportunities to generating something new or entering a new market (Verdu et al. 2012). For example, exercising growth option can be used to elicit unforeseen future opportunities (Fichman 2004; Kim and Kogut 1996) or allow for the development of future capabilities (Kogut and Kulatilaka 2001) which are effects to level of innovation activities of organizations. Having high flexibility to exercise multiple investment options (Bowman and Hurry 1993) or having portfolio of options enable firms to reply more readily to changing markets and technologies by rapidly creating new product or processes, modifying the combination of products and processes offered, or changing the level of production and processes or the technology used in an investment that somehow these activities relate to innovative performance of the firms.

Organizational learning is a starting point to develop capacity for innovating. Real options provide a condition for firms to improve their learning capability continuously (Li and Rajagopalan 2008; Majd and Pindyck 1987) in challenging environment. For instance, if the environmental conditions are unfavorable, a stage option permits an investment or project to be completed incrementally (Fichman 2004), a defer option refers to the possibility of waiting until more information has become available (Huchzermeier and Loch 2001) and switching options allow for investments to be redeployed (Trigeorgis 1993). These possibilities enable managers to learn more about the market at an earlier stage, thereby creating an opportunity to modify the marketing plan according to consumer requirements and increase the chance of market success. Through this continual learning process, an organization can effectively absorb new knowledge (Damanpour 1991) and generate new idea (Dishman and Pearson 2003), ultimately strengthening the organizational innovative capacity (Aragón-Correa et al. 2007; Li et al. 2012; Wang 2011). Based on the statements above, we propose the following hypothesis:

Proposition 1: Under condition of high uncertainty, real options reasoning are positively associated with innovative performance.

2.5 Real Options Reasoning and Organizational Learning

Real options create opportunity for firms to learn in different stages of their evolutionary processes. By suggesting various types of options (defer, stage,

switch, expand, abandon and scale) (Bowman and Hurry 1993), this approach makes it possible for firms to learn about their resources before making a huge commitment of the resources.

Previous studies have identified two types of learning (Ingram and Baum 1997; Pisano 1994) that, we argue, may happen during real options decision-making processes: 'Learning-by-doing' and 'learning-before-doing'. From this perspective, real options is a learning and selection mechanism that enables firm to adopt changes. Continuous learning that is achieved from sequential investing is analogous to an internal 'learning-by-doing' mode (Koussis et al. 2006). Moreover, in the high rapidly changing context, it will be more effective to engage in greater experimentation and prototyping with early testing of processes.

Learning-by-doing in the context of real options occurs when decision makers put their investment in different stages and try to learn in each stage. Alternatively, if firms decide to switch from the project A to project A' then it encourages experimentation and provides a condition for decision makers to 'learn by doing' or experiential learning. Through' learning by doing' (Kogut and Kulatilaka 2001), the existing firm's capabilities improve dynamically and it allows firms to get better at what they already do (Lane et al. 2006). On the other hand, delaying or temporary abandoning investments in a project allows the manager to make better-informed decisions (Hult et al. 2010) and simultaneously gives "the firm sufficient time to develop knowledge through learning-before-doing" (Carrillo and Gaimon 2000). However, the possibility of delaying an investment may lead to knowledge accumulation which is fundamental for organizational learning occurring (Arthur and Huntley 2005) but at the same time, it may cause low morale of people involved in the project which in turn may decrease the tendency of people to learn.

Glazer and Weiss (1993) and Glazer (1991) emphasized the importance of information and knowledge of organizations in changing condition. They noted that having information about expressed needs and the latent needs of customers and competitor's behavior and strategies in the target marketplace could potentially enable a firm to produce a market offering for some market segments more efficiently or effectively than that of competitors. A real option investment provides a firm with the flexibility to abandon a project (Kogut and Kulatilaka 2001) or make further investments (Fichman 2004) as new information arrives (Wang and Lim 2008). Besides, when customer preferences and rivals strategies are unpredictable, making a small learning investment allows firms to collect information about the marketplace and learn rapidly about their markets, track and identify wants and latent needs expressed by the customers over time and properly respond to demand changes. It seems that, exercising a series of incremental investments lead to a gradual improvement of a firm's capability to absorb new knowledge and information from market continuously. In this vein, the ability to delay the investment enables firms to scan and sense events and trends in their markets. This process allows the manager to make better-informed decisions due to uncertainty reduction (Hult et al. 2010) and thus better information. As a consequence, real options reasoning as a timely and effective managerial decision making (Barnett 2008)

assists firms to improve their ability to identify, assimilate and exploit the external knowledge (Teece et al. 1997) thereby facilitates organizational learning.

Proposition 2: Under condition of high uncertainty, real options reasoning improve organizational learning capability.

2.6 The Mediator's Role of Adaptive Capability

Does real options thinking have potential to improve adaptive capability of firms in a turbulent and uncertain environmental condition? Does high adaptive capability of firms lead to high innovative performance? In this section, we provide some theoretical argument to answer these questions.

It is widely accepted that, the essence of management is coping with change (Chakravarthy 1982). A key condition for successful change is the ability to attend to and accurately interpret the environment (Teece et al. 1997). In recent years, with increasing environmental complexity and dynamism (Goll and Rasheed 2004) the adaptability of the firm (Chakravarthy 1982; Gibson and Birkinshaw 2004) has attracted new academic interests in how firms adapt to changes (Tuominen et al. 2004) and obtain their effectiveness.

The most successful and innovative firms in the global marketplace use their adaptive capability to identify and exploit emerging market opportunities (Wang and Ahmed 2007). Adaptive capability as the key element of dynamic capabilities emphasizes the reconfiguration of resources and processes to respond to external changes (Gibson and Birkinshaw 2004). Researchers from the dynamic capabilities perspective (e.g. Eisenhardt and Martin 2000; Teece et al. 1997) have suggested that the ability to respond in a rapid and flexible manner to dynamic market environment is a key element of adaptive capabilities. It seems that real options thinking has potential to make this capability of firms even stronger. The ability to create different options by decision makers is a prerequisite for firms adapting to environment change (Sharfman and Dean 1997). In this regards, Sanchez (1995) noted that adaptive capability is manifested through strategic flexibility or real options reasoning. Whereas some strategic management and finance researcher like Barnett (2008), Luehrman (1998) and Lenos Trigeorgis (1996) think of "strategic flexibility" and "real options thinking" as essentially synonymous or that real options reasoning is a special form of strategic flexibility (Podoynitsyna et al. 2013).

Real options thinking provides a flexible platform to change direction of company according to market and technology changes and may provide a source that helps firms build adaptive capabilities in fast changing environments. Furthermore, there are always risks and uncertainties associated with innovative activities. Real options reasoning contends that uncertainty may be reduced over time (Dixit and Pindyck 1994) and therefore better-informed investment decisions may be made (Janney and Dess 2004) in consequence greater potential firm success in innovative activities and their adaptability.

Furthermore, some scholars suggest that adaptability should lead to improved and innovative performance (Bourgeois 1980). In this context, by studying 153 firms, Akgün et al. (2008) showed that adaptive capabilities such as market, technology, and management system, related positively to and simultaneously impacted firms' product innovativeness.

Real options thinking has two main dimensions: flexibility and uncertainty. This method enables firms to flexibly manage their irreversible investment capitals, and simultaneously, taking into account the uncertainties and risks of future cash flow (Yang and Blyth 2007). This strategy helps the managers and employee workforce to dynamically adapt their knowledge, skills, resources, capabilities and future operations to a changing business environment. So we can assume that, developing a flexible investment plan leads to the creation of new things for firms that have capability to continuously modify its resource base and adopt new forms of organizational change. Thus we have the basis to our second hypothesis:

Proposition 3: Under condition of high uncertainty, adaptive capability mediates the relationship between real options reasoning and innovative performance.

2.7 Moderating Effect of Absorptive Capacity

In the uncertain environment, real options reasoning approach suggests that, firms use various types of options to learn and keep flexibility at a relatively low cost (Bowman and Hurry 1993). This learning process is more likely to occur especially if accompanied by a high organization's absorptive capacity. In other words, the key to real options thinking is the flow of information that reduces uncertainty (Janney and Dess 2004; McGrath and Nerkar 2004) in the time between establishing the option and facing the exercise decision (Barnett 2008). If new information casts doubt on the project, the firm can avoid losses by letting the option expire. On the other hand, if the new information is favorable, the firm can exercise the option (Coff and Laverty 2001). Therefore the effectiveness and success of a real options thinking mostly depends on organizational ability to acquire and assimilate new information from marketplace and finally its ability to exploit knowledge. This ability to evaluate and utilize outside information and knowledge is called absorptive capacity or capability (Cohen and Levinthal 1990).

Besides, firms with a high level of absorptive capacity are likely to cultivate new knowledge to enhance their innovative activities (Zaheer and Bell 2005). In this way, Cassiman and Veugelers (2006) find a strong association between the external knowledge acquisition and innovative performance. Therefore, we hypothesize:

Proposition 4: Under condition of high uncertainty, absorptive capacity moderates the relationship between real options reasoning and innovative performance.

3 Conceptual Framework

The following Fig. 1 shows the likely relationship among main constructs of the study. We use real options reasoning as one of antecedent of innovative performance of firms. Besides, we believe that, just organizational learning or market orientation is not enough to sustain created competitive advantages in the long run. The firms need to learn from this experience and convert this behavior or strategy into culture of organization.

In order to check whether our main model is robust, future studies should take into consideration a set of control variables. These could be variables that are not considered in the hypotheses but may still influence innovative performance and real options reasoning. Future studies thus should control for some variables that are likely to affect firms innovative performance, including *firm age*, *size*, *past performance and R&D intensity*. In consonance with Tsai (2001) size can affect a firm's innovative performance. Large units tend to have more resources with which to enhance their innovation and performance. Future studies should control for the firm size by adding the logarithm of the total number of employees (Blonigen and Taylor 2003). Firm age, an important control variable, can be measured by the natural logarithm of the number of years a company has been in existence since younger companies often pursue more radical innovations than older companies (Wang 2011). R&D intensity can be measured by dividing the firm's mean R&D investment over the last 7 years by the mean number of employees in the same period (Verdu et al. 2012). Firm's past performance has a direct bearing on a firm's innovative performance (Rothaermel and Hess 2007). To control for this effect, future studies should insert a firm's net income, total revenues, and total assets into the regression equations.

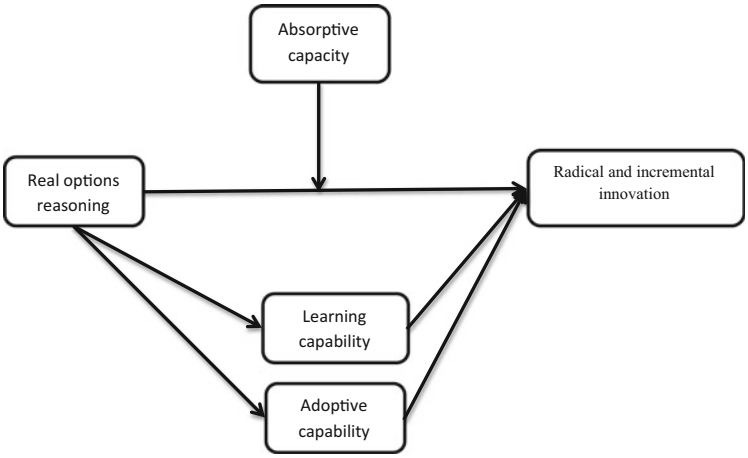


Fig. 1 Conceptual framework of study (*Source* original figure by Jahanshahi and Zhang)

4 Expected Results

We draw on Resource Based Theory (RBV) and contingency theory (the best way to organize depends on the nature of the environment to which the organization must relate) (Scott 2002) to enrich our understanding of the beneficial effects of real options reasoning on innovative performance under condition of high uncertainty, contending that absorptive capacity is critical factor that maximize this relationship. We expected that when technological and market uncertainty is high, with significant increase in absorptive capability as a dimension of dynamic capability, the role of real option reasoning in promoting innovative performance is becoming more important. Besides, adaptive capability is proposed as a central mediating variable between real options thinking and innovative performance because it is a critical capability for firms to navigate a market with high uncertainty.

5 Theoretical Contributions and Future Work

It is widely accepted that innovation has always been associated with great uncertainty. In this way, real option thinking has potential to enhance innovative performance of firms when uncertainty is high. Information and knowledge can play a central role in this context. Uncertainty means that there is a lack of information. Firms make initial learning investment and wait to receive valuable information from marketplace. If information is favorable then they decide to expand and continue the investing. Thus, the firm can be more confident in its allocation decisions to pursue or not to pursue an opportunity. We presume that absorptive capacity of firms can positively moderate the relationship between options thinking and innovative outcomes by creating, assimilating and exploiting information and knowledge from environment. The present study contributes to filling this gap in the literature.

In addition, we believe that by enhancing the level of adaptive capability of firms, real options thinking may positively effect the innovative performance of firms. Therefore, the contribution of this paper to the existing literature is threefold. In the first phase, by shedding light on the innovation management literature, this article especially contributes to the growing literature on innovative performance in rapidly changing environment (e.g., Ahuja and Katila 2001; Beneito 2006; Hagedoorn and Cloodt 2003; Prajogo and Ahmed 2006; Laursen and Salter 2006). One of the currently most debated and least studied issues in innovation studies is uncertainty (Huchzermeier and Loch 2001; Miller and Arikan 2004). The present research will contribute to this debate.

Consistent with previous studies (Miller and Friesen 1982), we expect that high levels of uncertainty generate more innovation through opportunity seeking and adaptation to change (Russell and Russell 1992; Utterback 1971). In this regard, we assume that real options as an effective opportunity seeking approach (Ireland et al. 2003) and adaptive capability as effective adaptive tools (Zhou and Li 2010) are essential to increase the level of innovative performance of firms in the context of

fast changing environments. Real options enable firms to adopt to different environment change and consequently enhance organizations adaptive capabilities. Adaptive capability (Gibson and Birkinshaw 2004) allows firm to respond to external product market opportunities more quickly. We posited that this relationship can become stronger by level of absorptive capacity of firms. Thus in the third phase, we will contribute to the growing body of absorptive capacity or capability. The absorptive capacity of a firm (Cohen and Levinthal 1990) demonstrate their ability to process external information signals, and this ability enables the firms to predict future technological and market trends more accurately. Finally, result of our study will have implications for research on innovation and real options reasoning in the context of developing and emerging countries.

Future research, can also focus on understanding how real options as a strategic decision making tools can support other strategic orientation (e.g. innovation orientation, networking orientation, entrepreneurship orientation) of firms, in particular firms operating in a rapidly changing market environment.

Furthermore, findings of almost all relevant studies are based on data collected in developed countries and more especially in the United States. However, little work has been done in developing countries to validate these results and to see if they are applicable across national boundaries. Therefore, we suggest that future research attempt to fill this gap by collecting data from developing countries.

Based on our conceptual paper, we provide the following strategic recommendations for innovative firms in rapidly changing environment. Top managers and decision makers are advised to take into account the real options thinking or reasoning as one of main strategies in dynamic environment. Real options offer a high level of flexibility in decision-making processes, which can act as a strategic weapon in rapidly changing environment to reduce perceived uncertainty.

Lastly, we develop several testable propositions that the thesis of these kinds of questions enrich our knowledge about how organizations can benefit from real options and may redefine the applicability of real options theory in real world or bring this emerging theory (Li et al. 2007) closer to the heart of strategic management.

References

Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: A longitudinal study. *Strategic Management Journal, 22*(3), 197–220. doi:10.1002/smj.157.

Akgün, A. E., Keskin, H., & Byrne, J. (2008). The moderating role of environmental dynamism between firm emotional capability and performance. *Journal of Organizational Change Management, 21*(2), 230–252. doi:10.1108/09534810810856453.

Aragón-Correa, J. A., García-Morales, V. J., & Cordón-Pozo, E. (2007). Leadership and organizational learning's role on innovation and performance: Lessons from Spain. *Industrial Marketing Management, 36*(3), 349–359. doi:10.1016/j.indmarman.2005.09.006.

Arthur, J. B., & Huntley, C. L. (2005). Opportunity and constraint: Organizations' learning from the operating and competitive experience of industries. *The Academy of Management Executive, 48*(6), 1159–1170. Retrieved from http://www.jstor.org/stable/info/20159735?.

Banbury, C. M., & Mitchell, W. (1995). The effect of introducing important incremental innovations on market share and business survival. *Strategic Management Journal, 16*(S1), 161–182. doi:10.1002/smj.4250160922.

Barnett, M. L. (2007). Making sense of real options reasoning: An engine of choice that backfires? *Organizational Decision Making, 914*, 1–17.

Barnett, M. L. (2008). An attention-based view of real options reasoning. *Academy of Management Review, 33*(3), 606–628. doi:10.5465/AMR.2008.32465698.

Beneito, P. (2006). The innovative performance of in-house and contracted R&D in terms of patents and utility models. *Research Policy, 35*(4), 502–517. doi:10.1016/j.respol.2006.01.007.

Bergh, D. D., & Lim, E. N. -K. (2008). Learning how to restructure: Absorptive capacity and improvisational views of restructuring actions and performance. *Strategic Management Journal, 29*(6), 593–616. doi:10.1002/smj.676.

Black, F., & Scholes, M. S. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy, 81*(3), 637–654. Retrieved from http://ideas.repec.org/a/ucp/jpolec/v81y1973i3p637-54.html.

Blonigen, B. A., & Taylor, C. T. (2003). R&D intensity and acquisitions in high-technology industries: Evidence from the US electronic and electrical equipment industries. *The Journal of Industrial Economics, 48*(1), 47–70. doi:10.1111/1467-6451.00112.

Bloom, N., & Van Reenen, J. (2002). Patents, real options and firm performance. *The Economic Journal, 112*(478), C97–C116. doi:10.1111/1468-0297.00022.

Bourgeois, L. J., III. (1980). Strategy and environment: A conceptual integration. *The Academy of Management Review, 5*(1), 25–39. Retrieved from http://www.jstor.org/stable/info/257802.

Bowman, E. H., & Hurry, D. (1993). Strategy through the option lens: An integrated view of resource investments and the incremental-choice process. *Academy of Management Review, 16*(4), 760–782.

Carrillo, J. E., & Gaimon, C. (2000). Improving manufacturing performance through process change and knowledge creation. *Management Science, 46*(2), 265–288. Retrieved from http://www.jstor.org/stable/info/2634763?.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science, 52*(1), 68–82. doi:10.1287/mnsc.1050.0470.

Chakravarthy, B. S. (1982). Adaptation: A promising metaphor for strategic management. *The Academy of Management Review, 7*(1), 35–44. Retrieved from http://www.jstor.org/stable/info/257246.

Coff, R. W., & Laverty, K. J. (2001). Real options on knowledge assets: Panacea or Pandora's box? *Business Horizons, 44*(6), 73–79. doi:10.1016/S0007-6813(01)80076-8.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152. Retrieved from http://www.jstor.org/stable/info/2393553.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal, 34*(3), 555–590. Retrieved from http://www.jstor.org/stable/256406.

Dishman, P., & Pearson, T. (2003). Assessing intelligence as learning within an industrial marketing group: A pilot study. *Industrial Marketing Management, 32*(7), 615–620. doi:10.1016/S0019-8501(03)00030-0.

Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty* (Vol. 14, p. 468). Princeton, NJ: Princeton University Press.

Driouchi, T., & Bennett, D. J. (2012). Real options in management and organizational strategy: A review of decision-making and performance implications. *International Journal of Management Reviews, 14*(1), 39–62. doi:10.1111/j.1468-2370.2011.00304.x.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly, 17*(3), 313. doi:10.2307/2392145.

Dutton, J. E., & Ashford, S. J. (1993). Selling issues to top management. *The Academy of Management Review, 18*(3), 397–428. Retrieved from http://www.jstor.org/stable/info/258903.

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal, 21*(10–11), 1105–1121. doi:10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E.

Fichman, R. G. (2004). Real options and IT platform adoption: Implications for theory and practice. *Information Systems Research, 15*(2), 132–154. doi:10.1287/isre.1040.0021.

Fichman, R. G., Keil, M., & Tiwana, A. (2005). Beyond valuation: "Options thinking" in IT project management. *California Management Review, 47*(2), 74–96. Retrieved from http://hbr.org/product/a/an/CMR304-PDF-ENG?cm_sp=doi-_-case-_-CMR304-PDF-ENG&referral=00103.

Freeman, C., & Soete, L. (1997). *The economics of industrial innovation* (3rd ed., p. 470). Cambridge, MA: MIT Press. Retrieved from http://www.amazon.com/The-Economics-Industrial-Innovation-Edition/dp/0262561131.

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal, 47*(2), 209–226. Retrieved from http://www.jstor.org/stable/info/20159573.

Glazer, R. (1991). Marketing in an information-intensive environment: Strategic implications of knowledge as an asset. *Journal of Marketing, 55*(4), 1–19. Retrieved from http://www.jstor.org/stable/info/1251953.

Glazer, R., & Weiss, A. M. (1993). Marketing in turbulent environments: Decision processes and the time-sensitivity of information. *Journal of Marketing Research, 30*(4), 509–521. Retrieved from http://www.jstor.org/stable/info/3172694.

Goll, I., & Rasheed, A. A. (2004). The moderating effect of environmental munificence and dynamism on the relationship between discretionary social responsibility and firm performance. *Journal of Business Ethics, 49*(1), 41–54. doi:10.1023/B:BUSI.0000013862.14941.4e.

Hagedoorn, J., & Cloodt, M. (2003). Measuring innovative performance: Is there an advantage in using multiple indicators? *Research Policy, 32*, 1365–1379. Retrieved from http://ideas.repec.org/p/ner/maastr/urnnbnnlui27-4270.html.

Hartmann, M., & Hassan, A. (2006). Application of real options analysis for pharmaceutical R&D project valuation—Empirical results from a survey. *Research Policy, 35*(3), 343–354. doi:10.1016/j.respol.2005.12.005.

Huchzermeier, A., & Loch, C. H. (2001). Project management under risk: Using the real options approach to evaluate flexibility in R&D. *Management Science, 47*(1), 85–101. doi:10.1287/mnsc.47.1.85.10661. Retrieved March 07, 2013, from http://www.scopus.com/record/display.url?eid=2-s2.0-0035239263&origin=inward&txGid=C485C2381E902733ED43DB7C6549C02B.aqHV0EoE4xIIF3hgVWgA:1.

Hult, G. T. M., Craighead, C. W., & Ketchen, D. J., Jr. (2010). Risk uncertainty and supply chain decisions: A real options perspective. *Decision Sciences, 41*(3), 435–458. doi:10.1111/j.1540-5915.2010.00276.x.

Ingram, P., & Baum, J. A. C. (1997). Opportunity and constraint: Organizations' learning from the operating and competitive experience of industries. *Strategic Management Journal, 18*(S1), 75–98. doi:10.1002/(SICI)1097-0266(199707)18:1+<75::AID-SMJ922>3.0.CO;2-6.

Ireland, R. D., Hitt, M. A., & Sirmon, D. G. (2003). A model of strategic entrepreneurship: The construct and its dimensions. *Journal of Management, 29*(6), 963–989. doi:10.1016/S0149-2063_03_00086-2.

Janney, J. J., & Dess, G. G. (2004). Can real-options analysis improve decision-making? Promises and pitfalls. *The Academy of Management Executive, 18*(4), 60–75. Retrieved from http://www.jstor.org/stable/info/4166124.

Kim, D. J., & Kogut, B. (1996). Technological platforms and diversification. *Organization Science, 7*(3), 283–301. Retrieved from http://www0.gsb.columbia.edu/faculty/bkogut/files/1996_OrgSci_Kim_Kogut.pdf.

Kogut, B., & Kulatilaka, N. (1994). Options thinking and platform investments: Investing in opportunity. *California Management Review, 36*(2), 53–71. Retrieved from http://www.jstor.org/stable/41165744.

Kogut, B., & Kulatilaka, N. (2001). Capabilities as real options. *Organization Science, 12*(4), 744–758. Retrieved from http://people.bu.edu/nalink/papers/orgscience.pdf.

Koussis, N., Martzoukos, S. H., & Trigeorgis, L. (2006). Real R&D options with time-to-learn and learning-by-doing. *Annals of Operations Research, 151*(1), 29–55. doi:10.1007/s10479-006-0127-3.

Krychowski, C., & Quélin, B. V. (2010). Real options and strategic investment decisions: Can they be of use to scholars? *The Academy of Management Perspectives, 24*(2), 65–78. Retrieved from http://amp.aom.org/content/24/2/65.full.

Lahiri, N., & Narayanan, S. (2013). Vertical integration, innovation, and alliance portfolio size: Implications for firm performance. *Strategic Management Journal, 34*(9), 1042–1064. doi:10.1002/smj.2045.

Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review, 31*(4), 833–863. doi:10.5465/AMR.2006.22527456.

Lane, P. J., & Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal, 19*(5), 461–477. doi:10.1002/(SICI)1097-0266(199805)19:5<461::AID-SMJ953>3.0.CO;2-L.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal, 27*(2), 131–150. doi:10.1002/smj.507.

Lavie, D. (2006). Capability reconfiguration: An analysis of incumbent responses to technological change. *Academy of Management Review, 31*(1), 153–174. Retrieved from http://papers.ssrn.com/abstract=744126.

Li, Y., James, B. E., Madhavan, R., & Mahoney, J. T. (2007). Real options: Taking stock and looking ahead. *Advances in Strategic Management, 24*, 31–66. doi:10.1016/S0742-3322(07)24002-1.

Li, G., & Rajagopalan, S. (2008). Process improvement, learning, and real options. *Production and Operations Management, 17*(1), 61–74. doi:10.3401/poms.1070.0008.

Li, Y., Wei, Z., Zhao, J., Zhang, C., & Liu, Y. (2012). Ambidextrous organizational learning, environmental munificence and new product performance: Moderating effect of managerial ties in China. *International Journal of Production Economics*. doi:10.1016/j.ijpe.2012.11.008.

Luehrman, T. A. (1998). Strategy as a portfolio of real options—Harvard Business review. *Harward Business Review, 76*(5), 89–99. Retrieved from http://hbr.org/1998/09/strategy-as-a-portfolio-of-real-options/ar/1.

Majd, S., & Pindyck, R. S. (1987). Time to build, option value, and investment decisions. *Journal of Financial Economics, 18*(1), 7–27. doi:10.1016/0304-405X(87)90059-6.

Maritan, C. A., & Alessandri, T. M. (2007). Capabilities, real options, and the resource allocation process. In J. J. Reuer & T. W. Tong (Eds.), *Real options theory* (Advances in strategic management, Vol. 24, pp. 307–332). Bingley: Emerald. doi:10.1016/S0742-3322(07)24011-2.

McGrath, R. G. (1999). Falling forward: Real options reasoning and entrepreneurial failure. *Academy of Management Review, 24*(1), 13–30. doi:10.5465/AMR.1999.1580438.

McGrath, R. G., Ferrier, W. J., & Aubrey L. Mendelow. (2004). Response: Real options as engines of choice and heterogeneity. *The Academy of Management Review*. Retrieved March 07, 2013, from http://www.jstor.org/stable/20159011.

McGrath, G., & Nerkar, A. (2004). Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. *Strategic Management Journal, 25*(1), 1–21. doi:10.1002/smj.358.

Merton, R. C. (1973). Theory of rational option pricing. *The Bell Journal of Economics and Management Science, 4*(1), 141–183. Retrieved from http://www.jstor.org/stable/info/3003143.

Miller, K. D., & Arikan, A. T. (2004). Technology search investments: Evolutionary, option reasoning, and option pricing approaches. *Strategic Management Journal, 25*(5), 473–485. doi:10.1002/smj.392.

Miller, K. D., & Folta, T. B. (2002). Option value and entry timing. *Strategic Management Journal, 23*(7), 655–665. doi:10.1002/smj.244.

Miller, D., & Friesen, P. H. (1982). Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. *Strategic Management Journal, 3*(1), 1–25. doi:10.1002/smj.4250030102.

Miller, K. D., & Shapira, Z. (2004). An empirical test of heuristics and biases affecting real option valuation. *Strategic Management Journal, 25*(3), 269–284. doi:10.1002/smj.374.

Oke, A., Walumbwa, F. O., & Myers, A. (2012). Innovation strategy, human resource policy, and firms' revenue growth: The roles of environmental uncertainty and innovation performance. *Decision Sciences, 43*(2), 273–302. doi:10.1111/j.1540-5915.2011.00350.x.

Pandza, K., Horsburgh, S., Gorton, K., & Polajnar, A. (2003). A real options approach to managing resources and capabilities. *International Journal of Operations & Production Management, 23*(9), 1010–1032. doi:10.1108/01443570310491756.

Pisano, G. P. (1994). Knowledge, integration, and the locus of learning: An empirical analysis of process development. *Strategic Management Journal, 15*(S1), 85–100. doi:10.1002/smj.4250150907.

Podoynitsyna, K., Song, M., van der Bij, H., & Weggeman, M. (2013). Improving new technology venture performance under direct and indirect network externality conditions. *Journal of Business Venturing, 28*(2), 195–210. doi:10.1016/j.jbusvent.2012.04.004.

Prajogo, D. I., & Ahmed, P. K. (2006). Relationships between innovation stimulus, innovation capacity, and innovation performance. *R&D Management, 36*(5), 499–515. doi:10.1111/j.1467-9310.2006.00450.x.

Reuer, J. J., & Leiblein, M. J. (2000). Downside risk implications of multinationality and international joint ventures. *The Academy of Management Journal, 43*(2), 203–214. Retrieved from http://www.jstor.org/stable/info/1556377.

Rothaermel, F. T., & Hess, A. M. (2007). Building dynamic capabilities: Innovation driven by individual-, firm-, and network-level effects. *Organization Science, 18*(6), 898–921. doi:10.1287/orsc.1070.0291.

Russell, R. D., & Russell, C. J. (1992). An examination of the effects of organizational norms, organizational structure, and environmental uncertainty on entrepreneurial strategy. *Journal of Management, 18*(4), 639–656. doi:10.1177/014920639201800403.

Sanchez, R. (1995). Strategic flexibility in product competition. *Strategic Management Journal, 16*(S1), 135–159. doi:10.1002/smj.4250160921.

Scott, W. R. (2002). *Organizations: Rational, natural, and open systems* (5th ed., p. 430). Upper Saddle River, NJ: Prentice Hall. Retrieved from http://www.amazon.com/Organizations-Rational-Natural-Systems-Edition/dp/013016559X.

Sharfman, M. P., & Dean, J. W., Jr. (1997). Flexibility in strategic decision making: Informational and ideological perspectives. *Journal of Management Studies, 34*(2), 191–217. doi:10.1111/1467-6486.00048.

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review, 32*(1), 273–292. doi:10.5465/AMR.2007.23466005.

Smith, K. G., Collins, C. J., & Clark, K. D. (2005). Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. *The Academy of Management Journal, 48*(2), 346–357. Retrieved from http://www.jstor.org/stable/info/20159660.

Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal, 48*(3), 450–463. doi:10.5465/AMJ.2005.17407911.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509–533. Retrieved from http://www.jstor.org/sici?sici=0143-2095(199708)18:7<509:DCASM>2.0.CO;2-#.

Tiwana, A., & Mark Keil, R. G. F. (2006). Information systems project continuation in escalation situations: A real options model. *Decision Sciences, 37*(3), 357–390. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.150.1914.

Tong, T. W., Reuer, J. J., & Peng, M. W. (2008). International joint ventures and the value of growth options. *Academy of Management Journal, 51*(5), 1014–1029.

Trigeorgis, L. (1993). Real options and interactions with financial flexibility. *Financial Management, 22*(3), 202–224. Retrieved from http://www.mendeley.com/catalog/real-options-interactions-financial-flexibility-3/.

Trigeorgis, L. (1996). *Real options: Managerial flexibility and strategy in resource allocation* (p. 427). Cambridge, MA: The MIT Press. Retrieved from http://www.amazon.com/Real-Options-Managerial-Flexibility-Allocation/dp/026220102X.

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *The Academy of Management Journal, 44*(5), 996–1004. Retrieved from http://www.jstor.org/stable/3069443.

Tuominen, M., Rajala, A., & Möller, K. (2004). How does adaptability drive firm innovativeness? *Journal of Business Research, 57*(5), 495–506. doi:10.1016/S0148-2963(02)00316-8.

Utterback, J. M. (1971). The process of technological innovation within the firm. *The Academy of Management Journal, 14*(1), 75–88. Retrieved from http://www.jstor.org/stable/254712.

Verdu, A. J., Tamayo, I., & Ruiz-Moreno, A. (2012). The moderating effect of environmental uncertainty on the relationship between real options and technological innovation in high-tech firms. *Technovation, 32*(9–10), 579–590. doi:10.1016/j.technovation.2012.06.001.

Wang, C.-H. (2011). The moderating role of power asymmetry on the relationships between alliance and innovative performance in the high-tech industry. *Technological Forecasting and Social Change, 78*(7), 1268–1279. doi:10.1016/j.techfore.2011.03.017.

Wang, C. L., & Ahmed, P. K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews, 9*(1), 31–51. doi:10.1111/j.1468-2370.2007.00201.x.

Wang, H., & Lim, S. S. (2008). Real options and real value: The role of employee incentives to make specific knowledge investments. *Strategic Management Journal, 29*(7), 701–721. doi:10.1002/smj.681.

Yang, M., & Blyth, M. (2007). *Modeling investment risks and uncertainties with real options approach*. Working paper. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.118.6560.

Zaheer, A., & Bell, G. G. (2005). Benefiting from network position: Firm capabilities, structural holes, and performance. *Strategic Management Journal, 26*(9), 809–825. doi:10.1002/smj.482.

Zhou, K. Z., & Li, C. B. (2010). How strategic orientations influence the building of dynamic capability in emerging economies. *Journal of Business Research, 63*(3), 224–231. doi:10.1016/j.jbusres.2009.03.003.

Uncovering Driving Forces for Better Product Innovation: Have Russian Firms Learned to Balance the Focus on Internal and External Partners?

Maria Smirnova, Daria Podmetina, Daria Volchek, and Vera Rebiazina

Abstract

The current study focuses on exploring how cooperation can help companies to reach their targets in new product development and market launch successfully. The overarching research question of the study is whether cooperation in innovation can help Russian companies to overcome market and institutional context inefficiencies and achieve better performance outcomes. More specifically, we address two aspects of cooperation: the role of cooperation with external partners as a factor of innovation success and the balance of internal versus external stakeholders' interests in framing innovation strategy. The study is empirically based on a cross-industry quantitative dataset of Russian innovative firms.

M. Smirnova (✉)
Graduate School of Management, Saint Petersburg State University, St. Petersburg, Russia
e-mail: Smirnova@gsom.pu.ru

D. Podmetina
Lappeenranta University of Technology, Lappeenranta, Finland
e-mail: Daria.podmetina@lut.fi

D. Volchek
Aalto University School of Business, Helsinki, Finland
e-mail: Daria.volchek@aalto.fi

V. Rebiazina
National Research University—Higher School of Economics, Moscow, Russia
e-mail: Rebiazina@hse.ru

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5_12

1 Introduction

As Drucker (1954) stated, innovation and marketing are key functions of any business. Commercialization of innovative ideas requires nowadays not just understanding of the target market, but also interaction with partners throughout the value chain or—in a broader network-based view—within a value constellation (Normann and Ramirez 1993). However, for firms from transition economies, there is one pitfall—a risk of openness (Smirnova et al. 2011), meaning a potential negative outcome from collaborating for innovation. When cooperating with external partners, Russian firms face obstacles such as instability of relationships in the market, low availability of information about the partners, and high risk of opportunistic behavior (Johanson 2007). Indeed, existing research indicates that Russian firms are less ready to open up when collaborating, and have lower readiness to disclose information (Podmetina et al. 2011; Salmi 2004).

Globalization of the economy opens the frontiers for successful new products and services. Even small innovative firms can reach their customers around the globe using modern IT infrastructure, and can thus explore more market opportunities.

The outcomes of the globalized competition challenge drivers and obstacles for innovations stemming from emerging or transition economies. On one hand, firms from emerging economies are facing successful learning effects while adapting to an imperfect institutional environment and superior local demand knowledge (Sheth 2011). However, on the other hand, firms from emerging economies are lacking experience and capital, and need to adapt their products and services to local needs. These latter factors influence the success of commercialization of innovative ideas. Hence, the marketing function becomes increasingly important and regains strategic meaning for linking a firm's environment and innovative processes. This strategic meaning is connected with the idea of collaboration for successful innovation (Prato and Nepelski 2013). Thus, research on such a core concept in marketing as market orientation tends to include orientation towards multiple stakeholders (Hult 2011; Greenley et al. 2005) whose interests have to be considered when planning and implementing development of the new processes and services.

Market orientation has been discussed as both a driver of innovativeness (Grewal et al. 2013; Han et al.1998) and a potential barrier to innovation success (Berthon et al. 1999). Indeed, as Christensen (1997) suggested, many large firms have been focusing on existing customers, serving their needs and investing in in-depth studies of their preferences, and thus missing future opportunities, new markets, and new technologies, as these were not connected with the core target market of the firms.

Hence, the core challenge for many marketers is to answer two questions: whose interests should a firm follow in order to be successful in the future, and whose interests should drive planning and implementation of innovation processes in a firm.

The risk of openness perceived by firms from emerging economies is often complemented by path dependence in prioritizing internal processes when running R&D activities. Firms endowed with their own R&D resources can also follow the strategy of focusing on their own resources and limiting interaction with external parties. Such closed strategy can be defined by established practices and can lead to losing leadership in the market due to a lack of connection with the market and core stakeholders. The balance between internal and external stakeholders is jeopardized by such a path dependence driven strategy.

As such, marketing has to both serve the need to understand future opportunities, nourishing innovative activities of a firm, and balance the interests of existing stakeholders to survive and strengthen market positions.

The current study focuses on exploring how cooperation can help companies to reach their targets successfully in new product development and market launch. The overarching research question of the study is whether cooperation in innovation can help Russian companies to overcome market and institutional context inefficiencies and achieve better performance outcomes. More specifically, we address two aspects of cooperation: the role of external partners' network management as a factor of innovation success, and the balance of internal versus external stakeholders' interests in framing innovation strategy. The study is empirically based on a cross-industry quantitative dataset of Russian innovative firms. The sample was formed based on prioritizing firms with the focus on innovative activities from various regions of the country. The surveyed firms were asked to address the ways Russian companies have made their choices about establishment and coordination of internal and external cooperation with the purpose of improving the firm's innovation performance. The conceptual framework of the study is presented in the following chapter. The sampling strategy and measurement quality are reported in the research design and methodology chapter. Then the key findings are presented. The study concludes with a discussion of the theoretical contribution and practical implications of the conducted work.

2 Theoretical Framework

2.1 Collaborative Innovation Research in Marketing

It is hard to underestimate the role of marketing in creating and maintaining success in innovation. Besides traditional marketing tools, broadening of the marketing concept application has led to substantial interest of marketing researchers in collaborative innovations.

The role of marketing knowledge and philosophy has been spread to managing and coordinating the whole portfolio of a firm's partners and stakeholders, rather than focusing only on customer interaction. Indeed, this perspective was developed during the 1990s, when the role of marketing and its potential contribution was re-assessed by researchers from all over the world. Morgan and Hunt (1994), Kotler (1992), Gummesson (1999), Christopher et al. (1991), Payne et al. (2001), and

Buttle (1999) have highlighted the roles of various groups of partners in implementing company's aims.

This stream of marketing research has highlighted the role of building a company's own relational ecosystem and maintaining a balance with internal and external partners. Intensified cooperation in innovations in the last decades reflects the fact that companies' internal resources and capabilities are not enough to satisfy the need for innovations and R&D (Hagedoorn 2002; De Propris 2002). Loch and Tapper (2002) list communication between research partners, customers, and use of external knowledge as the dimensions of a firm's external cooperation. Samsonowa (2012) classifies potential directions of collaboration for innovation that require performance measurement, including cooperation with academia, cooperation with customers and partners, and presence in the scientific community.

Hence, the new approach within the marketing concept has broadened the subject of analysis to customers and multiple partners. This required interdisciplinary learning from neighboring fields such as institutional economics (Williamson 1985; Thorelli 1986); agent theory (Jensen and Meckling 1976); transaction cost theory (Williamson 1985; Grönroos 1994); theory of resource dependency (Jarillo 1988); network approach (Hakansson 1982; Jackson 1985; Grönroos 1994); theory of social exchange (Hakansson 1982; Dwyer et al.1987; Anderson et al.1994); theory of social embeddedness (Granovetter 1985); theory of social network (Lomi and Grandori 1993), and the resource-based view (Barney 1991).

The resource dependence perspective theory (Pfeffer and Salancik 1978) implies that firms' interactions lead to interdependency based on complementarity of resources, which is achieved through mutual exchange and built on the resource base of both partners (Ganesan 1994; Ring and Van de Ven 1994). The resource interdependency can drive motivation for cooperation on innovation, but at the same time it could create pressures for the parties involved in cooperation throughout the value chain or in a wider value network.

Earlier research on management of inter-firm cooperation has highlighted not only the opportunities based on the combination of partners' resources, but also a need to focus on development of firm-specific organizational capabilities (Day and Van den Bulte 2002; Jacob 2003; Möller and Törrönen 2003). The latter are interrelated with managing innovation via network embeddedness, and hence stimulating firm's abilities to gain superior innovation output (Gonzalez-Brambila et al.2013). Indeed, existing studies demonstrate that external cooperation increases innovation capability and has a positive effect on innovation output (Bayona et al.2001; Kaufmann and Tödtling 2001; Klomp and van Leeuwen 2001; Hagedoorn 2002; Lööf and Heshmati 2002; Romijn and Albaladejo 2002; Belderbos et al. 2004; Vivero 2004; Veugelers and Cassiman 2005; Lundvall et al. 2002). Better cooperation skills foster companies' innovativeness, and ability to utilize external knowledge, which results in better innovation performance (Cohen and Levinthal 1990).

2.2 The Role of Cooperation: Internal and External Dimensions

Innovation collaboration becomes increasingly important for the innovation process (Prato and Nepelski 2013). Existing studies on collaborative innovation show that external links and cooperation increase a company's innovation capability and have a positive effect on innovation output (Bayona et al.2001; Kaufmann and Tödtling 2001; Klomp and van Leeuwen 2001; Hagedoorn 2002; Lööf and Heshmati 2002; Romijn and Albaladejo 2002; Belderbos et al.2004; Vivero 2004; Veugelers and Cassiman 2005; Lundvall et al.2002).

The motivations to partner up for innovation can be quite different, and not only linked to purely marketing purposes. For example, joint market development or joint technology commercialization sometimes force joint efforts even among competitors, for example, to introduce an industry standard that would support commercialization of new products or services (Garraffo 2002).

The focus on interaction highlights the need to assess the success and performance of collaboration, which resulted in a special field of research on innovation performance, including focus on collaboration (e.g., Samsonowa 2012; Loch and Tapper 2002; Smals and Smits 2012; Berghman et al.2012) and relational value (Walter et al.2001; Ravald and Grönroos 1996; Lindgreen and Wynstra 2005; O'Cass and Ngo 2012; Lindgreen et al.2012).

Among the dimensions of the interaction with the partners, researchers highlight strategic, technological, and social aspects (Wilson and Jantrania 1996). This multiplicity of potential outcomes of relationship development with firms' partners has also been reflected in research on conceptualizing and measuring relational value that is being co-created by partners and that contributes to the success of marketing activities, including new product development and innovation outcomes in general (Möller and Törrönen 2003). Walter et al. (2001) highlight the role of innovation development as an outcome of managing relations with stakeholders. Werani (2001) suggests differentiating collaboration outcomes linked to new products, including ideas for new products or product improvements, suggestions for improving technology transfer, and joint new product development. Tewes (2003) also formulates a need to separately assess non-monetary relationship value, including innovative and synergetic potential of collaboration. Forsström (2003) separates relational value based on competence development, including learning effects related to technical competencies, market information, and innovations.

2.2.1 Internal Cooperation for Innovation

Cooperation in R&D may occur on different levels: strategic (partner selection and management), executive (teams and processes), or infrastructural level (Deck and Strom 2002). A decision on innovation strategy is based on social interactions and analysis of innovation practices (Neyer et al.2009). Independent from the level of cooperation, firms need to develop specific organizational competencies to support interaction. These cooperation competencies are about how companies develop and manage partnerships (Dyer and Singh 1998) and integrate skills and tacit

knowledge with external partners. The motives for cooperation depend on the types of partners (Belderbos et al.2004).

The competence to cooperate in the R&D sphere or in NPD is valuable for all involved organizations. Companies with high skills in cooperation, or cooperation capability, can have access to a large range of technologies and better manage their R&D resources (Torkkeli et al.2009). Large companies do not fully rely on internal innovations, and tend to increase cooperation in R&D activities (Freeman and Hagedoorn 1994) and create their own cooperation values.

The intensified cooperation in innovations in the last decades indicates a lack of companies' internal resources and capabilities to satisfy a need for innovations and R&D (Hagedoorn 2002; De Propris 2002). The simultaneous implementation of innovation and cooperation strategies in companies has been discussed in a large number of studies. Some companies decide to cooperate based on their internal R&D expertise, and try to balance internal and external R&D based on their internal knowledge—a choice between "making and buying" (Cassiman and Veugelers 2002). Companies can externalize due to their internal weaknesses in innovation (Keupp and Gassmann 2009). Other companies cooperate with competitors in product R&D, process R&D, or both (Lin and Saggi 2002).

This leads us to the conclusion that cooperation is more important for companies with experience in internal R&D and R&D cooperation. Based on our observations, these two groups of companies seem to be more eager to expand their technology portfolio towards technology acquisition and to cooperate on commercializing internal R&D.

2.2.2 External Cooperation for Innovation

Companies can cooperate on innovations in the process of new product development with a variety of external parties, including suppliers (Smals and Smits 2012; Berghman et al.2012), competitors (Garraffo 2002), customers (Bogers et al.2010; von Hippel 1988), and research organizations (Samsonowa 2012). It is believed that the key sources for innovations are often lead users, suppliers, or universities (Holzweber et al. 2011). Companies use various channels (suppliers, users, universities) when they search for innovative opportunities (Laursen and Salter 2006). The issue of partner selection and the effect of innovation outcomes along the vertical and horizontal linkages has been focus of existing studies (Miotti and Sachwald 2003).

For cooperative companies, external partners can be classified as core and fringe (additional) (Hart and Sharma 2004), vertically forward or vertically backward, and horizontal or diagonal (von der Heidt 2008). The role of core and fringe partners will be quite different for cooperating companies (Hart and Sharma 2004); obviously core partners will contribute more to R&D, and cooperation with them will be more successful.

In a broad sense, companies are exploring the potential of establishing their own innovation networks and gaining benefits through their superior configuration (Corsaro et al.2012). Some studies have focused on factors that specifically induce companies to cooperate with foreign partners located in other countries, to carry out

innovative activities (Faria and Schmidt 2007). The existence of a strong relationship between internationalization and innovation is obvious for many companies, especially for companies from emerging economies (Podmetina et al.2009).

Companies with a market expansion strategy (domestic and international) actively cooperate with suppliers and customers (Smirnova et al.2009), gain new knowledge of markets to increase innovation, and have better skills for cooperation (Podmetina et al.2013). The level of companies' openness reflected by cooperation on innovation is linked to market expansion (Idrissia et al.2012; Lichtenthaler 2008; Faria and Schmidt 2007).

In previous academic studies, we found plenty of evidence of the positive effects of cooperation on innovation, such as increases in a company's innovation capability and a positive effect on the innovation and economic output (Bayona et al.2001; Kaufmann and Todtling 2001; Klomp and van Leeuwen 2001; Hagedoorn 2002; Lööf and Heshmati 2002; Romijn and Albaladejo 2002; Belderbos et al.2004; Vivero 2004; Veugelers and Cassiman 2005). Access to new knowledge and technologies resulted from cooperation on innovation, increasing the innovativeness (Lundvall et al.2002) of the company, and decreasing costs and risks (Faria and Schmidt 2007; Christensen 1997; Chesbrough 2003; Serrano and Fischer 2007; Kleinsmann and Valkenburg 2005).

2.3 Research on Cooperation for Innovation in Russia

Like any other transition economy, Russia is facing multiple challenges on the way to increasing its national competitiveness. Historically, the country had an above average resource base for innovation, but it faced severe changes in the institutional environment that led to the destruction of previously established connections and networks.

The results so far do not offer reasons to claim a success of the Russian innovative model. Among the factors influencing poor innovation performance of Russian companies are an unsatisfactory institutional environment and poor intellectual property rights (Bek et al.2013). Institutional changes and challenges have been highlighted in research on Russia (Mattsson and Salmi 2013; Puffer and McCarthy 2011; Manev and Manolova 2010). Institutional factors are known to influence personal relationships and involvement in networks structures, which are essential for any collaborative innovations. However, what is important is how Russian firms have coped with the institutional changes, providing they could be considered to be both challenges and opportunities.

During the process of institutional change, companies face new rules of the game and have to develop organizational capabilities and routines to cope with these (Peng 2003). While adapting to the new conditions in the external environment, market players have to decide on their innovation strategy, their own resource endowment, and the need to open up for cooperation with both internal and external partners. Chadee and Roxas (2013) emphasize that there is a direct link between the

institutional environment and innovation capacity in the case of the Russian economy.

Within the BRIC group, Russia is similarly inactive to Brazil and China in establishing international partnerships and having international co-inventors from abroad (Prato and Nepelski 2013). Surprisingly, BRIC's leader in international collaboration on innovation is India. In comparison with other emerging economies with big domestic markets, India targets its patent applications at foreign markets more actively (Prato and Nepelski 2013). Trifilova et al. (2013) have highlighted various challenges of international collaboration for innovation in emerging economies.

In compensating for the lack of support from the institutional environment, companies have to develop tools and strategies that aim at better connections to the market and opportunities to create commercial success out of their own inventions. Indeed, as Johanson (2007) states, companies have to re-establish their relationships and acquire organizational capabilities to match their plans with those of surrounding external partners.

The demand for better collaboration strategies becomes even stronger, because Russia seems to have exploited its path-dependent capital and resources based on the investments made during Soviet times. Hence, Chadee and Roxas (2013) point out the fact that, for the first time during the last decade, China has outperformed Russia on the number of patents per million people, according to data from the World Intellectual Property Organization. Russian market players are facing a challenge of moving from exploitative to explorative innovation (Jansen et al.2006) and increasing their own skills in developing an innovation ecosystem that is based on well-functioning partnerships. However, existing studies do not provide sufficient evidence on what strategies and approaches are utilized by Russian companies in addressing internal and external cooperation opportunities to adapt to the new rules of the institutional environment in order to achieve improved innovation outcomes.

The conceptual framework illustrating the interplay of internal and external cooperation on innovation, institutional change forces, and innovation output is presented in Fig. 1.

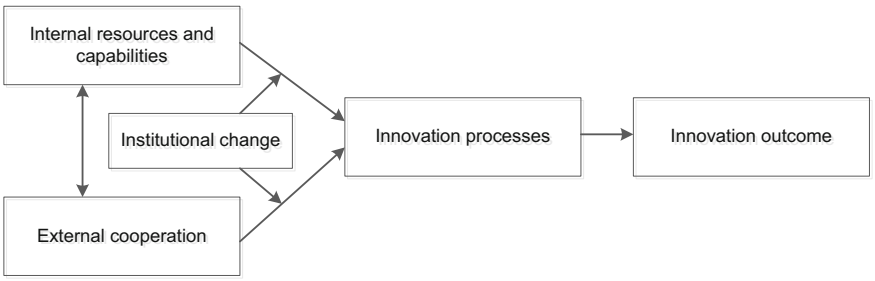


Fig. 1 Conceptual framework (*Source* original figure from the authors)

3 Research Design and Methodology

3.1 Data Collection

Survey data were collected in Russia from November 2009 to February 2010. A stratified sample comprised (1) Russian manufacturing companies, (2) whose industrial representation is equivalent to the proportion of respective industries in the Russian GDP, (3) which have an annual turnover not less than one million Russian rubles (24,000 euros based on the exchange rate of the European Central Bank on 1 February 2010), and (4) which position themselves as innovative. Of the firms following the described quotas of the stratum, 206 companies agreed to participate in the study through structured interviews.

A paper-based questionnaire consisting of 110 questions was developed for the purpose of data collection. The questionnaire was based on the recommendations for conducting innovation surveys (Oslo manual 2007; Frascati manual 1993). The key-informant technique was used to identify suitable respondents, who were initially approached by telephone and then met in person. These respondents held positions in the innovation department or represented top management of the companies.

The questionnaire was constructed in English, but distributed to the companies in Russian. In order to ensure an accurate translation, we employed a rigorous back-translation technique in line with Brislin's (1980) suggestions. In addition, bilingual researchers perused the translated survey questionnaires for content and face validity. The constructs and scales for analyzing companies' cooperation with internal and external partners, international activities of the firms, performance, and a number of other supportive indicators were included in the survey questionnaire. Only observations with no missing values were used in the current study, leading to the selection of 194 applicable cases.

Key information on the sample is presented in Appendix 1. The average age of companies in the sample is 43 years, while the year of foundation varies from 1720 to 2009. Among the sample companies, 17.5 % operated in metal, 13.6 % in machinery and equipment, 11.2 % in electrical and optical, 10.2 % in chemical, 10.2 % in information technology and telecommunications, 7.3 % in electrical machinery, 5.3 % in oil and refinery, 4.9 % in aircraft and shipbuilding, 3.9 % in rubber and plastic, and 16 % in other industries.

The share of companies conducting internal R&D was high at 77.8 %, of which 53 % conduct R&D systematically and 47 % irregularly. The R&D intensity (ratio of R&D expenditure to company sales) was between 1.5 and 3.0 % for 40 % of companies. Out of the 194 companies in the final sample, 2.1 % assessed their economic situation as "near bankruptcy", 10.5 % as "bad", 53.9 % as "satisfactory", 29.3 % as "good", and only 4.2 % as "excellent".

3.2 Operationalization and Methodology

The research questions of the study address the way Russian companies have made their choices about establishment and coordination of internal and external cooperation with the purpose of improving innovation performance.

Companies' approaches have been classified based on two main criteria: internal and external cooperation degree. These two aggregated indicators can demonstrate the balance companies aim to achieve and maintain, reflecting their view of the role of cooperation in driving competitive performance and innovation outcomes. On the other hand, these indicators also illustrate the positioning of sample companies within the innovation ecosystem. It is clear that cooperation is not a one-way road; there should be reliable and efficient partners available in the market in order to develop cooperative actions and achieve expected results.

A two-step cluster procedure has been applied to identify an optimal number of clusters, specifying the number of approaches Russian companies have formed over the years of transition. Further variables have been used to describe the identified clusters of companies. These include dimensions of company performance, company age, market orientation, and perceived external pressures. Operationalization of study variables has been based on existing research.

Internal cooperation is based on a scale, measuring the degree of sharing the interests of departments, joining resources, and integrating efforts towards reaching improved overall and particularly innovation performance outcomes (Kahn and Mentzer 1998). From the marketing perspective, this implies that market orientation is being spread and applied both reactively and proactively (Narver et al.2004). In other words, departments freely communicate ideas related to strategic objectives of the firm, know the needs of each other, and have the same vision on the perspective of further company development.

External cooperation implies openness towards various partners in a number of aspects related to innovation activities. The scale has been derived from the Eurostat, Community Innovation Survey (2008). The range of innovation activities can vary from a focus on technology that can be driver for future innovations, to mutual development of new products, organizational changes, and marketing innovations. Thus, both the extent and the range or spectrum of external cooperation is being measured.

Performance measures are multidimensional and reflect growth, profitability, customer value, and adaptability dimensions of the overall company performance. The original measure was developed by Venkatraman (1989) and later refined by Vorhies and Harker (2000). The multidimensionality of this approach helps in identifying differences in the impact of collaborative innovation on subdimensions of company performance. In the context of a transition economy, companies have to make their strategic choices, frequently leading to various directions of company development and thus different performance outcomes.

External pressure factors combine several types of external forces with a potential impact on the company's strategy. The given measure includes pressure from such stakeholders as competitors, consumers, suppliers, government, and

Table 1 Descriptive statistics and reliability

	Mean value	Min	Max	Std. deviation	Cronbach's Alpha	Factor loadings
Internal cooperation	4.21	1	5	0.852	0.872	0.768–0.859
External cooperation	2.75	1	5	1.132	0.903	0.738–0.857
Performance: growth	0.46	−2	2	0.910	0.866	0.848–0.916
Performance: profitability	0.45	−2	2	0.973	0.926	0.918–0.949
Performance: customer value	0.69	−2	2	0.852	0.888	0.879–0.932
Performance: adaptability and new product success	0.61	−2	2	0.785	0.852	0.819–0.911

control authorities. Moreover, key stakeholders as competitors, consumers, and suppliers are differentiated by country of origin and market of operation: Russian vs. foreign, operation in Russian vs. international markets.

Types of *marketing innovations* have been included in the study to illustrate the range of marketing innovations applied by companies, including improvements in product design, product packaging, product promotion, new distribution channels in the domestic market and abroad, new pricing policies, and new international market entry. We have also asked sample companies to give examples of specific marketing innovations that have taken place during the last 3 years.

Innovation-Related Cooperation with External Stakeholders: A dichotomous question was used to find out whether external organizations (partners) were involved in innovation-related processes.

The variables used in further analysis in aggregated form were further tested for reliability and validity (Table 1).

4 Key Findings

Based on the two-step cluster analysis procedure, we have identified five clusters of Russian firms, reflecting different patterns in the way they combine and manage internal versus external coordination of their innovative activities. Internal cooperation implies openness, readiness to share information and resources, while following the same vision of future company development. External cooperation comprises various directions of potential involvement of external parties in innovation processes.

Internal cooperation was focused on the nature of cooperation between the departments and functions supporting successful initiation, planning, and implementation of innovations. Joint understanding of the needs of each other, sharing ideas and the same vision of company development should increase the effectiveness

Table 2 Cluster solution overview: internal vs. external cooperation, company age

Cluster number		1	2	3	4	5	
Number of firms in cluster		n = 33	n = 36	n = 40	n = 41	n = 44	
	All firms	Low-Low	Average-Low	Average-High	High-High	High-Low	*Sig.*[*]
Internal cooperation	*4.21*	2.82	3.97	3.97	4.94	4.97	*0.000*
External cooperation	*2.75*	2.29	1.58	3.41	4.18	2.11	*0.000*
On marketing	*2.81*	2.36	1.69	3.37	4.24	2.20	*0.000*
On technology	*2.72*	2.31	1.52	3.47	4.14	2.03	*0.000*
Age	43	26	49	53	27	*48*	*0.002*

[*]p-value of the ANOVA test for statistical difference of means between the clusters

and efficiency of internal cooperation. External cooperation embraces, in the current study, the scope of working together with external parties on various types of innovation processes.

The two-step cluster analysis has revealed five distinctive collaboration strategies applied by the sample firms, resulting in five clusters (see Table 2 for the results of the cluster analysis).

The cluster names reflect the mean cluster values on internal and external cooperation in comparison with the sample mean values for both clustering variables. The clusters are significantly different from each other based on the means comparison ANOVA test.

Cluster means demonstrate that, in all cases, internal collaboration is rather more intensive than external collaboration. Clustered companies have quite different strategies in balancing the role of internal versus external parties in innovation processes. Some clusters have a rather balanced role of internal versus external parties, including clusters 1, 3, and 4. Cluster 4 (High–High) indicates a particular focus on developing both internal and external cooperation, while cluster 1 (Low-Low) has below-average values for both types of cooperation. Cluster 3 (Average-High) has somewhat below-average internal and above-average external cooperation, but there is a certain balance of internal and external cooperation based on the cluster mean values. Clusters 2 (Average-Low) and 5 (High-Low) however demonstrate imbalance in cooperation with a stronger focus on internal cooperation on innovation.

It is interesting that two clusters with different, but balanced in both cases, strategies on cooperation with internal and external partners on innovation (cluster 1 (Low-Low) and cluster 4 (High-High)) represent the youngest companies in the studied sample—26 and 27 years respectively, in comparison with the sample average of 43 years.

In addition to age, we have used industry characteristics to identify the profile of each cluster and the existing differences between them (see Appendix 1).

4.1 Cluster Differences: Company Performance Outcomes

In order to evaluate the effectiveness of selected partnering strategies, we compared performance outcomes for the companies from identified clusters. Statistically significant differences in subdimensions of the performance measure supported the distinctiveness of all five strategies. We based our performance measurement on the approach suggested by Venkatraman (1989), which includes four subdimensions of company performance, namely growth, profitability, customer value, and adaptability. From the perspective of marketing and innovation, this classification of performance measures is particularly interesting.

Not surprisingly, cluster 4 (High-High) demonstrates above-average, and the highest in the sample, performance across all four subdimensions. Second in terms of performance success is cluster 5 (High-Low), with above-average performance on all four subdimensions. Regardless of the overall success of the cluster 5 cooperation strategy, it is noticeable that the companies in this cluster have some weak points, such as extended time to market and lower sales growth.

Cluster 3 (Average-High) demonstrates an average performance outcome, but the profitability indicators of this cluster are above the sample average. We also see that this cluster has a dramatic drop in its time-to-market indicator, compared to other indicators in the performance subdimensions.

A particularly interesting comparison can be made between clusters 1 (Low-Low) and 2 (Average-Low). Although these clusters pay substantially less attention to both internal and external cooperation in the innovation context, the difference between them is visible in a rather balanced and low-intensive approach by cluster 1 (Low-Low), and an unbalanced approach by cluster 2 (Average-Low), where internal cooperation is close to average, but the external cooperation measure is the lowest in the sample. These differences in cooperative strategies result in a very substantial performance variation. Cluster 2 (Average-Low) demonstrates the worst performance among all the clusters. Negative values of most performance indicators demonstrate a perception of being worse than competitors in growth, profitability, and adaptability.

The most surprising results on performance are seen in cluster 1 (Low-Low). Despite their lack of investment in innovation-related internal and external cooperation, the performance of the companies in this cluster is not as bad as of the companies in cluster 2. Particular attention should be paid to above-average results on the number of successful new products and new product launches, supported by sales growth.

The demonstrated performance results indicate the contingency of overall outcomes with the selected cooperation strategy in terms of balancing internal and external cooperation on innovation (Table 3).

Table 3 Performance differences between the clusters

Cluster number		1	2	3	4	5	
Number of firms in cluster		n = 33	n = 36	n = 40	n = 41	n = 44	
	All firms	Low-Low	Average-Low	Average-High	High-High	High-Low	*Sig.*[*]
Performance: growth							
Market share increase	*0.51*	0.29	−0.09	0.41	***1.05***	***0.74***	*0.000*
Relative market share	*0.52*	0.43	−0.15	***0.51***	***1.05***	***0.66***	*0.000*
Sales growth	*0.38*	***0.58***	−0.05	0.41	***0.94***	***0.47***	*0.000*
Performance: profitability							
Business profitability	*0.47*	0.11	−0.33	***0.52***	***1.08***	***0.79***	*0.000*
Return on investment (ROI)	*0.46*	0.12	−0.25	***0.50***	***0.97***	***0.81***	*0.000*
Sales profitability	*0.47*	0.27	−0.21	***0.53***	***1.08***	***0.61***	*0.000*
Performance: customer value							
Customer satisfaction	*0.69*	0.50	0.06	0.62	***1.11***	***1.05***	*0.000*
Creation of customer value	*0.65*	0.44	0.18	0.56	***1.05***	***0.89***	*0.000*
Creation of customer loyalty	*0.67*	0.37	0.27	0.61	***1.05***	***0.87***	*0.000*
Performance: adaptability and new product success							
Number of successful new products	*0.80*	***0.92***	0.18	0.66	***1.17***	***1.02***	*0.000*
New product launches	*0.70*	***0.86***	0.24	0.43	***1.14***	***0.81***	*0.000*
Time to market	*0.35*	0.29	−0.15	0.15	***1.08***	***0.35***	*0.000*

[*]p-value of the ANOVA test for statistical difference of means between the clusters

4.2 Driving Forces for Cooperation: The Role of External Pressures

Although we are able to see visible differences in performance outcomes, we cannot identify the drivers for the identified differences that the companies consider when shaping their cooperation focus and priorities. Table 4 illustrates the role of the pressure factors from the core stakeholders: competitors, customers, suppliers, government, and regulative authorities. Our results demonstrate that pressure from Russian competitors and the pressure from Russian consumers represent the two strongest external effects perceived by the sample companies. Earlier studies confirm that Russian companies are strongly competition-oriented (Smirnova et al.2011), which is also visible in high mean values across all identified clusters.

The third strongest effect is represented by the pressure from the requests for better control for quality of goods. These trends are homogeneous for all sampled companies, with no significant differences between the clusters. There are just a few factors that can help to explain the differences between the clusters, including the role of Russian suppliers ($p = 0.003$) and the requests for better control for quality of goods ($p = 0.000$). These two factors are perceived as the most important by the

Table 4 Differences between the clusters in the role of external pressures

Cluster number		1	2	3	4	5	
Number of firms in cluster		n = 33	n = 36	n = 40	n = 41	n = 44	
	All firms	Low-Low	Average-Low	Average-High	High-High	High-Low	*Sig.*[*]
External pressures							
Pressure from Russian competitors	*3.57*	3.25	3.82	3.27	3.85	3.63	*0.128*
Pressure from foreign competitors in Russia	*2.84*	2.46	2.65	2.97	3.32	2.72	*0.108*
Pressure from competitors on the international market	*2.61*	2.15	2.32	2.75	2.89	2.79	*0.126*
Pressure from Russian consumers	*3.53*	3.18	3.67	3.27	3.85	3.63	*0.092*
Pressure from foreign consumers	*2.46*	2.06	2.28	2.47	2.57	2.77	*0.244*
Pressure from Russian suppliers	*2.48*	2.18	2.05	2.53	3.17	2.36	*0.003*
Pressure from foreign suppliers	*2.24*	1.96	2.11	2.20	2.60	2.25	*0.333*
Governmental policy on innovations	*2.74*	2.53	2.51	2.77	3.23	2.62	*0.096*
Better control for quality of goods	*3.17*	3.00	2.54	3.10	4.02	3.11	*0.000*

[*]p-value of the ANOVA test for statistical difference of means between the clusters

companies from cluster 4 (High-High), supporting the uniqueness of this cluster in comparison with the others. In general, companies from cluster 4 (High-High) perceive higher pressure from most external stakeholders.

Companies from cluster 1 (Low-Low) again demonstrate surprising results, as they perceive the pressure from external stakeholders as the lowest on all indicators. Analyzing these results in the context of performance measures, we need to state that a lack of focus on stakeholders and a certain insensitivity to external pressures do not damage the opportunity of these companies to launch new products and face sales growth.

4.3 Structure of External Innovation-Focused Partnerships

To have a deeper insight into the strategies of external cooperation and consideration of the interests of particular external parties in innovation-related process, we have analyzed who are the core external partners for the companies from each cluster (Table 5). The strategy of companies from cluster 4 (High-High) has been once again confirmed by intensity of cooperation with the whole range of partners. Particularly intensive is cooperation with suppliers in Russia, re-confirming the role

Table 5 Involvement of external partners in innovation processes

Cluster number		1	2	3	4	5
Number of firms in cluster		n = 33	n = 36	n = 40	n = 41	n = 44
	All firms	Low-Low	Average-Low	Average-High	High-High	High-Low
Suppliers in Russia	46.1	36.4	50.0	55.0	70.7	25.0
Suppliers abroad	21.4	12.1	16.7	27.5	34.1	13.6
Clients in Russia	52.4	51.5	69.4	52.5	65.9	34.1
Clients abroad	20.9	12.1	25.0	25.0	34.1	6.8
Intermediaries in Russia	27.2	27.3	25.0	32.5	43.9	11.4
Intermediaries abroad	14.6	9.1	13.9	12.5	31.7	6.8
Stakeholders	23.8	24.2	8.3	35.0	36.6	20.5
Competitors in Russia	15.0	15.2	16.7	7.5	26.8	13.6
Competitors abroad	6.3	6.1	2.8	7.5	17.1	0
Consultants	40.3	27.3	27.8	60.0	51.2	40.9
External commercial research centers and organizations	25.7	24.2	2.8	42.5	39.0	20.5
State research centers	31.1	24.2	11.1	50.0	43.9	29.5
Universities	26.7	18.2	16.7	47.5	31.7	20.5
Partners in JVs	25.2	18.2	13.9	30.0	46.3	18.2
Other partners	18.0	12.1	8.3	27.5	34.1	9.1

of suppliers, which has been previously demonstrated by the role of external pressure from the supplier side. The next strongest cooperation is with clients in Russia, followed by cooperation with R&D partners and consultants.

Cluster 1 (Low-Low) has also confirmed the consistency of its companies' strategy: the cluster demonstrates below-average frequencies of cooperation with external partners. One exception is cooperation with customers, where the cluster companies have close to sample average interaction frequency.

The other three clusters also have particular specifics, revealed by detailed external partner analysis. Thus, second on the performance measures, cluster 3 (Average-High) has above-average or average interaction intensity with suppliers, customers, stakeholders, and partners in joint ventures. With some external partners, this cluster's companies interact more frequently than other clusters: consultants, external commercial research centers and organizations, state research centers, and universities. Thus, both direct value-chain partners (customers and competitors) and research-centered partners are actively involved in innovation processes.

Cluster 2 (Average-Low), despite overall lower frequency of cooperation with external partners, still has some partners with which cluster companies interact with above-average frequency. These partners include suppliers in Russia, clients in Russia and abroad, and R&D partners.

Finally, cluster 5 (High-Low) demonstrates below-average frequency of cooperation with external partners, with the exception of cooperation with external

consultants, where the cluster demonstrates sample average frequency between the clusters and the highest frequency within the cluster among all the partners.

The results demonstrate that companies from particular clusters have formed a purposeful approach to shaping their innovation-centered partnership portfolio.

4.4 Marketing Innovations by Cluster Companies

Clusters are also differentiated by the role of marketing innovations. Similarly to other results, companies from cluster 4 (High-High) have above-average frequency of marketing innovations in most aspects, with the exception of foreign market entry. Particularly higher than the sample average is the frequency of improving product design by this cluster's companies.

Cluster 1 (Low-Low) has a focus on promotion and pricing, to increase the success of its own innovations. We need to note here that, despite a lack of focus on external partners, this cluster has surprisingly high adaptability results, associated with the number of successful new products and their market launch. Companies from this cluster have rather basic types of marketing innovations that took place over the last 3 years. Many companies in this cluster have mentioned brand creation as an example of marketing innovation.

Cluster 2 (Average-Low) is particularly low-profile in marketing innovations. This cluster also has the worst performance results among all the sample clusters. Cluster 3 (Average-High) has a focus on distribution channels and international market entry, while cluster 5 (High-Low) focuses on promotion methods (Table 6).

Table 6 Marketing innovations by clusters

Cluster number		1	2	3	4	5
Number of firms in cluster		n = 33	n = 36	n = 40	n = 41	n = 44
	All firms	Low-Low	Average-Low	Average-High	High-High	High-Low
Improving product design	26.2	12.1	22.2	27.5	43.9	18.2
Improving product packaging	19.4	18.2	16.7	17.5	29.3	13.6
Improving product promotion	30.1	33.3	11.1	30.0	34.1	38.6
New distribution channels in Russia	22.3	12.1	8.3	37.5	34.1	20.5
New distribution channels abroad	11.7	9.1	2.8	17.5	19.5	11.4
New pricing policy	19.4	24.2	8.3	22.5	29.3	13.6
Entering new international market	11.2	12.1	2.8	20.0	9.8	13.6

5 Discussion and Conclusion

In this study, we focused on five aspects of cooperation conducted by Russian companies for the purpose of improving their innovation performance. First, we addressed a notion of balance in managing internal and external stakeholder networks. This step led us to identify five cooperation strategies. Second, we established a linkage between the cooperation strategy and a firm's performance in terms of growth, profitability, customer value, and successful new product launches. Third, we identified the drivers—pressures from the key stakeholders—that shape companies' cooperative strategic choices. Fourth, we mapped a structure of the external cooperation portfolios and pointed out the lead partners relevant to different collaboration strategies. Fifth, we identified a marketing mix structure adopted in each of the cooperation portfolios. A summarized description of the cooperation strategies and their subsequent performance outcomes is presented in Table 7.

In line with theoretical argumentation that better cooperation skills increase companies' innovativeness and ability to utilize external knowledge, which results in better innovation performance (Hagedoorn 2002; Cohen and Levinthal 1990), the results of our analysis showed that the firms that are most active in cooperation demonstrate better performance in terms of growth, profitability, customer value, and introduction of new products to the market (cluster 4). These firms strongly focus on cooperation with domestic suppliers, R&D partners both domestically and abroad, and consulting companies, and seem to be relatively reluctant to grow their businesses internationally.

However, a focus on internal cooperation with a lack of attention to external partners can also produce good performance results (cluster 5). These companies seem to be driven mostly by internal knowledge creation (Cassiman and Veugelers 2002) and, in comparison with ***full cooperators*** (cluster 4), rely much less on cooperation with such external stakeholders as suppliers and clients. Nevertheless, these ***internal cooperators*** put a strong emphasis on R&D cooperation and external consulting services. Regardless of their weaker attention to external partners, these firms perform almost as well as full cooperators.

The cooperation strategy represented in cluster 1 demonstrates that firms can also succeed in innovation with a lack of market and stakeholders focus. These firms, which we identify as ***reluctant cooperators***, are able to achieve high sales growth and successfully launch new products, potentially due to a strong focus on customer relationships and continuous introduction of favorable pricing policies.

Two other cooperative strategies (clusters 2 and 3), which fall under the term ***average cooperators***, do not seem to represent a particular interest for this research, due to their low performance outcomes. However, it is worth noting that average cooperators in cluster 3 that have a cooperation focus skewed towards the external partners actually represent the most internationalized group of companies across the whole sample. Their growth, profitability, and customer value indicators seem to be average in comparison with other companies that adopted other cooperation strategies. But as foreign market expansion requires high resource commitment,

Table 7 Cluster summary

Cluster number	1	2	3	4	5
Number of firms in cluster	n = 33	n = 36	n = 40	n = 41	n = 44
Summarizing characteristics	Reluctant cooperators	Average cooperators		Full cooperators	Internal cooperators
Internal cooperation	Low	Average	Average	High	High
External cooperation	Low	Low	High	High	Low
Marketing innovations	Focused: Promotion & pricing	Low	Focused: Distribution & foreign market entry	High	Focused: Promotion
External partnership profile	Sample average	Client-focused	Vertical partnerships and R&D oriented	Intensive	Clients and consultants
Performance					
Growth	Low, except for sales growth	Negative	Average	High	Above average
Profitability	Low	Negative	Average	High	Above average
Customer value	Low	Low	Average	High	Above average
Adaptability	High	Low	Below average	High	Above average

their cooperation activities can have a delayed effect on the companies' performance outcome.

As we noticed in our study, young Russian companies prefer choosing either to follow the market by achieving better internal and external cooperation, or to ignore the market and partnerships while still succeeding in launching new products. These companies fall into the reluctant and full cooperators groups. Older firms pursue a tailored approach to their internal and external stakeholders, and thus represent semi- and average cooperators.

Appendix 1

Key information on the sample

Variable	Items	Percentage
Size	Small (1–50)	9.8
	Medium (51–250)	32.0
	Large ()	33.5
	Very large ()	24.7
Share of governmental ownership	10 % or less	15.4
	10–25 %	26.9
	25–50 %	23.1
	more than 50 %	34.6
Domestic vs. foreign ownership	100 % domestic	93.8
	Joint Venture (share of foreign ownership is less than 50 %)	5.2
	Joint Venture (share of foreign ownership is more than 50 %)	0.5
	100 % foreign	0.5
Location	Saint Petersburg and region	28.3
	Nigniy Novgorod and region	15.0
	Rostov-on-Don and region	10.2
	Saratov and region	5.9
	Samara and region	11.2
	Perm and region	3.7
	Ekaterinburg and region	16.0
	Novosibirsk and region	3.2
	Krasnoyarsk and region	6.4

Appendix 2

Cluster solution overview by industry

Cluster number	1 Low-Low	2 Average-Low	3 Average-High	4 High-High	5 High-Low
Electrical machinery	8.3	16.7	8.3	33.3	33.3
Electrical and optical industry	22.2	5.6	38.9	11.1	22.2
Rubber and plastic industry	25.0	12.5	25.0	37.5	0.0
Aircraft	25.0	25.0	37.5	0.0	12.5
Chemical industry	9.5	14.3	23.8	33.3	19.0
Machinery and equipment	15.4	15.4	30.8	15.4	23.1
Information technology	9.1	27.3	9.1	18.2	36.4
Telecommunications	11.1	11.1	11.1	33.3	33.3
Oil refinery	18.2	0.0	18.2	36.4	27.3
Metallurgy	25.0	30.6	11.1	13.9	19.4
Shipyards	0.0	0.0	0.0	50.0	50.0
Other	15.6	25.0	18.8	18.8	21.9

References

Anderson, J. C., Hakansson, H., & Johanson, J. (1994). Dyadic business relationships within a business network context. *Journal of Marketing, 58*(4), 1–15.

Barney, J. B. (1991). Returns on bidding firms in mergers and acquisitions, reconsidering the relatedness hypothesis. *Strategic Management Journal, 9*(1), 71–78.

Bayona, C., García-Marco, T., & Huerta, E. (2001). Firms' motivations for cooperative R&D: An empirical analysis of Spanish firms. *Research Policy, 30*(8), 1289–1307.

Bek, M. A., Bek, N. N., Sheresheva, M. Y., & Johnston, W. J. (2013). Perspective of SME innovation clusters development in Russia. *Journal of Business and Industrial Marketing, 28* (3), 240–259.

Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research Policy, 33*(10), 1477–1492.

Berghman, L., Matthyssens, P., & Vandenbempt, K. (2012). Value innovation, deliberate learning mechanisms and information from supply chain partners. *Industrial Marketing Management, 41*(1), 27–39.

Berthon, P., Hulbert, J. M., & Pitt, L. F. (1999). To serve or create? Strategic orientations towards customers and innovation. *California Management Review, 42*, 37–56.

Bogers, M., Afuah, A., & Bastian, B. (2010). Users as innovators: A review, critique, and future research directions. *Journal of Management, 36*(4), 857–875.

Buttle, F. A. (1999). The S.C.O.P.E. of customer relationship management. *Customer Relationship Management, 1*(4), 327–336.

Cassiman, B., & Veugelers, R. (2002). R&D cooperation and spillovers: Some empirical evidence from Belgium. *American Economic Review, 92*(4), 1169–1184.

Chadee, D., & Roxas, B. (2013). Institutional environment, innovation capacity and firm performance in Russia. *Critical Perspectives on International Business, 9*(1/2), 19–39.
Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business Press.
Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Boston, MA: Harvard Business School Press.
Christopher, M., Payne, A., & Ballantyne, D. (1991). *Relationship marketing: Bringing quality, customer service and marketing together*. Oxford: Butterworth-Heinemann.
Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity—A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152.
Corsaro, D., Cantu, C., & Tunisini, A. (2012). Actors' heterogeneity in innovation networks. *Industrial Marketing Management, 41*, 780–789.
Day, G. S., & Ch. Van den Bulte. (2002). *Superiority in customer relationship management: Consequences for competitive advantage and performance*. Marketing Science Institute Report, No. 02–123.
De Propris, L. (2002). Types of innovation and inter-firm co-operation. *Entrepreneurship & Regional Development, 14*, 337–353.
Deck, M., & Strom, M. (2002). Model of co-development emerged. *Research-Technology Management, 45*(3), 47–53.
Drucker, P. (1954). *The practice of management*. New York, NY: Harper & Brothers.
Dwyer, F. R., Schurr, P. H., & Sejo, O. (1987). Developing buyer-seller relationships. *Journal of Marketing, 51*(April), 11–27.
Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660–679.
Faria, P., & Schmidt, T. (2007). *International cooperation on innovation: Empirical evidence for German and Portuguese firms*. ZEW Discussion Papers 07–060, ZEW—Zentrum für Europäische Wirtschaftsforschung/Center for European Economic Research.
Forsström, B. (2003). *A conceptual exploration into "value co-creation" in the context of industrial buyer-seller relationship.* Paper presented at the 19th annual IMP conference, Lugano, Switzerland, September 4–6, 2003.
Freeman, C., & Hagedoorn, J. (1994). Catching up or falling behind: Patterns of international inter firm technology partnering. *World Development, 22*, 771–780.
Ganesan, S. (1994). Determinants of long-term orientation in buyer-seller relationships. *Journal of Marketing, 58*(2), 1–19.
Garraffo, F. (2002). *Types of coopetition to manage emerging technologies*. In 2nd annual conference, Innovative Research in Management, Stockholm, Sweden.
Gonzalez-Brambila, C. N., Veloso, F. M., & Krackhardt, D. (2013). The impact of network embeddedness on research output. *Research Policy, 42*(9), 1555–1567.
Granovetter, M. (1985). Economic action and social structure. *American Journal of Sociology, 91*, 481–510.
Greenely, G. E., Hooley, G. J., & Rudd, J. M. (2005). Market orientation in a multiple stakeholder orientation context: Implications for marketing capabilities and assets. *Journal of Business Research, 58*, 1483–1494.
Grewal, R., Chandrashekaran, M., Johnson, J. L., & Mallapragara, G. (2013). Environments, unobserved heterogeneity, and the effect of market orientation on outcomes for high-tech firms. *Journal of the Academy of Marketing Science, 41*(2), 206–233.
Grönroos, C. (1994). From marketing mix to relationship marketing: Towards a paradigm shift in marketing. *Management Decision, 32*(2), 4–20.
Gummesson, E. (1999). *Total relationship marketing*. London: Butterworth-Heinemann.
Hagedoorn, J. (2002). Inter-firm R&D partnerships: An overview of major trends and patterns since 1960. *Research Policy, 31*(4), 477–492.
Hakansson, H. (1982). *International marketing and purchasing of industrial goods: An interaction approach*. Chichester: Wiley.

Han, J. K., Kim, N., & Srivastava, R. (1998). Market orientation and organizational performance: Is innovation a missing link? *Journal of Marketing, 62*(4), 30–45.

Hart, S. L., & Sharma, S. (2004). Engaging fringe stakeholders for competitive imagination. *Academy of Management Executive, 18*(1), 7–18.

Hult, G. T. M. (2011). Market-focused sustainability: Market orientation plus! *Journal of the Academy of Marketing Science, 39*(1), 1–6.

Idrissia, M. O., Amaraa, N., & Landrya, R. (2012). SMEs' degree of openness: The case of manufacturing industries. *Journal of Technology Management and Innovation, 7*(1), 186–210.

Jackson, B. B. (1985). *Winning and keeping industrial customers: The dynamics of customer relationships*. Lexington, KY: Lexington Books.

Jacob, F. (2003). Kundenintegrations-Kompetenz. Konzeptualisierung, Operationalisierung und Erfolgswirkung. *Marketing ZFP, 25*(2), 83–98.

Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science, 52*(11), 1661–1674.

Jarillo, J. C. (1988). On strategic networks. *Strategic Management Journal, 9*(1), 31–41.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360.

Johanson, M. 2007. *Networks in transition*. In Proceedings of the 23rd IMP conference, Manchester Business School, Manchester, UK.

Kahn, K., & Mentzer, J. (1998). Marketing's integration with other departments. *Journal of Business Research, 42*(1), 53–62.

Kaufmann, A., & Todtling, F. (2001). Science-industry interaction in the process of innovation: The importance of boundary-crossing between systems. *Research Policy, 30*(5), 791–804.

Keupp, M. M., & Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management, 39*(4), 331–341.

Kleinsmann, M., & Valkenburg, R. (2005). Learning from collaborative new product development projects. *Journal of Workplace Learning, 17*(3), 146–156.

Klomp, L., & van Leeuwen, G. (2001). Linking innovation and firm performance: A new approach. *International Journal of the Economics of Business, 8*(3), 343–364.

Kotler, P. (1992). Marketing's new paradigm: What's really happening out there. *Planning Review, 20*(5), 50–52.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovative performance among UK manufacturing firms. *Strategic Management Journal, 27* (2), 131–150.

Lichtenthaler, U. (2008). Open innovation in practice: An analysis of strategic approaches to technology transactions. *IEEE Transactions on Engineering Management, 55*(1), 148–157.

Lin, P., & Saggi, K. (2002). Product differentiation, process R&D and the nature of market competition. *European Economic Review, 46*, 201–211.

Lindgreen, A., Hinglet, M. K., Grant, D. B., & Morgan, R. E. (2012). Value in business and industrial marketing: Past, present and future. *Industrial Marketing Management, 41*(1), 207–214.

Lindgreen, A., & Wynstra, F. (2005). Value in business markets: What do we know? Where are we going? *Industrial Marketing Management, 34*(7), 732–748.

Loch, C., & Tapper, U. A. S. (2002). Implementing a strategy-driven performance measurement system for an applied research group. *Journal of Product Innovation Management, 19*(3), 185–198.

Lomi, A. & Grandori, A. (1993). *The network structure of inter-organizational communities: Preliminary evidence from a study of inter-firm relations in the Southern Italian mechanical industry*. European Science Foundation Conference, Berlin, Germany.

Lööf, H., & Heshmati, A. (2002). *On the relationship between innovation and performance: A sensitivity analysis*. Working paper series in economics and finance 0446, Stockholm School of Economics (Revised October 01, 2001).

Lundvall, B.-A., Johnson, B., Andersen, E. S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy, 31*(2), 213–231.

Manev, I. M., & Manolova, T. S. (2010). Entrepreneurship in transition economies: Review and integration if two decades research. *Journal of Developmental Entrepreneurship, 15*(1), 69–99.

Mattsson, L.-G., & Salmi, A. (2013). The changing role of personal networks during Russian transformation: Challenges for Russian management. *Journal of Business and Industrial Marketing, 28*(3), 190–200.

Miotti, L., & Schwald, F. (2003). Cooperative R&D: Why and with whom? An integrated framework of analysis. *Research Policy, 32*(8), 1489–1499.

Möller, K., & Törrönen, P. (2003). Business suppliers' value creation potential. A capability – based analysis. *Industrial Marketing Management, 32*, 109–118.

Morgan, R., & Hunt, S. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing, 58*, 20–38.

Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and proactive market orientation and new-product success. *The Journal of Product Innovation Management, 21*, 344–347.

Neyer, A.-K., Bullinger, A. C., & Moeslein, K. M. (2009). Integrating inside and outside innovators: A socio-technical systems perspective. *R&D Management Journal, 39*(4), 410–419.

Normann, R., & Ramirez, R. (1993). From value chain to value constellation. *Harvard Business Review, 71*(July-August), 65–77.

O'Cass, A., & Ngo, L. V. (2012). Creating superior customer value for B2B firms through supplier firm capabilities. *Industrial Marketing Management, 41*(1), 125–135.

Oslo Manual. (2007). *The measurement of scientific and technological activities. Proposed guidelines for collecting and interpreting technological innovation data*. Paris: OECD. http://www.oecd.org/science/inno/2367580.pdf

Payne, A., Holt, S., & Frow, P. (2001). Relationship value management. *Journal of Marketing Management, 17*, 785–817.

Peng, M. W. (2003). Institutional transitions and strategic choices. *Academy of Management Review, 28*, 275–296.

Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York, NY: Harper & Row.

Podmetina, D., Vaatanen, J., Torkkeli, M., & Smirnova, M. (2009). Innovativeness and internationalisation. Empirical study of Russian R&D oriented companies. *International Journal of Innovation Management, 13*(2), 1–23.

Podmetina, D., Vaatanen, J., Torkkeli, M., & Smirnova, M. (2011). Do Russian firms utilize open innovation paradigm? Study of technology commercialization and acquisition. *International Journal of Business Innovation and Research, 4*(4/5), 298–317.

Podmetina, D., Volchek, D., Dabrowska, J., & Fiegenbaum, I. (2013). Human resource practices and open innovation. *International Journal of Innovation Management, 17*(5), 1–22.

Prato, G. & Nepelski, D. (2013). *A framework for assessing innovation collaboration partners and its application to BRICs*. Working paper by Institute for Prospective Technological Studies.

Puffer, S. M., & McCarthy, D. J. (2011). Two decades of Russian business and management research: An institutional theory perspective. *Academy of Management Perspectives, 25*(2), 21–36.

Ravald, A., & Gronroos, C. (1996). The value concept and relationship marketing/A. Ravald, Ch. Grönroos. *European Journal of Marketing, 30*(2), 19–30.

Ring, P. S., & Van de Ven, A. H. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review, 19*, 80–118.

Romijn, H., & Albaladejo, M. (2002). Determinants of innovation capability in small electronics and software firms in southeast England. *Research Policy, 31*, 1053–1067.

Salmi, A. (2004*). Institutional change of business networks: Russian transition revisited*. In Proceedings, 20th IMP conference, Copenhagen, Denmark.

Samsonowa, T. (2012). *Industrial research performance management: Key performance indicators in the ICT industry* (p. 464). Berlin, Heidelberg: Physica-Verlag.

Serrano, V., & Fischer, T. (2007). Collaborative innovation in ubiquitous systems. *Journal of Intellectual Manufacturing, 18*, 599–615.

Sheth, J. (2011). Impact of emerging markets on marketing: Rethinking existing perspectives and practices. *Journal of Marketing, 75*(4), 166–182.

Smals, R. G. M., & Smits, A. A. J. (2012). Value for value—the dynamics of supplier value in collaborative new product development. *Industrial Marketing Management, 41*(1), 156–165.

Smirnova, M., Naude, P., Henneberg, S. C., Mouzas, S., & Kouchtch, S. (2011). The impact of market orientation on the development of relational capabilities and performance outcomes: The case of Russian industrial firms. *Industrial Marketing Management, 40*(1), 44–53.

Smirnova, M. M., Podmetina, D., Vaatanen, J., & Kouchtch, S. (2009). Key stakeholders' interaction as a factor of product innovation: The case of Russia. *International Journal of Technology Marketing, 18*, 230–247.

Tewes, M. (2003). *Der Kundenwert im Marketing: Theoretische Hintergründe nd Umsetzungsmöglichkeiten einer wert- und marktkorientierten Unternehmensführung*. Wiesbaden: Dt. Universitätsverlag.

Thorelli, H. B. (1986). Networks: Between markets and hierarchies. *Sloan Management Review, 7* (1), 37–51.

Torkkeli, M., Podmetina, D., & Väätänen, J. (2009). Knowledge absorption in emerging economy—Role of Foreign investments and trade flows in Russia. *International Journal of Business Excellence, 2*(3–4), 269–284.

Trifilova, A., Bartlett, D., & Yochanan, A. (2013). Challenges of international technology collaboration with Russian R&D organizations. *Critical Perspectives on International Business, 9* (1/2), 40–57.

Venkatraman, N. (1989). Strategic orientation of business enterprises: The construct, dimensionality and measurement. *Management Science, 35*, 942–962.

Veugelers, R., & Cassiman, B. (2005). R&D cooperation between firms and universities: Some empirical evidence from Belgian manufacturing. *International Journal of Industrial Organization, 23*(5–6), 355–379.

Vivero, R. (2004). The impact of process innovations on firm's productivity growth: The case of Spain. *Applied Economics, 34*, 1007–1016.

Von der Heidt, T. (2008). *Developing and testing a model of cooperative interorganisational relationships (IORs) in product innovation in an Australian manufacturing context: A multi-stakeholder perspective*. A thesis submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy, School of Commerce and Management, Southern Cross University, Australia.

Von Hippel, E. (1988). *The sources of innovation*. New York, NY: Oxford University Press.

Vorhies, D. W., & Harker, M. (2000). The capabilities and performance advantages of market-driven firms: An empirical investigation. *Australian Journal of Management, 25*(2), 145–171.

Walter, A., Ritter, T., & Gemünden, H. G. (2001). Value creation in buyer-seller relations. *Industrial Marketing Management, 30*, 365–377.

Werani, T. (2001). *On the value of cooperative buyer-seller relationships in industrial markets*, ISBM Report 2–2001, Institute for the Study of Business Markets: The Pennsylvania State University.

Williamson, O. E. (1985). *The economic institutions of Capitalism: Firms, markets, relational contracting*. New York, NY: The Free Press.

Wilson, D. T., & Jantrania, S. (1996). Understanding the value of a relationship. *Asia-Australia Marketing Journal, 2*(1), 55–66.

About the Editors

Alexander Brem is Professor of Technology and Innovation Management at the University of Southern Denmark (Sønderborg, DK) and Head of the Innovation and Business Group at the Mads Clausen Institute. His research interest is on Technology and Innovation Management, with a special focus on boundaries to Psychology, Marketing and Entrepreneurship. He is Author, Reviewer and Editorial Board Member of various international journals, such as *Technovation* or *International Journal of Innovation Management*. Books from Alexander Brem are published by e.g. Imperial College Press, Palgrave MacMillan as well as Springer.

Éric Viardot is Director of the Global Innovation Management Centre and Permanent Professor of Marketing and Strategy at EADA Business School in Barcelona. He has a Doctorate in Management and he is a graduate of the HEC Business School, Paris, and the Institute of Political Sciences, Paris. Éric Viardot has published various books and articles on Strategic Management and Marketing with a strong focus on Technology and Innovation Management. He is currently the Co-Editor in Chief of *the International Journal of Technology Marketing* and a Member of the Editorial Board of *Technovation*. Éric Viardot teaches regularly in executive programs in Europe. He is an active consultant and trainer and has worked with several major multinational corporations.

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5

About the Authors

Sharad Agarwal is a Doctoral Student at Indian Institute of Management Ranchi, India. He has completed B.Tech and MBA before joining the Doctoral Program at IIM, Ranchi. He has previously worked at Indian Institute of Management, Indore for a year as an Academic Associate. His current research interests are in the area of Corporate Social Responsibility (CSR), Consumer Neuroscience, Neuro-Aesthetics and Neural Decision Making. His articles have previously appeared in international journals of repute and edited books.

Gé B. C. Backus is Director of Connecting Agri and Food, an advisory organization in food and agriculture. He has worked for many years at Wageningen University. His main research interests are in Supply Chain Management issues, with a special focus on Information Sharing. His work is published in, among others, *International Journal of Quality and Reliability Management, European Review of Agricultural Economics, Food-Control,* and *Computers and Electronics in Agriculture*. He led assigned projects for among others the European Commission, FAO and the Dutch Government and worked with or consulted for major companies in the food industry, like Agrifirm, Ahold, Cargill, Nevedi, Rabobank, Nutreco, and Vionfood. His current work focusses predominantly on applying and implementing modern ICT tools in food markets.

Dr. Louis Brennan is a Fellow of Trinity College and Professor within the School of Business. He previously served as Director of the Institute for International Integration Studies at Trinity College. Dr. Brennan has served as a Faculty Member and Researcher in Engineering and Business Schools in Asia, Europe and the USA. His fields of interest include Global Strategy and International Business, Global Supply Chain Management, Operations Strategy and Technology Management. He has published extensively in these areas in internationally refereed journals, conference proceedings and edited books. Dr. Brennan's consulting interests lie in mediating and shaping the future.

Taşkın Dirsehan joined the Faculty of Business Administration (lectured in English) in Marmara University as a Marketing Research Assistant in February 2011. He received his B.A. in Business Administration from Galatasaray University

A. Brem, É. Viardot (eds.), *Adoption of Innovation*,
DOI 10.1007/978-3-319-14523-5

in 2009, his M.A. in Production Management and Marketing from Marmara University and Ph.D. in Marketing from Istanbul University. His research and teaching interests are in the areas of Sustainability, International Marketing, Consumer Behavior, Brand Management and Marketing Research. His research has been published in various national and international journals including *Boğaziçi Journal Review of Social*, and *Economic and Administrative Studies*. He has also presented his research at various conferences including National Marketing Congress and International Strategic Management Conference.

Christian Franz Horn is Research and Teaching Assistant at the Department of Marketing, University of Bamberg, Germany. He studied in Business Administration and Sociology in Bamberg, Germany and Marketing Management in Budapest, Hungary. In 2010, he received his Bachelor Degree in Sociology and his Diploma in Business Administration. His research interests include Forecasting Methods, Market Analysis, Online Marketing, Crowdsourcing and Innovation Management. Currently, he is taking part in the Doctoral Programme at the Department of Marketing. His work has been published in *Management Research Review*, *Marketing Intelligence and Planning* and presented on conferences such as European Marketing Association Conference or International Symposium on Forecasting.

Paul T. M. Ingenbleek is Associate Professor of Marketing at Wageningen University. His main research interests are at the interface between Strategic Marketing and (Sustainable) Development in the Food and Agribusiness Industries. His work is published in, among others, *Journal of Product-Innovation Management*, *International Journal of Research in Marketing*, *Journal of Business Research*, *Journal of Public Policy and Marketing*, and *Journal of Business Ethics*. He led assigned projects for among others the European Commission and the Dutch Government and worked with or consulted for major companies in the food industry, like Unilever, Arla, Danone, Flora Holland and Nutreco, as well as with nongovernmental organizations like Fair Trade and Organic Agriculture. His current research focusses predominantly on Developing and Emerging Markets, in particular sub-Saharan Africa.

Bjoern Sven Ivens holds the Chair of Marketing at Otto-Friedrich-University Bamberg, Germany since 2009. Before that he was a Full Professor of Marketing at the University of Lausanne, Switzerland. He has studied Business Administration (University of Erlangen-Nuremberg, Germany) as well as International Relations (University of Strasbourg, France). He holds a Doctoral Degree as well as a Habilitation Degree from the University of Erlangen-Nuremberg. His main research areas lie in the fields of Business Relationships, Customer Management, Price Management and Branding. His work has been published, among others, in *Journal of Business Research, Industrial Marketing Management, European Journal of Marketing, International Journal of Electronic Commerce* as well as *Marketing Theory*. He is working closely with industrial companies such as Siemens and is a founding member of the European Foundation for Key Account

Management. He is also serving as member of the board of NAA, Germany's oldest service provider specializing in training and coaching in marketing and sales.

Asghar Afshar Jahanshahi received his B.A. and M.A. Degrees in Public Administration from the University of Sistan and Baluchestan, Iran, in 2003 and 2006, respectively. He was among the top ten students accepted to the Master's entrance exam. While studying for his Master Degree he used to teach at university as an instructor of three courses related to business, for example, Management Information Systems, Human Resource Management, and International Marketing. He was accepted as a Ph.D. Scholar at Pune University on January 2009. He has done research for three years on Electronic Commerce. Presently, he works as Postdoctoral Fellow at the Pontificia Universidad Católica de Chile (Catholic University of Chile).

Audhesh Paswan (Ph.D., University of Mississippi) is Professor of Marketing, University of North Texas. His research interests include Services Marketing, Innovation and NPD, Marketing Channels, Franchising, Retailing, Macro-Marketing, Brand Management, Cross-Cultural and International Marketing, and Knowledge Management. He has published over 60 articles in peer reviewed journals such as the *Journal of Marketing, Decision Sciences Journal, Journal of Retailing, Journal of Public Policy and Marketing, European Journal of Marketing, Journal of Business Research, Journal of Macro-Marketing, Journal of Brand Management, Journal of Product and Brand Management,* and *Journal of Services Marketing*. He can be reached at P.O. Box 311396, University of North Texas, Denton, TX, 76203-1396, USA; Tel: 001-940-565-3121; Fax: 001-940-565-3837; Email: paswana@unt.edu.

Daria Podmetina, D.Sc. (Tech), is a Post-Doctoral Researcher and Project Manager at Lappeenranta University of Technology, Finland. Her main research focus is on Innovation Strategies of Companies from Transition and Post-Transition Economies, mainly Russia, Cross-Border Cooperation and Inward-Outward Internationalisation. The other research interests are improving Competitive Advantage, Developing Innovation Capabilities, Open Innovation, R&D Internationalisation, and Cooperation on Innovation. She has publications in *International Journal of Innovation Management, International Journal of Technology Marketing, Journal of East – West Business, Multinational Business Review, International Journal of Business Excellence, International Journal of Business Innovation and Research, International Journal of Entrepreneurship and Innovation Management* and others.

Vanessa Ratten is an Associate Professor of Entrepreneurship and Innovation at the Department of Management, La Trobe Business School at La Trobe University, Melbourne, Australia. She teaches Entrepreneurial Business Planning, Managing Innovation in Organisations and Entrepreneurship. Dr. Ratten has previously been on the Business Faculty of Duquesne University, the University of Queensland,

Queensland University of Technology and Deakin University. She has won a Vice Chancellors Award for community engagement with innovation and entrepreneurship programs. Dr. Ratten's main research areas are Entrepreneurship, Innovation and Sport.

Vera A. Rebiazina is an Associate Professor at Strategic Marketing Department, National Research University Higher School of Economics. Her research interests include Marketing, Marketing Strategies in Emerging Markets, Innovation Marketing and Relationship Marketing. Teaching is mainly devoted to the field of B2B Marketing, Relationship Marketing and Methodology of Marketing Research, including Quantitative Methods. She has publications in Russian and international peer reviewed journals. Vera Rebiazina is a member of European Institute for Advanced Studies in Management, American Marketing Association and European Marketing Academy. She has managerial experience through realization of successful consulting projects for leading companies such as NOKIA, L'OREAL, MTS and AC NIELSEN.

Susan E. Reid, Professor of Marketing, Williams School of Business, Bishop's University, has research interests including Technology and Market Vision, Front-End Strategy for New Products and Services, New Product Development with Emergent Technologies, Networks, the Modelling of Decision-Making involved in High-Tech Businesses, and Marketing History. She has published in refereed journals including: *Journal of Product Innovation Management*, *Industrial Marketing Management*, *Technological Forecasting and Social Change*, *R&D Management*, *World Development*, *Business History*, *International Journal of Technology Marketing*, *International Journal of Technology Management* and *International Journal of Biotechnology*. She is associated to the Canada Research Chair on the Management of Technology and has over 25 years of experience working and consulting for the biopharmaceutical, nanotechnology and aviation sectors.

Maria Smirnova is an Associate Professor, Head of Marketing Department, Graduate School of Management, Saint Petersburg State University. Her research interests include Industrial Marketing, Interfirm Relationships and Networks, Marketing Capabilities, International Marketing and Quantitative Research Methods in Marketing. Her research has been published in journals such as *Journal of Purchasing and Supply Management, Industrial Marketing Management, Journal of Innovation Management, Journal of Marketing Theory and Practice, Marketing Intelligence and Planning*, etc.. Since 2011 she is Editor of Newsletter of European Marketing Academy (EMAC).

Dr. Alessandra Vecchi is a Senior Research Fellow at London College of Fashion. She was formerly based in the School of Business and in the Institute for International Integration Studies (IIIS) at Trinity College in Dublin in Ireland. She has also been nominated Assistant Professor in the Department of Management at the University of Bologna in Italy where she holds a Marie Curie Fellowship. Besides

teaching several subjects mostly in the field of International Business and Operations Management at postgraduate level, she supervises M.A. and Ph.D. students in a wide array of Fashion Management related subjects.

Chander Velu is a Member of the Faculty at the Institute for Manufacturing (IfM) at the Department of Engineering, University of Cambridge, UK. Prior to joining the IfM, he was a Member of the Faculty at Judge Business School, University of Cambridge. He has worked as a consultant with PricewaterhouseCoopers and Booz Allen and Hamilton in London. He is a Fellow of the Institute of Chartered Accountants in England and Wales. His research work focuses on Marketing Strategy and Innovation with a particular interest in Business Model Innovation.

Daria Volchek, D.Sc. (Econ.), is a Postdoctoral Researcher at Aalto University School of Business, Department of Management studies. Her primary areas of research interest are in International Entrepreneurship, Growth Strategies of Small and Medium-Sized Enterprises, and Immigrant Entrepreneurship. She has published in the *Journal of International Entrepreneurship, Journal of East–West Business, International Journal of Innovation Management, and Journal of International Business and Entrepreneurship Development*.

Prof. M. J. Xavier obtained his Doctorate in Management (1984) from the Indian Institute of Management, Calcutta in the year 1984. His areas of interest include E-Learning, Marketing Analytics, Neuromarketing and Spirituality. He has authored three books and published more than 100 articles in journals and magazines in India and abroad. He has served as Visiting Faculty Member to a number of business schools in India and abroad including The University of Buckingham, U.K. (1993), The Texas Christian University, U.S.A. (1999), California Polytechnic State University, USA (2003–2005) and The American University of Armenia, Armenia (2006). His book 'Marketing in the New Millennium' won the DMA-Escorts Award for the best Management Book of the Year 1999. He is the recipient of several awards including the AIMS' Outstanding B-School Director Award in 2013.

Stephen X. Zhang is an Assistant Professor of Management of Innovation and Entrepreneurship at Pontificia Universidad Católica de Chile (Catholic University of Chile). His research interest includes empirical analysis of Real Options in Innovation and Entrepreneurship; Open Innovation; Valuation of Technology; and Entrepreneurial Strategies. Stephen is also the Director of Innovation Certificate, which provides courses to 600 students per semester on topics related to Innovation and Entrepreneurship. Lastly, Stephen enjoys living in Chile both as one of the few expat professors in the top university and as an Asian venturing in South America. Webpage: www.ing.puc.cl/szhang

Mohammadali Zolfagharian (Ph.D., University of North Texas) is Associate Professor at the Chair of Marketing and Applied Anthropologist at the Department of Marketing, University of Texas–Pan American, Edinburg, Texas. His research interests include Consumer (Culture) Behavior, Services, and Social/Macro Marketing using both Quantitative and Qualitative (i.e., Ethnographic) Approaches. His research is published in several books and journals such as *Decision Sciences Journal*, *Journal of Services Marketing*, *Journal of Business and Industrial Marketing*, *Journal of Consumer Marketing*, and *Services Marketing Quarterly*. He has collaborated with or provided consulting to several organizations including Motorola, Hospice, The Entrepreneur Authority, and City of McAllen.