Contributions to Management Science

João Leitão

Open Innovation Business Modeling

Gamification and Design Thinking Applications

Springer

Contributions to Management Science

More information about this series at http://www.springer.com/series/1505

João Leitão

Open Innovation Business Modeling

Gamification and Design Thinking Applications

Springer

João Leitão
NECE, Research Center in Business Sciences
University of Beira Interior
Covilhã, Portugal

ISSN 1431-1941 ISSN 2197-716X (electronic)
Contributions to Management Science
ISBN 978-3-319-91281-3 ISBN 978-3-319-91282-0 (eBook)
https://doi.org/10.1007/978-3-319-91282-0

Library of Congress Control Number: 2018943301

© Springer International Publishing AG, part of Springer Nature 2019
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The subject of this book, that is, open innovation business modeling, using gaming and design thinking applications, is per se innovative in the sense that crosses several management science and other recent topics, by reconciling distinct streams of the emerging literature on open innovation, absorptive capacity, strategic coopetition, and design thinking, in the same volume. For that reason, it may be considered complex and challenging, inasmuch as it involves topics still being explored, which need additional contributions to progressively build up their theoretical body, grounded on conceptual and empirical applications, of both a qualitative and quantitative nature. It therefore requires a wide-ranging literature review and an openness to perspectives based on the paradigm of open innovation, which transfers to outside the organization some of the mechanisms for stimulating research and development (R&D) and innovation resources, but without neglecting the strategic importance of the organization's dynamic competences, based on continuous attention to resources, competencies, capacity for management, and organizational (re) configuration.

The firm's absorptive capacity triggers its propensity to be engaged in capturing and assimilating knowledge, spurred either by internal factors or by cooperation liaisons, thereby stimulating cooperation for innovativeness.

In this line of reasoning, this book revisits the theoretical framework on innovation and recovers Zahra and George's (2002) model of absorptive capacity and other related work, aiming to analyze a set of internal and liaison factors of the firm that affect firm-level absorptive capacity and entrepreneurial innovation capacity, in the context of open business models' implementation in a strategic coopetition framework; to propose a new business model approach entitled "open innovation bridge"—a Tangram model; and to exemplify the identification of critical elements of the transactional structure of open innovation business models, using both gaming and design thinking applications.

As the firm is an open system, it is important to analyze internal firm-level factors that spur absorptive capacity, as well as the factors concerning resources and liaison flows used to absorb and communicate with external sources of knowledge, within a

transactional structure *rationale* that needs further understanding in the context of open innovation business models. By mapping these factors, managers can design a more efficient open innovation business model in order to generate more innovation.

In operational terms, this book contributes to providing an analytical tool for designing the business model entitled "open innovation bridge"—a Tangram model, which considering the gaps previously identified in the growing literature on business models allows identification of the resources and transactional elements of open innovation business models, in the context of strategic coopetition.

It also provides an empirical application, following the Tangram model, and an analysis of firm-level resources and transactional elements is provided, by making use of a dataset of 571 service firms and 562 manufacturing firms which participated in the European Community Innovation Survey (CIS), 2010. The results of a logistic regression analysis reveal that the resources represented by acquisition of external knowledge and internal R&D activities, as well as the transactional elements, namely, cooperative liaison relationships with consultants and universities, plus external R&D activities, have a positive influence on the entrepreneurial innovation capacity, although they denote different ranges according to the subsamples under analysis, outlining the advanced development stage of the open innovation business models of service firms.

Development of the proposed model and the subsequent test, besides revealing the applicability of the proposal, also provides axes of strategic action for managers and public policy decision-makers, as well as opening up avenues for future research.

The book also provides a new pedagogical tool for teaching and learning technological entrepreneurship using business modeling. For accomplishing this, an innovative syllabus is proposed, as well as new tools for inspiring, analyzing, ideating, prototyping, and testing entrepreneurial opportunities connected to forms of qualified entrepreneurship, integrating the previously referred analytical tool "the Tangram model" and other established tools for gaming and designing open innovation business models.

Covilhã, Portugal João Leitão

Book Plan and Objectives

Given the complexity of the topic, which seeks to converge four themes to be reconciled in the scope of the management science field, the book plan is structured as follows.

In Part I, aiming to define the theoretical framework governing this book and justify the design of the proposed model, a literature review is carried out to present the state of the art anchored on four main aspects, namely, (i) innovation, (ii) absorptive capacity in open innovation, (iii) coopetition links in open innovation, and (iv) open innovation business model.

The first of these explores different conceptualizations of innovation, sources, and ecosystems, identifying seven phases in the vast research literature on innovation management and allowing better understanding of the evolutionary path from the seminal work of Schumpeter (1911, 1942) to the contemporary framework of theoretical formalization and research, instigated by Chesbrough (2003), which deals with the theme of open innovation in multiple research dimensions, including that referring to business models. There is a brief presentation of the conceptualizations considered of reference for carrying out this study, bearing in mind the framework drawn up by Chesbrough (2003), Enkel et al. (2009), and Grimaldi et al. (2016), showing the importance of organizations finding appropriate mechanisms to identify external sources of knowledge and potentiating the elements to activate their absorptive capacity, which will tend to strengthen their capacity to create innovation.

In relation to the second aspect, referring to the contribution of Zahra and George (2002), the subject of absorptive capacity is revisited in an original way, in the context of open innovation, distinguishing between "potential" and "fulfilled" absorptive capacity, and underlining the importance of identifying those activating and stimulating elements, in terms of the organization's internal factors and the so-called liaison factors, brought about through establishing cooperative relationships with external stakeholders.

The third aspect introduces a topic connected to the core of the book, but at the same time a challenging one, inasmuch as the interlinking of strategic coopetition

and open innovation remains to be achieved in the literature of reference despite the growing number of systematic literature reviews and empirical applications on both topics separately.

In the fourth aspect, the emphasis is on a priority mechanism for operationalizing an organization's strategy, i.e., the business model, which as defined by Foss and Saebi (2016) quoting Teece (2010; p.172) is "the design or architecture of the processes for creating and delivering value, including the mechanisms for capturing value." A brief review of the main business model conceptualizations is made, as well as of the most consensual dimensions of business models in the literature, i.e., content, structure, and governance. This serves to justify the focus of this book on exploring the transactional structure of business models. Also presented in this regard is a necessary distinction in order to clarify the concept of business model innovation, which considering the review carried out can be achieved through contingency approaches to business model innovation and through deeper knowledge of the elements of the model's transactional structure referred to above.

In this theoretical and investigation context, the research suggestion proposed by George and Bock (2011) is taken up again, pointing to the need to map the critical elements of the transactional structure identified in the analysis of business models, from an unexplored perspective of open innovation business models. Also from a perspective of reinforcing firms' absorptive capacity, these must have a dynamic vision of the open innovation business model to be implemented through a series of links that allow absorbing external sources of knowledge, as well as deepening knowledge about the critical elements of their transactional structure.

Therefore, considering the literature and previous research efforts on innovation management, this book aims to identify, explain, and draw up the transactional structure of open innovation business models, using internal and liaison factors as well as absorptive capacity and coopetition relationships, to strengthen the firm's capacity to create innovation.

Accordingly, after the literature review, a conceptual model is proposed, entitled "open innovation bridge"—a Tangram model, which aims, firstly, to provide a creative and innovative approach applicable to open innovation business models in the context of strategic coopetition and, secondly, to provide an operational instrument for identifying the resources and transactional elements of the open innovation business model, which will strengthen firms' capacity for innovation.

Part II develops an empirical application of open innovation business models, containing an analysis supported by a study applied to industrial and service firms that participated in CIS 2010—*Community Innovation Survey*, which aims to test the Tangram model proposed, identify the critical elements of the transactional structure of open innovation business models, and provide strategic axes for action for managers and public policy decision-makers, as well as avenues for future research on the emerging topic of open innovation business modeling.

Part III aims to provide a pedagogical tool, that is, a syllabus for technological entrepreneurship designing, which facilitates the organization of a course that crosses gamification and design thinking and helps all the entrepreneurial teachers and students to think critically on the design, exploration, and exploitation of open

innovation business models. Moreover, it provides a new tool for rethinking and innovating traditional closed innovation business models and for designing and exploring new projects of qualified entrepreneurship sourced on inventions, new technologies, and new modes of technology transfer and commercialization.

Contents

List of Figures

List of Tables

Part I
State of the Art on Open Innovation Business Models

Chapter 1
Theoretical Framework and Proposed Model

1.1 Innovation: From the Concept to Ecosystems

Setting out from the concept of "creative destruction" proposed by Schumpeter (1942), firms that are not innovative are replaced by those that are. An innovative firm is one that takes advantage of opportunities available in the surrounding environment, mobilizing both physical infrastructure and forms of demand-pull through new business which is intensive in incorporating knowledge, created by existing firms. To take advantage of those opportunities, both new and established firms must make additional investment in innovation in order to create new sources of spillovers.

The change in firms' competitive model is achieved through increasing their capacity for innovation. According to Schumpeter (1942), innovation can be seen as a new process, product innovation, the use of new materials, a new combination of materials or organizational innovation. For that author, the innovative entrepreneur is the central economic agent who can launch new products on the market, through more efficient combinations of production factors or through practical application of some invention or technological innovation, or even the change in a production process.

The seminal work by Schumpeter (1942) initiated the path towards fruitful development of the so-called Theory of Innovation, whose focus has gradually shifted from a clear interest in the macroeconomic perspective of growth towards the microeconomic perspective, promoting a wide range of research activities dealing with innovation management, underlining the importance of developing the capacity for business innovation, firstly inside the firm, and as will be seen in the course of this book, more recently, anchored on the interests and strategies of stakeholders situated both inside and outside the firm.

Taking up the Schumpeterian vision that guides this approach, the prominent Austrian economist paid special attention to analyzing the impact of radical innovations carried out in the same period of time, which create the "creative destruction"

© Springer International Publishing AG, part of Springer Nature 2019

J. Leitão, *Open Innovation Business Modeling*, Contributions to Management Science, https://doi.org/10.1007/978-3-319-91282-0_1

process mentioned earlier, which emerges from continuous market choices and through replacement of obsolete processes and products.

This dynamic conceptualization was based on the previous work of Sombart (1928), which analyzed the destructive process that contributes to creating new waves of products and markets, as well as substituting earlier references.

The contribution of Schumpeter (1942) lies in his proposal for identification of the mechanisms that destroy obsolete sectors and traditional technology, when faced with the emergence of new industrial segments and new technology able to create monopolies, temporarily, and the so-called creative wave, at the heart of which innovation is the main agent of economic transformation, in structural terms.

The same author approaches the dynamics of the economy in four situations of a cyclical nature, which are: (i) initial balance, i.e., the routine which is constant regarding agents' behavior, over time; (ii) innovation, which breaks the routine and destroys those agents that are not able to accompany the innovating dynamics; (iii) renewed balance through creative destruction, which corresponds to a process of firm selection, favoring a return to a new balance; and (iv) economic evolution.

The Schumpeter Theories caused a break with Neoclassical Theories, inasmuch as the former author positioned innovation as an endogenous process of firms' economic routine, valuing the pro-monopoly approach, which guides the firm in seeking technological and technical progress. Schumpeter (1942) proposes that innovation is stimulated according to market structure and research and development (R&D) activities, originating in the R&D activities carried out in large firms, which contrasts with the view of Neoclassical Theories that pointed towards technology and innovation acting as factors outside the firm and the economy itself, attributing a secondary role to the firm as a passive user of inventions created in the surrounding environment.

Also according to Schumpeter (1942), innovation is pushed and guided by discoveries based on scientific knowledge, i.e., what is known as technology push or science and technology push. In this situation, innovation derives from inventions and not from the market, as would happen in the market pull or demand pull scenario, where the demand acts as an activator or determinant (Nelson 1959).

For Schmookler (1966), technological progress is oriented by various economic and social factors. Therefore, market opportunities are the most important determinant factors for technological progress.

In the 1970s, the tendency is characterized by a break with the more traditionalist perspective, a new theory emerging which would allow optimization of the combination of scientific and technological opportunities and economic needs originating in the market and society (Freeman 1979).

In this context, innovation is held to be an evolutionary process resulting from the production of new knowledge. The interactions between the different actors and the subsequent spread of knowledge can act, together, as a lever for development and economic growth (Nelson and Winter 1982; Pavitt 1984; Kline and Rosenberg 1986; Lundvall 1992).

According to Kaufmann and Tödtling (2001), those interactions are one of the most important characteristics of the innovation process and concern forms of

internal collaboration between the firm's different departments (namely, R&D and innovation, production, marketing, logistics, distribution, etc.). In turn, external cooperation is established with other firms and R&D institutions, such as universities, laboratories, university technology transfer services, consultants, financial institutions, teaching and training institutions and public administration, etc.

Therefore, the innovation process is increasingly seen as an interactive learning process, which becomes possible through joining and integrating the interests of various social and economic agents who have different forms of access to different types of knowledge and information.

Regarding the capacity for business innovation, in terms of product innovation, two different types of innovation can be recognized, namely, "new to the firm" and "new to the market".

The former type involves modifications and improvements to the firm's existing products, as well as the firm's new products, which improve or replace existing ones (Kaufmann and Tödtling 2001). This product innovation involves new product varieties, small improvements in design, technical alterations to one or more products and the introduction of new products. This is usually called incremental innovation, originating in small alterations of a technical nature and resulting from changes made according to the global knowledge available. In microeconomic terms, this type of innovation implies a non-drastic reduction in the marginal cost per unit produced.

The second type covers new products for the firm and for the market (Kaufmann and Tödtling 2001), equipped with new ranges of qualities, services or functions in the context of a particular market, which leads to a situation of temporary monopoly, in that there are no direct competitors for the new supply. This type of innovation requires more than incremental investment and tends to push innovative advancements. In turn, in microeconomic terms, this type of innovation implies a drastic reduction in the marginal cost per unit produced.

Dosi (1988) characterizes innovation as being a process of research, discovery, experimentation, development, imitation and adaptation of new products, processes or new organizational techniques. This author suggests two new categories of analysis, i.e., technological paths and paradigms based on the scientific paradigms originally proposed by Kuhn (1961).

According to Tigre (1998, 2005), technical progress plays an important role as a key variable in the change processes of firms, markets and economies, underlining the importance of all the dimensions that involve learning in this context, including formal processes and the training of human capital. Here too, cooperation and knowledge networks are crucial in stimulating learning capacity, individually, but also socially, above all in environments characterized by great uncertainty.

Cassiolato and Lastres (2005) and Tigre (2005) argue that the changes occurring in firms regarding technical progress create new routines and procedures in the firms themselves and in the economy, contributing to new avenues of technological exploration and economic growth. The generation of innovations depends on scientific development, in terms of both fundamental research and applied research.

The same occurs with the relatively recent understanding that entrepreneurship is a driving force of endogenous growth in modern societies, acting as a stimulant of job creation, new firm creation, competitiveness and innovation, with governments being under pressure to accept its determinant importance through the development of public policies to strengthen entrepreneurship and firms' innovative capacity (Monitor Group 2009; Silva and Leitão 2009; Leitão and Baptista 2009; Leitão and Baptista 2011; Nambisan and Baron 2013; Baptista and Leitão 2015; Devezas et al. 2017).

In the same line of thought, Stokes (2005) argues that innovation and knowledge are essential to attain economic growth and international competitiveness.

According to Silva and Leitão (2009), innovation is not something intermittent that happens by chance, nor is it something resulting from the action of a single agent. In truth, innovation is the result of an interactive process between the firm and the surrounding environment[1].

For Qingrui et al. (2007), regarding the main lines of research on innovation management, five phases can be identified. They also add a sixth phase, introduced by Chesbrough (2003), which will be subject to explanation here later on, as well as a more recent seventh phase that integrates a holistic view based on the symbiosis of entrepreneurial, innovative and sustainable ecosystems.

In the first phase: Entrepreneur/Innovator; which occurred during the 1940s and 1950s, the focus of research was on firms' innovation at the micro-economic level. Research was based fundamentally on Schumpeter's Theory of Innovation, where the entrepreneur is considered to be a driving force of innovation. The main research topics were the material process of innovation, the critical success factors affecting innovation and the driving forces of innovation (Myers and Marquis 1969; Rothwell and Zegveld 1981; Freeman 1995).

At this point, the basic questions of innovation were not yet stabilized and research efforts showed a focus on separate components. Therefore, this first phase had the main characteristic of following a research philosophy centered on individual management of innovation.

In the second phase: R&D Activities; which occurred in the course of the 1960s and 1970s, academic studies became more specialized in the different fields of innovation, namely, the sources of innovation inside organizations, ways to achieve innovation and ways to promote innovation in organizations through management of R&D activities. In this phase, researchers studied, fundamentally, R&D departments and their activities.

Abernathy and Utterback (1975) were responsible for one of the greatest contributions in this phase, which became known as the "U-A" pattern, and which divided the evolutionary pattern of product innovation, process innovation and industrial

[1]According to Kline and Rosenberg (1986), innovation is not gradual, linear or even well behaved. For these authors, bi-directional flows occur. On one hand, the supply of innovation promotes the development of science, and on the other, the demand for innovation forces the creation of science. It is of note that on various occasions, technical progress does not derive from science but rather from certain needs identified in the market.

organization in three phases: the fluid phase; the transition phase; and the specific phase; these three phases being linked to the product's life cycle.

In the third phase: Users; which also began during the1970s, research focused on users' role in determining innovation and the innovation process, attempting to address the following question: how can firms employ users as a source of innovation? Von Hippel (1988), one of the most prominent researchers in this third phase, presented the concept of the "user as innovator" and the lead user. By considering, users as sources of innovation, this concept gained growing importance and interested in this has re-emerged today connected to the subject of co-creation (Rayna and Striukova 2015).

In the same line of analysis, Shapiro (2001) proposes that firms should invite users to participate in R&D processes, in the form of co-innovation partnerships. Shapiro (2001) also developed the lead user method and methods to identify sources of innovation in "betrayed" users and potential users.

The fourth phase: Systems; appearing in the course of the 1980s, emerged from the growing need for organizations to set more ambitious goals regarding the effectiveness of innovation, in order to respond better to all situations arising from change, which contributed to revealing certain limitations of the more traditional theoretical approach to innovation.

In this phase, the contributions of Xu et al. (1997) and Xu and Chen (2001) stand out, being based on Systems Theory and marking the change of focus from the individual parts of innovation systems to renewed emphasis on the Systems of Organizations, through development of Innovation Portfolio Theory, which involves five forms of portfolio, namely: (i) coordination of product innovation and process innovation; (ii) coordination of radical innovation and incremental innovation; (iii) coordination of the benefits of implicit innovation and explicit innovation; (iv) coordination of technological innovation and the organizational culture of innovation; and (v) coordination of independent internal innovation and cooperative external innovation.

During this phase, Innovation Theory evolved in two branches, in the form of Integrated Innovation Theory and Systematic Innovation Theory (Iansiti 1998; Jiang and Chen 2000; Tidd et al. 2001). The former involves the creative integration of existing innovative elements, following a systematic approach. For example, Janszen (2000) considers firm innovation as a complex self-adaptable system. The latter, referring to theories based on the innovation system, focuses primarily on the organizations and institutions that participate in the process of generating technological innovation (Coriat and Weinstein 2002).

In the fifth phase: Ecosystems; occurring in the 1990s and early 2000s, researchers concentrate their efforts more on developing Innovation Theory, through an ecosystem approach (Isenberg 2010; van der Borgh et al. 2012; Leitão et al. 2018), focusing on so-called Total Innovation Management (i.e., innovation carried out at any time, in all processes, in different functions and in global terms).

For Bell and Pavitt (1993), the origin of innovative processes involves various factors and depends on the characteristics of the product and the market. This thesis uses the typology proposed originally by Pavitt (1984), according to which industrial

sectors can be classified in terms of their technological and innovative patterns, namely: dominated by suppliers; scale-intensive; specialized suppliers; and science-based.

According to Shapiro (2001), each firm should be a hundred per cent innovative, to be more able to face up to competitors and respond to customers' needs.

Also for Bean and Radford (2001), innovation should be approached as a business and should occur in any aspect or dimension that involves the organization and interested parties.

According to this perspective still being developed, any employee or stakeholder (internal or internal) can act as an innovator, making effective use of their creativity (Shapiro 2001; Wheatley 2001; Tucker 2002).

The sixth phase: Coopetitive Symbiosis; introduced by Chesbrough (2003), recommends a boundary which serves as a theoretical pillar for this book, i.e., the change from a paradigm of closed innovation to a new paradigm of open innovation and coopetitive symbiosis. The author underlines that in the closed innovation model, knowledge is generated inside the firm, with some projects being selected for development and others being abandoned. Subsequently, some of those projects will effectively be launched on the market. Since those projects can only enter and exit in one way, this process is labelled a closed system. The author presents the model of *AT&T Bell Laboratories* (Texas) as an example of this type of closed system. In opposition, he formulates a proposed model of open innovation, in which ideas emerge from internal or external sources, and technology can enter the innovation process in different phases and projects, which can flow to the market in multiple ways (namely, outward licensing, spin-off creation or marketing and sales channels). The author presents IBM, Intel and Procter & Gamble as examples of open innovation systems that follow this type of innovation process organization. He adds that intellectual property is necessarily treated differently in the case of a model of open or closed innovation. It is of note that on one hand, in the closed system, firms accumulate intellectual property assets aiming to ensure exclusive rights to exploit those assets and avoid litigation costs. On the other hand, in the open system, firms should consider strategic alternatives for project development, in the form of an industrial consortium, rights of intellectual co-ownership and typologies of inward or outward licensing.

According to Wright and Dana (2003), the alternative strategies faced by small business units have shown substantial changes, and for that reason, restrictions of a geographical and spatial nature ceased to be insurmountable barriers. According to the same authors, this is due to the emergence of a new paradigm of open innovation and coopetitive symbiosis, characterized by reduced transaction costs and a growing complexity of innovation management which push both large and small business units toward implementation of multifaceted strategies, so as to deal better with different scenarios, namely: (i) symbiotic management with an ally in the same network; (ii) competition with a rival in a different network; and (iii) negotiation with a different network, and perhaps becoming part of it.

In a scenario of multipolar competition of the global economy and coupling the views of Wright and Dana (2003) and Dana et al. (2008), it should be underlined that

both entrepreneurs/innovators (in the Schumpeterian sense) and business units should (re)consider their competitive strategies, namely, those of open innovation and coopetition, so as to ensure successful performance in global markets, as this is the fundamental way to reach world-class efficiency through symbiotic networks of stakeholders inside and outside the organization.

In the context of open innovation, most intellectual property assets that are not found to be profitable or even suitable for commercial exploitation purposes are considered an integral part of the so-called critical elements of innovation, in that they are part of the category of assets that can generate additional profits for the current business model, or even create new business models, and in this way stimulate entry to new markets, exploiting, exploiting liaison relationships (West and Bogers 2014).

The spillover effects arising from internal and external relationships formed by firms cannot be considered a cost of organizing business activities, but rather as an opportunity to expand both the size of the business and the market itself (Dahlander et al. 2016).

In an open innovation process, external channels through which technology can be introduced in the firm, namely those assured by universities, international and national laboratories, university and business spin-offs, start-ups, consultants, specialized firms, inventors, retired specialists and Ph.D. students, are considered critical elements in defining the transactional structure of open innovation business models, oriented toward firm and market development (George and Bock 2011).

From the perspective of Nooteboom et al. (1999), in the context of open innovation systems, the important role played by intermediaries is underlined in strengthening cooperative relationships and strategic alliances, aiming to link sources of technological innovation and firms.

Chesbrough et al. (2006) present the concept of open innovation as corresponding to the use of entry and exit knowledge flows, in order to reinforce internal innovation and develop markets for the external use of innovation. Therefore, firms can and must use external knowledge, as well as new internal and external paths for market exploitation, so as to assure the development of their own technology. This paradigm, as opposed to the closed innovation system, concerns a dynamic process that combines both internal and external ideas, using business models that allow (re) definition of the requirements for access to that system. The business models used assure the combination of internal and external knowledge, defining and implementing internal and external mechanisms to create value added.

Enkel et al. (2009), Cassiman and Valentini (2016) and Grimaldi et al. (2017) approach R&D activities as an open system, in that the latter includes knowledge that can produce value, originating in the firm's internal and external channels devoted to innovation.

For Chesbrough and Bogers (2014), open innovation allows identification and better understanding of the knowledge considered useful, for the purpose of creating value added, which can be transmitted through multiple channels, originating in the heart of the firm and on a multiple base of agents (ranging from the individual researcher/inventor to universities themselves and university and business spin-offs

and start-ups), which can function as partner R&D organizations focused on the innovation process, stimulating the mapping, connection and leverage of external sources of knowledge.

For Dahlander and Gann (2010), interaction between organizations is fundamental, since no organization can innovate in isolation and must connect with different partners in order to acquire ideas and resources from the surrounding environment, namely, new ways to access talent, new results from intellectual property, innovative technology to be licensed or spread, or even new forms of collaboration on different geographical bases.

More recently, the affirmation of a seventh phase has been foreseen, based on the holistic construct of: entrepreneurial, innovative and sustainable ecosystems; which are based on knowledge and cross the collective and eclectic dimensions of interrelated approaches to entrepreneurship, innovation and sustainability (van der Borgh et al. 2012; Nambisan and Baron 2013; Chesbrough et al. 2014; Leitão et al. 2018).

According to the vision of Isenberg (2010), an entrepreneurial ecosystem is formed of diverse elements that can be grouped in six domains: (1) a receptive culture (i.e., tolerant in relation to risks and mistakes and raising the social status of the entrepreneur); (2) facilitating policies and leadership (i.e., regulatory policies with incentives and supported by public R&D institutes); (3) access to sources of finance (i.e., business angels, risk capital, microcredit, crowdfunding, crowdsourcing and direct participation in capital); (4) relevant human capital (i.e., qualified and unqualified staff, mass-produced entrepreneurs, specialized training in entrepreneurship, coaching and mentoring programs); (5) markets favorable to innovative products (considering early users and relevant markets); and (6) a wide range of institutional and infrastructural support (such as juridical and management consultants, transport and telecommunication infrastructures, associations promoting entrepreneurship and innovation, etc.).

Chesbrough et al. (2014) suggest that the doors are therefore open to exploration of this holistic approach to ecosystems according to the paradigm of open innovation, highlighting the need to make additional research efforts in the area of entrepreneurship and innovation, aiming to deepen not only the strategic component of open innovation, but also the so far little explored operational component more linked to open innovation business models.

The synthesis of the seven phases identified above is presented in Table 1.1, highlighting that in the first three phases of Innovation Theory the aggregate focus is on individual processes and innovation activities, including the individual elements of the five forms of innovation identified by Schumpeter (1911), namely: (1) new products; (2) new production methods; (3) new sources of raw material; (4) exploiting new markets; and (5) new forms of firm organization.

In the next four phases, the aggregate focus is now analysis of innovation systems, following an evolutionist approach, which needs to be deepened in terms of mechanisms, processes, interactions and networks involving different actors whose interests may temporarily diverge or converge, but which can come to be absorbed in a reciprocal association that allows them to enjoy mutual benefits in a logic of coopetitive symbiosis, in order to assure evolution of the innovation system,

Table 1.1 Lines of research on innovation management

Aggregate focus	Phase: period	Description: (1) Research focus; (2) Research topics; and (3) Main characteristic	Studies of reference: examples
Individual processes and innovation activities	1st Phase: Entrepreneur/innovator 1940s and 1950s	1. Entrepreneur/innovator as a driving force of innovation	Schumpeter (1911, 1942) Myers and Marquis (1969)
		2. Critical success factors affecting innovation and the driving forces of innovation	
		3. Research philosophy centered on individual management of innovation	
	2nd Phase: R&D activities 1960s and 1970s	1. R&D departments and their activities, as sources of innovation	Abernathy and Utterback (1975)
		2. Sources of innovation inside organizations, ways to achieve innovation and forms of promoting innovation within organizations, through management of R&D activities	
		3. Internal promotion of innovation	
	3rd Phase: Users 1970s and 1980s	1. Users as sources of innovation	Von Hippel (1988)
		2. Active roles of users in innovation processes	
		3. Interactive promotion of internal R&D activities, resorting to investment and external sources, i.e., the users of innovation	
Innovation systems	4th Phase: Systems 1980s and 1990s; and early 2000s	1. Anticipating the change that requires innovation	Xu et al. (1997), Iansiti (1998), Jiang and Chen (2000), Tidd et al. (2001), Xu and Chen (2001)
		2. Organizations' systems; innovation portfolio and coordination mechanisms	
		3. Evolution from the focus on the individual parts of innovation systems to an approach that is more adaptable to change	
	5th Phase: Ecosystems 1990s; and first decades of the twenty-first century	1. Total innovation management carried out, globally, in all processes and functions	Bell and Pavitt (1993), Shapiro (2001), Wheatley (2001), Tucker (2002), Isenberg (2010), van der Borgh et al. (2012)
		2. Relationships with stakeholders; innovation approached as a business	

(continued)

Table 1.1 (continued)

Aggregate focus	Phase: period	Description: (1) Research focus; (2) Research topics; and (3) Main characteristic	Studies of reference: examples
		from a multidimensional perspective	
		3. Evolution to a more holistic approach to ecosystems	
	6th Phase: Coopetitive symbiosis First decades of the twenty-first century	1. Open innovation and coopetitive symbiosis	Chesbrough (2003), Wright and Dana (2003), Dana et al. (2008)
		2. Determinants of open innovation; innovation of business models	
		3. Evolution from the paradigm of closed innovation to an open approach based on the still unexplored concept of coopetitive symbiosis, covering mechanisms of coordination, collaboration and cooperation	
	7th Phase: Entrepreneurial, innovative and sustainable ecosystems First decades of the twenty-first century	1. Ecosystems	Isenberg (2010), van der Borgh et al. (2012), Nambisan and Baron (2013), Chesbrough et al. (2014)
		2. Structure and components of ecosystems; models of systemic management	
		3. Evolution from the paradigm of open innovation to a multifunctional approach to ecosystems of entrepreneurship and innovation.	

Source: Own elaboration

concerning multiple dimensions which cover the individual, the firm, the regional unit, national entities, supranational platforms, etc.

1.2 Absorptive Capacity in Open Innovation

1.2.1 Absorptive Capacity: Conceptualization

Authors such as Camisón and Forés (2010) and García-Morales et al. (2007, 2012) propose that absorptive capacity transforms firms into organizational units oriented toward innovation, by using their technological skills and being involved in a learning context, which contributes to increasing firms' likelihood of achieving a

more complex knowledge structure, being therefore less obvious and more difficult to follow, replicate or imitate.

Cohen and Levinthal (1989, 1990) used a behavioral lens to position the concept of absorptive capacity as an individual cognitive structure, to deal with the active search for solutions and processes of cumulative learning. Subsequently, the same concept was used in the context of groups and organizations with storage and application capacities, and with determinant effects on performance, through the association and connection of ideas able to raise new forms of knowledge.

In this way, a firm's process of seeking external sources of knowledge covers a range of activities aiming to deal with problems detected and opportunities identified, thereby involving the processes of creativity and recombination of technological ideas, in order to generate new knowledge and innovation.

Absorptive capacity corresponds to the firm's ability to recognize and exploit knowledge flows, which can be an effective source of competitive advantage. Consequently, absorptive capacity depends on the firm's activating factors, namely, the knowledge stock forming part of its processes, people and products, which are determined by cumulative learning and subsequent performance in a continuous learning process, depending on the level of knowledge presented by individuals (Cohen and Levinthal 1989, 1990). That knowledge stock in the firm activates certain connections, which allows improved assimilation of external knowledge flows and their use in order to create new organizational configurations and processes (King and Lakhani 2011).

Similarly to the definition of absorptive capacity proposed by Cohen and Levinthal (1989, 1990), together with the view of Omidvar (2013), the evolutionary learning process of any organization can also be categorized by an approach of the cognitive type, which allows identification of two types of absorptive capacity, i.e., real and potential. The former concerns the ability to identify, assimilate and apply new external knowledge, which is dependent on the previous knowledge stock, without considering the characteristics of the emitters and receivers of knowledge. The latter depends on the characteristics of those involved in this type of process. However, there is a gap in the literature on organizational management, which this book aims to fill, concerning improved understanding of the influence of the transactional structure of the organization's internal and external relationships, in general, and of open innovation business models in particular.

For Cohen et al. (2002), absorptive capacity corresponds to the ability to identify knowledge of value in the external environment, as well as the ability to assimilate and align that knowledge with the existing knowledge stock in the internal environment. The exploitation of internal R&D activities should also be included in that same capacity, as this contributes to activating the firm regarding the extraction of knowledge that can be of value (Cohen and Levinthal 1989; Arora and Gambardella 1994; Cassiman and Veugelers 2006; Noblet et al. 2011; Sánchez-Sellero et al. 2014).

In the perspective of Kim (2001), knowledge creation depends on the firm's absorptive capacity, and so the firm must possess the necessary learning capacity to strengthen skills related to problem-solving capacity. Therefore, firms must be able

to assimilate existing knowledge (used for imitation purposes) and develop problem-solving skills, internally, to assure the firm is in a position to create new knowledge (used for innovation purposes). This author analyzed the success of the *Samsung Corporation*, as the world's largest producer of memory chips, which became possible through continuous use of its absorptive capacity to convert both external and internal knowledge in innovation. *Samsung* concentrated on acquiring previous explicit knowledge through literature reviews that identified and defined the state-of-the-art, as well as through practices of technological surveillance and licensing within external technologies. In addition, the firm resorted to hiring staff with professional experience obtained in other companies (direct competitors or otherwise), as a way to "import" technology. The mechanisms used by *Samsung* in South Korea are only possible due to the great effort to develop human resources and their skills, in the strategic area of science and engineering. Added to the facts described above is the Korean culture, atmosphere and historical heritage, which favor the creation of an environment where human resources are very dedicated to work, have long working hours and are motivated to exceed Japanese firms, due to the long period of Japanese occupation.

Zahra and George (2002) consider absorptive capacity as a dynamic capacity, creating a model of components, antecedents, contingencies and results of absorptive capacity. The authors' model was innovative in that the component of value recognition was replaced by an acquisition component, thereby re-allocating the influence of appropriability regimes.

The same authors went on to expand the model, by incorporating the concept of transformation, to substitute the assimilation component. In doing so they came to consider both the mechanisms of activation and the mechanisms of social integration, revisiting absorptive capacity, which came to be divided in "potential" and "fulfilled" absorptive capacity. The former is related to acquisition and assimilation of new external knowledge, through reconfiguration of the resource database and implantation of capacities. In turn, the latter deals with the transformation and exploitation of new forms of external knowledge toward the development of new products and processes. "Potential" absorptive capacity without its actual fulfilment does not produce an effect on the firm's competitive advantage. The transformation process gives firms the capacity to make changes in existing processes, activating them in order to absorb new knowledge through their own means of interpretation and understanding, within the organization's existing cognitive structures.

Social integration mechanisms help to lower the barriers between assimilation and transformation, contributing to increased absorptive capacity, which is understood in the new model referred to above as a dynamic capacity involving a set of organizational routines (for example, social interactions) and processes. The cognitive ability to learn and absorb depends on a firm's capacity to value external knowledge (Zahra and George 2002). Moreover, firms cannot transform their knowledge assets when they are unable to assimilate external knowledge (Todorova and Durisin 2007), which means it is necessary to make additional research efforts concerning the mechanisms for activating absorptive capacity.

Zahra and Hayton (2008) suggest that absorptive capacity has a significant influence on the firm's ability to learn successfully in external markets and attain higher performance internationally.

More recently, Enkel et al. (2016) formalized the concept of absorptive capacity, taking the individual as the unit of analysis, concluding that the absorption or exploitation of new technology depends on the individual's capacity to learn from external sources of knowledge.

Other authors, such as Arora and Gambardella (1994) and Zahra and George (2002), analyzed the role of absorptive capacity in determining the ability to exploit alliances. In this context, the stock of external knowledge, as well as physical and human capital, increases the likelihood of greater absorptive capacity and successful exploitation of coopetition relationships.

Leonard-Barton (1992) and Baptista et al. (2007) underline, in an original way, that top management support is also critical for firms to be able to activate their technological competences and thereby strengthen their knowledge stock, by stimulating their absorptive capacity and strengths.

Therefore, absorptive capacity also enables firm employees to be more oriented towards innovation, since they are encouraged to use their technological skills (García-Morales et al. 2007) and to be more involved in learning processes that will allow the firm to achieve a complex knowledge structure that is difficult to replicate (Camisón and Forés 2010; García-Morales et al. 2012).

Sánchez-Sellero et al. (2014) emphasize the importance of foreign direct investment as an effective mechanism for transferring knowledge able to influence positively receiving firms' absorptive capacity and innovation.

Martín-de Castro (2015) positions absorptive capacity as a dynamic capacity covering the following set of dimensions: (i) identification and acquisition of external knowledge; (ii) assimilation of external information and knowledge; (iii) transformation, which combines the firm's knowledge base with the external knowledge acquired more recently; and (iv) exploitation that uses the new knowledge and learning for organizational and innovation purposes.

Here, an additional window of opportunity is identified, which this book aims to respond to, i.e., analysis of the role of transactional structures in transforming and exploiting the firm's absorptive capacity, especially through relationships formed with external stakeholders, in a context of open innovation.

Corporate strategies that consider and include elements of the transactional structure, through seeking out external sources of knowledge, namely, clients, suppliers, competitors or universities, have a positive and significant effect on firms' innovation capacity (Katila 2002; Katila and Ahuja 2002; Laursen and Salter 2006; George and Bock 2011; Pereira and Leitão 2016; Sikimic et al. 2016; Enkel et al. 2016). This type of strategy aims to strengthen a given organization's problem-solving capacity, involving the creation of innovations and recombination of technological ideas.

1.2.2 Absorption in Open Innovation and Coopetition

According to the literature, absorptive capacity improves the results of innovation, in terms of speed, quality and frequency, which emphasizes the organizational learning associated with the internal innovation effort and stimulates absorptive capacity (Lane et al. 2006; Volberda et al. 2010; Noblet et al. 2011; Sánchez-Sellero et al. 2014). However, this type of strategy depends on the firm's capacity to detect and assimilate external sources, i.e., its own absorptive capacity (Cohen and Levinthal 1990).

In this context, understanding and mastery of the mechanisms of open innovation are of critical importance, since this type of innovation originates precisely in the detection and assimilation of ideas that appear, at different stages, from internal and external sources (Chesbrough 2003).

Combined management of entering or exiting knowledge flows contributes to reinforcing internal innovation and to developing markets with a view to external use of innovation based on new activities, such as outward licensing activities; acquisition of external knowledge; industrial or R&D consortia; cooperative agreements; spin-off creation; marketing; co-branding; sales; distribution; co-creation, etc. (Chesbrough et al. 2006; Salter et al. 2014; Rayna and Striukova 2015; Sikimic et al. 2016).

Returning to the vision of Rothaermel and Alexandre (2009), the greater a firm's absorptive capacity, the greater its skill in capturing all the benefits of the flexibility associated with forms of technology sourcing. In this way, added absorptive capacity contributes to activating innovation and increasing the rate of involvement in coopetition activities (Ritala and Hurmelinna-Laukkanen 2009; Rodrigues et al. 2011).

Following the same line of reasoning, the possibility of benefiting from knowledge spillovers through the firm's absorptive capacity contributes to strengthening the firm's internal innovation and developing its relevant markets (Chesbrough et al. 2006), considering coopetition as a kind of inward knowledge flow.

Coopetition can be defined by the set of inter-organizational relations that are based on the combination of transactional relations of cooperation and competition (Bengtsson and Kock 2000; Bouncken et al. 2015; Pereira and Leitão 2016; Sikimic et al. 2016).

Therefore, in coopetitive regimes, firms must be able to manage strategically the following competitive dimensions: what; with whom; when; and on what conditions to share their critical success factors (Levy et al. 2003).

In this context, absorptive capacity is of determinant importance, concerning the influence of managing transactional relations in coopetition (Hakanen 2014).

Referring to firms' international competitive dimension, Zahra and Hayton (2008), Rodrigues et al. (2011) and Sánchez-Sellero et al. (2014) suggest that absorptive capacity has a positive and significant effect on firms' ability to learn successfully and improve their performance.

Consequently, the capacity for business innovation depends on the existence of a strong absorptive capacity in the firm to ensure access to external sources of knowledge and create new communication channels with external stakeholders (Corso et al. 2003; García-Morales et al. 2015; Lucena and Roper 2016).

Wu and Voss (2015) emphasize that firms with a strong absorptive capacity are more likely to assimilate and exploit new business ideas and knowledge. In addition, if firms have the same type of strategic behavior regarding both the domestic and international market, this will have a greater impact on their business as a whole and the level of performance achieved, in that such behavior will allow them benefits arising from the effects of novelty and learning about pioneering approaches, which at the end of the day give them the strategic advantage of being the first.

Martín-de Castro (2015) claims that firms need to develop their dynamic capacities in order to improve and complement their strategy of open innovation.

Therefore, firms that manage to increase their knowledge stock will be more likely to obtain additional benefits, from (internal and external) processes of integrating information and knowledge (from employees, clients, competitors, financing bodies, social media, etc.) in their knowledge base and in their capacity for business innovation (Escribano et al. 2009; Lin et al. 2012; Vrontis et al. 2016).

Consequently, it is necessary to know the typologies of business models, with special focus on open innovation models, which allow on one hand, activation of the firm's absorptive capacity, and on the other, establishing and managing, in a highly differentiated way, a transactional structure of coopetition relationships with internal and external stakeholders. These will allow, firstly, capitalization of the internal factors determining business innovation capacity, and secondly, extended access to external sources of knowledge and increased size of the firm's relevant markets.

1.3 Coopetition Linkages in Open Innovation

1.3.1 Coopetition: Definitions

Rusko (2011) defines coopetition as a composite of collaboration and competition between firms. For Luo et al. (2007), this concept was originally introduced in the 1980s by Raymond Noorda and became a topic of study embraced by various researchers in the following decade, highlighting here the subjects of dyadic coopetition (Bengtsson and Kock 2000, 2003) and multi-faceted coopetition (Amburgey and Rao 1996; Tsai 2002; Luo and Slotegraaf 2006).

Various authors define coopetition as a strategy to increase market power. For example, Brandenburger and Nalebuff (1996) and Garraffo (2002) analyzed the formation of strategic cooperation agreements by firms devoted to developing emerging technology. Firms began by cooperating, adding and sharing value, obtaining synergies and exploiting the markets. Then they started to compete in order to maximize their market shares.

According to Bagshaw and Bagshaw (2001), coopetition makes it possible for the firms involved to reach higher levels of performance, compared to those achieved in competitive arrangements, inasmuch as the former allows strategic management of cooperation and competition, which can control and reconcile partners and competitors' behavior to everybody winning in this new relationship, despite being able to obtain gains in different proportions (Rodrigues et al. 2011).

Chien and Peng (2005) propose that inter-organizational connections evolve to a social structure of coopetition, becoming an instrument for cooperation and also for coopetition, operating at multiple levels, namely firms, strategic business units, departments and work groups. That structure can also be used to develop a marketing strategy, contributing to cost reduction, increased competitiveness and attaining a leading position in the market.

Walley (2007) classified that same combination as a hybrid activity, through which firms cooperate and compete (Bengtsson and Kock 2000).

The conceptualization of coopetition evolved to become positioned as a strategic option for forming links of an inter-organizational nature, based on combining cooperation and competition (Bouncken et al. 2015).

1.3.2 Coopetition Linkages: Benefits and Risks

The main benefit arising from use of this strategic option lies in the creation of inter-organizational links leading to the launch of completely new products and radical innovations (Tether 2002; Quintana-Garcia and Benavides-Velasco 2004; Bouncken and Kraus 2013).

Ritala and Hurmelinna-Laukkanen (2009) claim that coopetition helps to develop incremental innovations in existing products or services, being an effective way to create new innovations, especially in highly technological industries and in a context of great uncertainty, contributing to positive network externalities and lessening the intensity of the competition.

Other researchers identify as benefits associated with involvement in coopetition arrangements: strengthening the capacity to generate innovation; increased value added; and productivity gains (Brandenburger and Nalebuff 1996; Dussauge et al. 2000; Tether 2002).

The literature also identifies as benefits of coopetition: synergy effects; sharing costs and risks; obtaining scale economies; and sharing activities (Luo et al. 2007; Chin et al. 2008; Gnyawali and Park 2009, 2011; Porter and Kramer 2011; Rodrigues et al. 2011).

Walley (2007) also underlines the importance of joining R&D activities and gaining access to external sources of knowledge and resources, which the firm can later apply in its routines (Bengtsson and Kock 2000).

As a result of coopetition, firms can strengthen their competitive advantage, through reinforcing the capacity for business innovation, which otherwise would

only be possible at advanced stages of their life-cycle, or even impossible (Afuah 2000; Levy et al. 2003; Ritala and Hurmelinna-Laukkanen 2009).

In addition to these benefits, Gnyawali and Park (2011) point out the effects of value creation and appropriation, in broader terms i.e., with spillovers to the relevant industry regarding technological development and the potential attraction of other competitors, leading to intensified competition and pressure to lower prices.

Despite the benefits of coopetition identified above, especially those occurring at the center of development of innovation activities, this strategic option is not risk-free, since it can encourage episodes of opportunism and leaks of secrets or knowledge.

Baumard (2009) argues that firms are simultaneously cooperative and competitive, which sometimes leads to sharing behavior and at others to holding on to secrets.

Therefore, the risks associated with conflicts originating in coopetition schemes are latent (Bonel and Rocco 2007; Pellegrin-Boucher et al. 2013); internal tensions within partner firms (for example, conflicts of protagonism or roles) (Dowling et al. 1996); and the need for firms to deal with the possible loss of freedom and flexibility (Baumard 2009).

In addition, the change in the firm's set of competences and capacities can have a negative effect on its competitive advantages and consequently on its performance (Afuah 2000).

Another risk widely mentioned in the literature concerns the possibility of opportunist behavior, which can emerge through coopetition linkages. Indeed, sharing knowledge and know-how can lead to some partners taking advantage of others (i.e. there are risks of appropriation), or even being less involved in or committed to fulfilling the aims of the strategic coopetition partnership (Levy et al. 2003; Baumard 2009; Bouncken and Kraus 2013; Pellegrin-Boucher et al. 2013).

As argued by Cassiman et al. (2009), those risks can endanger the attainment of radical innovations, as firms may have to seek a balance between sharing knowledge and protecting and safeguarding confidentiality.

In the coopetition context, it is critical to control knowledge flows during the joint development of R&D activities, inasmuch as exercising that strategic option involves risks, namely those associated with the accidental sharing of information, knowledge or competences.

In the case when partners are direct competitors, the risks of appropriation associated with a strategic alliance can be greater (Park and Russo 1996).

In this line of thought, strategic management determining what should be shared; with whom; when; and on what conditions; helps to minimize the likelihood of having to face scenarios of imitation and copying by competitors (Levy et al. 2003), as well as the possible occurrence of leaks of specific knowledge (Bengtsson and Kock 2000).

Chin et al. (2008) analyzed specific means for managing coopetition arrangements and identified a hierarchical model to deal with this type of strategic option, in order to avoid the risk of appropriation, through managing leadership, long-term

commitment, organizational learning, trust, knowledge and risk-sharing, the information system and the conflict management system.

For example, Gnyawali and Park (2011) point out that the global firms of Sony and Samsung manage coopetition through developing a mentality of pro-coopetition management, as well as complementary resources and capacities, and experience of coopetition between firms. Therefore, all these dimensions of management are of fundamental importance to ensure the success of coopetition arrangements. The same authors underline that the use of crossed licensing mechanisms is fundamental to set a balance between what to share and what should be held in reserve.

Hung and Chang (2012) explored the means used in coopetition arrangements, when the partner firm is a direct competitor or uses very similar technology, and concluded that it is more frequent to resort to contractual agreements than to establish joint-ventures.

Ritala and Hurmelinna-Laukkanen (2013) claim that a firm's skill in acquiring external knowledge, i.e., its absorptive capacity, and its capacity to protect its innovations, have a significant impact on the cooperating competitor's development of radical and incremental innovations.

Returning to the vision of Bengtsson and Raza-Ullah (2016), there is a need to approach the subject of coopetition from a multi-dimensional perspective, namely by exploring the motivations, direct axes, processes and results.

1.3.3 Motivations and Applications of Open Innovation

Rusko (2011) concludes that one of the main motivations for competitors becoming involved in coopetition linkages lies in the creation of greater value added or benefit, in order to improve economic performance.

In turn, Walley (2007) seconds the previous view, adding the associated benefits, from a dual perspective, for both competitors and customers.

In the view of Garraffo (2002), the decision to cooperate with competitors usually has the following motivations: (i) accessing or transferring new technology and complementary knowledge; (ii) entering new markets; and (iii) influencing, or even controlling, technological standards.

Therefore, understanding the motivations for coopetition between competitors is crucial for better assessment of their degree of commitment to technological development and the creation of new markets. Consequently, the decision to follow up coopetition projects focused on technological development or on reinforcing collaborative efforts towards market development depends above all on the purpose underlined by each partner in the coopetitive relationship.

In this line of thought, Jong and Marsili (2006) proposed a typology of coopetition arrangements, defined as follows: (i) transfer of patents and knowledge, characterized by limited commitment in terms of cooperative development of technology and effort to create new markets; (ii) collaborative R&D activities, characterized by high commitment in terms of cooperative technology developments and

very limited efforts regarding market development on a joint basis; (iii) strategic alliances to define new standards, characterized by high commitment in terms of collaborative efforts focused on generating new markets and reduced commitment concerning cooperative technological development; and (iv) collaborative agreements to integrate established firms, characterized by high commitment to cooperative technological development and major collaborative efforts to ensure access to markets.

According to the same authors, these four types of coopetitive arrangements determine the firm's capacity to compete in the market and implement a portfolio of coopetition activities, subject to evolution over time, according to the needs and opportunities identified in the market. When those arrangements involve firms that work with radical innovations, it is critical to define new standards or new converging technology, so that coopetition activities are carried out in articulation with market opportunities related to those radical innovations.

From a trade-off point of view, between costs and benefits, Padula and Dagnino (2007) summarize, in principle, the two dominant paradigms. On the one hand, the cooperative paradigm, which underestimates the costs arising from the negative interdependences of cooperation, and on the other, the competitive paradigm, which underestimates the power of the benefits originating through the positive interdependences of cooperation. Briefly, following now a rationale of negotiation, coopetition activities involve the sharing of mutual interests, which will imply obtaining bonuses in original zero-outcome games, in a game scenario of the win–win type.

Bengtsson and Kock (2003) define coopetition as a dyadic relationship, in that cooperation is related to activities directly linked to inputs, for example, R&D, purchases, logistics and processing of new materials. In turn, competition is more linked to activities directly related to process outcomes, such as distribution, services, product development and marketing. Between inputs and outputs, in terms of processes, are the so-called intermediate activities such as production and transformation.

Still concerning the dyadic approach, Luo (2004) introduced four fundamental strategic domains of coopetition, which are also dyadic, and may even involve other agents such as the government and public sector. Those domains are: (i) coopetition with global rivals; (ii) coopetition with foreign governments; (iii) coopetition with strategic partners; and (iv) coopetition within a multinational.

From the author's perspective, coopetition with the government should be treated simply as coopetition, inasmuch as this corresponds to situations where two or more competing firms can collaborate, strategically, in the context of public procurement actions or in response to different actions undertaken by the government to promote this type of strategic relationship.

Different approaches to coopetition use the vision based on resources and games theory to demonstrate that coopetitive arrangements can create more innovative activities than simple collaboration between non-competing entities.

For Brandenburger and Nalebuff (1996), Dussauge et al. (2000) and Tether (2002), competitors can engage in a collaborative game, through exchanging

resources, which in turn can generate value added for the participants. Several authors emphasize that the main benefit derived from collaboration between competitors lies in the creation of completely new products (Tether 2002; Quintana-Garcia and Benavides-Velasco 2004).

Belderbos et al. (2004) argue that cooperative R&D activities between competitors generate incremental gains in efficiency. On the contrary, Nieto and Santamaria (2007) propose that coopetition does not favor innovation, in that it promotes opportunist behavior and contributes to minimizing trust between competitors.

Ritala and Hurmelinna-Laukkanen (2009) propose that coopetition helps to develop incremental innovation in current versions of products and services, being a very effective way to create innovations, especially in high-technology industries.

The formation of partnerships between different firms in the context of innovation projects, in order to share risks, costs and expertise has become an important pattern regarding innovation management, with added interest for researchers and managers (Chesbrough 2003; Huston and Sakkab 2006). This pattern tends to result in a growing number of coopetition activities founded on strategic cooperation between competitors concerning innovation activities.

Therefore, reinforcing absorptive capacity and creating collaboration schemes with competitors contribute to an increased rate of involvement in coopetition and imitation activities, especially those involving incremental innovations, which consequently stresses the need to ensure protection of the intellectual property of assets, to minimize their appropriability (Ritala and Hurmelinna-Laukkanen 2009).

Continuing this line of reasoning, radical innovations face less competitive pressure, in that markets are more embryonic, which facilitates differentiation due to the associated degree of novelty.

Cohen et al. (2002) studied this process using the concept of absorptive capacity presented above. As was underlined earlier (see Sect. 1.2.1), this concept has to do with identification of knowledge that can be valued, the capacity for assimilation and its alignment with existing knowledge stocks, and is also related to its subsequent exploitation at the center of development of internal R&D activities in favor of successful innovation.

Therefore, as mentioned by Cohen and Levinthal (1989), the firm's knowledge base has here a very important role, taking on a twin function, i.e., of innovation and absorption, as the tendency to assimilate external knowledge creates an incentive to invest in R&D activities.

Gambardella (1992) also concludes that firms equipped with better programs of internal R&D activities are more able and better prepared to absorb external scientific information.

Other authors have given their attention to analyzing the determinant role of the firm's absorptive capacity in exploiting the alliances they establish (Arora and Gambardella 1994; Zahra and George 2002).

Nevertheless, exploitation of those alliances raises serious challenges, namely in the area of patent protection, which is critical for obtaining competitive advantages, in that protection, besides preserving the inventors' intellectual property, guards

against imitation and to a certain extent gives a basis of support for internal use of the technology (Aoki and Schiff 2008).

As stated by Dagnino and Rocco (2009), when coopetition occurs between public and private competitors, for example, between universities and industrial partners, in the context of the challenging task of knowledge production, two situations can arise, namely, coopetition through publications or coopetition through intellectual property rights. To overcome these potentially problematic situations, the same authors suggest three possible strategies to mitigate the competitive pressure between the university and industry, in terms of patents being registered in co-authorship. The first implies strategic management and implementation of phased processes, i.e., first the patent is protected, followed by publication later. The second regards the removal of data that should not be subject to publication, to avoid incurring risks when registering the patent. The third corresponds to collaborative registry of the patent, sharing property rights and duties in the registry process. Firms consider this type of coopetition as unfavorable, preferring to use the form of exclusive rights, for commercializing the technology.

The impact of coopetition relationships formed with the scientific community has warranted great attention from various researchers, for example, Li (2011), Vasudeva and Anand (2011), Kostopoulos et al. (2011) and Rusko (2011).

Li (2011) devotes his attention to external sources of technology, absorptive capacity and innovative capacity, in the context of high-technology firms owned by the Chinese State, analyzing the effects of three types of investment oriented to the acquisition of technological knowledge (i.e., internal R&D, importation of technology and purchase of national technology) on business innovation capacity. The author finds that the importation of technology has a positive influence on business innovation capacity, as long as internal R&D activities are carried out at the same time. However, he also concludes that the purchase of national technology, namely through patent licensing, produces a positive effect on firms' innovation capacity. Furthermore, he finds that the source or nature of external knowledge influences absorptive capacity.

Vasudeva and Anand (2011) focus their attention on analyzing firms that face technological discontinuity, and on the use of alliance portfolios to obtain external knowledge flows. The authors sub-divide absorptive capacity into "latitudinal" and "longitudinal" components. The former correspond to the use of various types of knowledge and the latter represent the knowledge sources most distant from firms. The empirical evidence obtained suggests that a firm with a moderate "latitudinal" absorptive capacity (meaning a portfolio of average diversity of its portfolio) is more likely to make optimal use of knowledge.

Kostopoulos et al. (2011) explore the role of absorptive capacity as a mechanism for identifying and transforming inward knowledge flows in tangible benefits, as well as a means to attain greater innovation capacity and better financial performance over time. The authors suggest that in the context of coopetitive arrangements or collaborative relationships, inward flows of external knowledge are directly related to absorptive capacity and indirectly related to innovation.

The main motivations for competitors becoming involved in coopetitive arrangements have to do with the possibility of generating greater added value and creating a larger market (Bagshaw and Bagshaw 2001; Rusko 2011; Liu 2013).

Ritala and Hurmelinna-Laukkanen (2013) made a study of various Finnish industries in order to determine the critical success factors of coopetition linkages in innovation tasks. The authors concluded that firms' absorptive capacity and regime of appropriation have a positive impact on the creation of incremental innovations, in the coopetition context. In addition, for the specific case of radical innovations, the appropriation regime produces a positive impact, while absorptive capacity does not show statistical significance.

Given the evidence obtained, the authors draw up different management strategies according to dealing with incremental or radical innovations. In the former case, the focus should be on sharing knowledge, learning and protection of knowledge, as these affect the results of coopetition arrangements positively. In the latter case, the emphasis should be on holding on to the knowledge considered critical, as well as addressing emerging innovations and market opportunities. In this way, these capacities can make the firm more able to benefit from a more secure and reliable exchange of knowledge.

Salvetat et al. (2013) carried out a qualitative analysis applied to thirty-seven firms in the space and aeronautical sector, revealing the strategic need for firms involved in coopetition arrangements to firstly protect knowledge and subsequently ensure effective management of the processes of knowledge creation and transfer activities. The sector analyzed has the strategic priorities of shared exploitation of resources, identification of subsidies and gaining markets. Those priorities are fulfilled through managing inter-organizational processes adapted to coopetition linkages based on three pillars: (i) capital management; (ii) work team management; and (iii) management of coopetition linkages, following the coopetition project; considering firms' knowledge, competences and development of capacities, tending towards the transformation of routines in new organizational practices and procedures.

In the same line of analysis, Hakanen (2014) points out that the firm's absorptive capacity can influence the management of links between firms and external stakeholders, as well as producing an impact on the use of knowledge created jointly and co-learning regarding the generation of innovative solutions.

In the line proposed by Padula and Dagnino (2007), the firm's strategy toward cooperating, competing or coopeting is influenced by the firm's knowledge structure.

Therefore, firms opting for cooperation, competition or coopetition links face the need to increase resources or acquire a knowledge stock for internal use (Bengtsson and Kock 2000; Enberg 2012).

This acquisition of external knowledge is particularly important for firms, in that it favors the strengthening of competitiveness and innovation, in facing the competitive challenge of rivals.

In this connection, Ritala and Hurmelinna-Laukkanen (2013) argue that firms compete in a scenario of continuous change and uncertainty, and for those reasons, they must renew their knowledge base in order to remain competitive.

As proposed by Roy and Yami (2009), collaboration with external competitors is of critical importance. Therefore, the formation of strategic partnerships between different firms in innovation projects, aiming to share risks, costs and know-how, has become an important pattern regarding innovation management, of interest to both academics and managers (Chesbrough 2003; Huston and Sakkab 2006; Enkel et al. 2009; Gassmann et al. 2010; Sikimic et al. 2016).

In the same connection, coopetition linkages can serve as a strategic and relational instrument, allowing knowledge asymmetries to be overcome, with respect to innovation (Brolos 2009).

In the view of Ritala and Hurmelinna-Laukkanen (2009) and Enberg (2012), firms involved in coopetition linkages tend to have similar knowledge stocks, which allows more successful knowledge-sharing, as well as assertive integration and dissemination of new knowledge and new products.

Baumard (2009) also concludes that these firms tend to face similar market conditions, needs and uncertainties, which sharpens the capacity to anticipate changes and develop new products that are profitable for all the firms involved in coopetition linkages. The same author concludes that coopetition relationships between competitors have a positive influence on innovation activities.

Gast et al. (2015) propose a similar line to the one presented above, pointing out the existence of a positive relationship between coopetition and firms' innovation capacity.

These views are in agreement with Rodrigues et al. (2011), who setting out from an application of games theory to the coopetition arrangement between *Apple* and *Nike*, conclude that both parties increased sales, market quota, market penetration rates and the international recognition of their brands.

In the same line, Bouncken and Fredrich (2012) stress that firms involved in coopetition arrangements record improved performance and successful development of radical innovations.

More recently, avenues of research were opened up by Ritala et al. (2014), who focused on the ways of implementing business models. The authors developed an application to the case of Amazon, revealing that the firm has three different areas of business where it is possible to implement coopetition business models.

Taking the practical approach of Jarzabkowski (2005) as a reference, the study by Dahl et al. (2016) points out the need to consider coopetition as a space of strategic alternatives containing activities with cooperative and competitive objectives, around which it is fundamental to understand the structure of inter-organizational relations, the roles of the actors involved and finally the organization's direction.

Pereira and Leitão (2016) warn of the need to draw up new business models that allow definition and respect for the direction proposed by the organization regarding R&D projects developed through coopetition arrangements with competing partners, as this practice will allow not only reinforcement of the elements activating absorptive capacity, but also improvement of the mechanisms for transferring technology,

and consequently stimulation of the creation, spread and regulation of defensive mechanisms, which can be used as routines by the partners involved so as to overcome the risk of appropriation.

Summarizing, according to Bengtsson and Raza-Ullah (2016), to improve understanding of the strategic dimension of coopetition, it is essential to deepen knowledge of the roles of the different actors involved in coopetition linkages, in the demanding context of open innovation. Indeed, it is necessary to define who competitors and cooperative partners are, as the different forms of direct and indirect cooperation, as well as the multiple levels of organizational structures, contribute to greater complexity of this defining task, which is of critical importance in drawing up the business model and determining the success of the transactional structure identified to follow through this strategic option.

1.4 Open Innovation Business Model

1.4.1 Business Model: Definitions

In the last two decades, the notion of a business model has emerged as one of the fundamental elements of the modern language of organizational management, and is greatly used by investors or entities providing risk capital, involved in assessing plans for business opportunities or business plans. The graphic approach is of growing importance in this domain, contemplating design and gamification and following an approach of the problematization *vs.* solution type.

The business model includes more than the firm's current strategy, directing attention to activities and above all to the responsible organization. The model notion is attractive, in that it can be inspected, measured and verified. In addition, models can be replicated, tested, compared and improved. This increases the probability of the promoters of a business initiative being more able to gain the confidence of financing bodies or risk capital providers, as well as developing a proposal of value based on the different activities of the value chain and identifying relevant segments and replicable mechanisms for capturing value (Foss and Saebi 2015).

In the context of the evolutionary path of the literature of reference, the business model construct has served multiple purposes, with the following being highlighted among them: (i) a basis for firm classification (Timmers 1998; Rappa 2001; Amit and Zott 2001; Osterwalder et al. 2005); (ii) an antecedent of the heterogeneity of firms' performance (Weill et al. 2005; Zott and Amit 2010); and (iii) a new form of innovation (Geroski 2003; Markides 2006, 2008; Teece 2010; Foss and Saebi 2016).

Since 2000, the business model construct has gained space as a form of classification, particularly to respond to the challenges faced by firms connected to electronic business and to classify the elements directing value creation processes in the digital context (Amit and Zott 2001; Rappa 2001; Magretta 2002).

The literature on business models reveals a multiplicity of definitions (see Table 1.2 for a selection of definitions) and understandings of this fundamental

Table 1.2 Business model: selected definitions

Author(s)	Business model: definition	Key elements
Timmers (1998)	It is an architecture for a product, service or information flows, including a description of the: diverse business, actors and their corresponding roles; of the potential benefits for the different actors in the business; and sources of income.	The actors and their roles, the potential benefits for the actors in the business and sources of income
Amit and Zott (2001)	It is a portrayal of three dimensions: (i) content; (ii) structure; and (iii) governance; of the transactions drawn up in order to create value through exploiting business opportunities.	Content of the transaction, transaction structure and transaction governance
Chesbrough and Rosenbloom (2002)	Creates a heuristic logic that connects the technical potential with the attainment of economic value.	Proposal of value, target segment, value chain, costs/income structure, value network and competitive strategy
Magretta (2002)	They are stories explaining how firms operate. A good business model answers a number of "old" questions raised by Drucker (1994): Who is the customer? What is valued by the customer? And also answers fundamental questions that any manager should know to ask, namely: How do we make money from this business? What is the underlying economic reasoning that explains how value can be delivered to customers, at an appropriate cost?	Target customer, proposal of value, delivering value and capturing value
Morris et al. (2005)	A concise representation of how an inter-related set of decision variables in the areas of business strategy, systems architecture and economics are approached, in order to obtain a sustainable competitive advantage in defined markets.	Proposal of value, customer, internal capacities, way to make money, market positioning and growth objectives in a period of time
Johnson et al. (2008)	Consists of four blocking elements which when considered together create and deliver value.	Proposal of value for the customer, profit formula, key resources and key processes
Casadesus-Masanell and Ricart (2010)	A reflection of the strategy carried out by the firm.	Choices and consequences
Teece (2010)	Articulates the logic, data and other evidence supporting the proposal of value for the customer and a viable structure of income and costs, for the firm to deliver that value.	The benefit delivered and the value captured
George and Bock (2011)	A way of delimiting an entrepreneurial idea of an opportunity that is definable, establishing a set of relevant objectives	Organizational activities, strategic objectives and opportunity

(continued)

Table 1.2 (continued)

Author(s)	Business model: definition	Key elements
	which will guide the entrepreneurial action and the organizational investment, as well as delimiting the organizational activities that can activate exploitation of the opportunity.	
Sorescu et al. (2011)	A well-specified system of interdependent structures, activities and processes that serves as an organizing logic for the firm to create value (for its customers) and capture value (for itself and for its partners).	Activities, format and governance
Boons and Lüdeke-Freund (2013)	Formed by the value proposal, which can include ecological/social value and economic value, through the supply of products and services. The structure should be founded on principles of sustainable value chain management. The customer interface should be concerned with activating close relationships with customers and other stakeholders, following a logic of wide-ranging responsibility for production system management and consumption, rather than simply managing sales. The financial aspect should deal with distributing costs and economic benefits among the actors involved.	Value proposal, close relationships, sustainability and social impact
Wirtz et al. (2016)	A simplified and aggregate representation of activities relevant for the firm.	Strategy, resources, network, customer, market supply, income, production costs and procurement
Foss and Saebi (2016)	«the design or architecture of the processes of creating and delivering value, including mechanisms for capturing value» (cf. originally proposed by Teece 2010: p.172).	Value proposal, market segments, value chain structure and system architecture

Source: Own elaboration from Foss and Saebi (2015, 2016)

concept for operationalizing a given organization's competitive strategy (Osterwalder et al. 2005; Zott et al. 2011; Foss and Saebi 2015, 2016).

There seems to be a certain consensus around the understanding that a business model explains the logic according to which an organization creates, delivers and captures value (Chesbrough and Rosenbloom 2002; Teece 2010; Osterwalder and Pigneur 2010).

Consequently, the business model includes the links between activities or between the organizational units that perform certain activities, as well as activities developed with external stakeholders in order to create, deliver and capture value (Stieglitz and Foss 2009; Zott et al. 2011; Santos et al. 2015).

In the view of George and Bock (2011:p.99), «a business model is the design of organizational structures that can activate commercial opportunity». Therefore, a business model of innovation implies finding a new way of organizing and configuring business (Casadesus-Masanell and Zhu 2013).

A business model reflects, therefore, the hypotheses considered by a given organization's management concerning the customer's needs and the best way to organize activities to create, deliver and capture value (Tikkanen et al. 2005; Teece 2010; Doz and Kosonen 2010).

Once the activities are articulated, the business model logic is submitted to a market test, and it may be modified and retested considering the changes made in environmental conditions (Teece 2010).

However, the review of the literature of reference on business models allows, once more, identification of a gap, i.e., the lack of well-tuned instruments to allow effective management of the lines of change and innovation in terms of the business model, which would safeguard their evolutionary adaptation to market conditions and changes inside the organization.

From an organizational perspective, an organization's capacity to change its business model is fundamentally influenced by its capacities and by the existing design. Therefore, firms can cultivate the necessary conditions to embrace and operate possible changes in its business model, by developing dynamic capacities (cf. Teece 2010) that can serve as elements activating systematic change in the business model.

It is of note that the literature itself made a necessary change by positioning the process of managing business model change as a dynamic capacity (Doz and Kosonen 2010; Demil and Lecocq 2010; Achtenhagen et al. 2013), but it fails when it comes to identifying, distinctively, the transactional structure and dynamic capacities necessary to support the very dynamics of change and innovation in the business model.

Standing out in the literature is the view that dynamic business models are essential determinants of firms' performance (Teece 2010; McGrath 2010; Sosna et al. 2010; Foss and Saebi 2015, 2016).

Foss and Saebi (2015, 2016) classify three types of change in the business model, namely evolution, adaptation and innovation. This classification delineates the different implications for the development of dynamic capacities, and in this way casts light on the organizational dimension of business model dynamics.

This more organizational vision contrasts with an established approach in the literature that highlights the disruptive capacity of new business models (cf. Voelpel et al. 2004; Chesbrough 2010; Teece 2010) or the need to adapt them over time (cf. Doz and Kosonen 2010; Demil and Lecocq 2010).

According to Foss and Saebi (2015), however, this established approach does not answer an additional need that consists of developing the organizational capacity to systematically manage and implement changes in the business model. Therefore, the design methodology of the business model emerges as a possible systematic approach to all an organization's dimensions, as (re)definition of the so-called value proposal, in dynamic terms, requires the identification and valuation of

partners, resources, relationships, customers, relevant markets and above all internal organizational aspects in an uninterrupted way.

1.4.2 Elements of the Business Model Structure

Drucker (1994) argues that an organization's business model, or to use this respected author's own terminology, the "business theory", has three parts, namely, the assumptions about the organization's environment, the organization's specific mission and the key competences necessary to fulfill that mission. Taken together, those assumptions define the reasons for which the organization is remunerated, the results with special significance and the critical factors that must be highlighted to hold on to its competitive position.

Various studies underlined three key elements of the business model structure, namely: delivering a value proposition to customers; the activities required for that delivery; and a logic of how those activities create profit for the firm (Amit and Zott 2001; Magretta 2002; Chesbrough and Rosenbloom 2002; Johnson et al. 2008; Teece 2010; Zott and Amit 2010; Zott et al. 2011).

Although the income-generating model has warranted much attention from researchers, it is in the so-called business system (i.e., in the collection of all the activities through which the value proposition delivery is processed) that the critical substance of the business model lies (Itami and Nishino 2010).

According to Morris et al. (2005), the business model corresponds to detailed specification of the activities a firm undertakes to exploit a previously identified business opportunity.

Consequently, it is based on information and knowledge, through which the firm can gather partners, suppliers, customers and other parties in its network (Voelpel et al. 2004), added to subjective components, such as cognitive aspects relating to the firm's limits and the competition, as well as to economic, competitive and institutional contexts able to affect the organization and the range of benefits that must be included in the product supply (Doz and Kosonen 2010).

According to the perspective of Osterwalder (2004), the main elements of the business model structure are presented in Table 1.3 below.

1.4.3 Business Model Dynamics and Innovation

Although the view that business models can be subject to innovation has existed since the study by Mitchell and Coles (2003), only very recently do research efforts appear to have woken up to a situation still to be explored (Zott et al. 2011). However, innovation of the business model is a construct requiring greater clarification (Suddaby 2010), as its opacity hinders its operationalization and its very measurement (Casadesus-Masanell and Zhu 2013).

Table 1.3 Main elements of the business model structure

Studies	Value proposition	Income and costs	System of activity	Relationship with the customer	Partners
Hamel (2000)	Market product/ range	Pricing structure	Key processes	Relationship dynamics	Suppliers; partners; and colligations.
Amit and Zott (2001)	Transaction component		Configuration of architecture		Transaction component
Alt and Zimmermann (2001)		Sources of income; and business logic	Structure; and processes	Processes	Structure
Applegate (2001)	Product and service supplied	Benefits received by the firm; financial performance; income; and cost structure	Operational model	Sales and marketing model; brand; and reputation	Partners
Linder and Cantrell (2001)	Value proposition	Pricing model; and income model	Commerce process model	Commercial relationship	
Magretta (2002)	What does the customer value?	How do we make money from this business?			
Afuah and Tucci (2003)	Value for the customer	Pricing; source of income; and cost structure	Connected activities; value configuration		
Chesbrough and Rosenbloom (2002)	Value proposition	Cost structure	Value chain structure		Position on the value chain
Gordijn (2002)	Value supply	Value transfer	Configuration of *3e* value		Actors
Bonaccorsi et al. (2006)		Income; cost structure			
Brousseau and Penard (2006)		Income flow; cost structure; and income generation	Assembly costs	Knowledge management	Transaction costs
Osterwalder and Pigneur (2010)	Products and services supplied to a customer segment	Difference between what value pays and what it costs to organize production	Includes the phases of the value chain, as well as resources and key capacities	Management of relations, affections and feelings with the customer	Competitors, financing entities, suppliers, customers, etc.

Source: Elaborated from Birkinshaw and Ansari (2015)

Schneider and Spieth (2013) identify three generic themes in this area of work, namely: (i) pre-requisites; (ii) process; and (iii) effects; drawing attention to the need to carry out more research into the process and elements of the business model structure, and into the activating factors and anticipatory factors of the growing environmental volatility (Schneider and Spieth 2013).

For Birkinshaw and Ansari (2015), organizations can identify opportunities created through competitive and technological surveillance, with a strategic motivation, and in this way capitalize on associated developments, through changes in various elements of the business model (cf. presented earlier in Sect. 1.4.2.).

Foss and Saebi (2016) identify four fundamental focus areas in the literature on business model innovation (see Table 1.4), namely, conceptualization and classification of forms of business model innovation; process of business model innovation; business model innovation as a result; and implications of business model innovation in organizational and performance terms.

In the conceptual aspect, business model innovation concerns the creation of a new value proposition and reconfiguration of the business system in order to give support to the underlying value proposition (Osterwalder 2004; Markides 2006).

Business model innovation represents a new, holistic form of organizational innovation that requires theory building, operationalization and testing.

Studies carried out concerning the CEO's responsibility indicate that business model innovation is a key source of sustained value creation (IBM Survey 2006), even if this implies adoption of a philosophy of continually introducing new products and services, as a source of competitive advantage (Economist Intelligence Unit 2005).

Aiming to compile the different conceptualizations of business model innovation, which are quite scattered in the literature, Table 1.5 presents a selection of definitions in chronological order.

Earlier studies indicate that firms usually turn to two main activities, i.e., experimentation and introduction, to create, change or adapt the business model.

Morris et al. (2005) argue that the innovation process emerges above all as a function of different conditions and situations, not resulting from a solid plan, inasmuch as it originates through a learning process of the trial and error type, and not by applying a set of "golden rules".

As for the implications of business model innovation, innovative business models are found to have a positive influence on performance, even in volatile environments (Zott and Amit 2007).

In similar terms, Cucculelli and Bettinelli (2015) conclude that established firms that innovate their business models end up recording positive effects on their performance.

Nevertheless, according to Chesbrough (2010), the crux of business model innovation is not only related to reconfiguration of the objective elements of the business model. In fact, firms have a sharp awareness of the changes required in their business model, but when they try to operate these changes, they usually come up against quite substantial barriers to change.

Table 1.4 Business model innovation: research focus areas

Focus areas	Method	Examples
1.1. Conceptualization and classification of forms of business model innovation	Conceptual approach and examples of cases	Markides (2006, 2008), Johnson et al. (2008), Koen et al. (2011), Santos et al. (2009), Sorescu et al. (2011), Amit and Zott (2012)
	Data search	Giesen et al. (2007)
1.1.1.2. Process of business model innovation	Conceptual approach and examples of cases	Deshler and Smith (2011), Berglund and Sandström (2013), De Reuver et al. (2009), Evans and Johnson (2013), Girotra and Netessine (2013, 2014), Cavalcante (2014)
	Individual case studies and multiple case studies	Demil and Lecocq (2010), Doz and Kosonen (2010), Dunford et al. (2010), Moingeon and Lehmann-Ortega (2010), Sosna et al. (2010), Deshler and Smith (2011), Pynnonen et al. (2012), Enkel and Mezger (2013), Frankenberger et al. (2013), Günzel and Holm (2013), Achtenhagen et al. (2013), Aspara et al. (2013), Khanagha et al. (2014), Dmitriev et al. (2014), Mezger (2014)
	Content analysis	Bohnsack et al. (2014)
	Experimental analysis	Eppler et al. (2011), Eppler and Hoffman (2012)
3. Business model innovation as a result	Individual case studies and multiple case studies	Anderson and Kupp (2008), Gambardella and McGahan (2010), Sánchez and Ricart (2010), Yunus et al. (2010), Wirtz et al. (2010), Abdelkafi et al. (2013), Richter (2013), Visnjic Kastalli and Van Looy (2013)
4. Implications of business model innovation in organizational and performance terms	Data search	Pohle and Chapman (2006), Zott and Amit (2007), Giesen et al. (2007), Aspara et al. (2010), Bock et al. (2012), Hall and Wagner (2012), Huang et al. (2013), Denicolai et al. (2014), Wei et al. (2014), Velu and Jacob (2014), Cucculelli and Bettinelli (2015), Kim and Min (2015)

Source: Elaborated based on Foss and Saebi (2016)

The literature on organizational change and strategic renewal provides various ways to explore the topic of how organizations can progress through the change processes.

In this connection, Bock et al. (2012) identify, in theoretical terms, the effects of culture and structure on the firm's strategic flexibility, in the course of the business model innovation process. In turn, Hamel (2000) and Markides (2006) present, in

Table 1.5 Business model innovation: selected definitions

Author(s)	Definitions
Mitchell and Coles (2004)	Process of developing and substituting the business model for the supply of a previously unavailable product or service to customers and final users
Markides (2006)	Discovery of a business model that is considerably different from an existing business model
Santos et al. (2009)	Reconfiguration of activities in an existing business model, which is new to the product/service market in which the company competes
Aspara et al. (2010)	Set of initiatives to create new value, challenging the existing, specific business models of a given industry, its roles and relationships in certain geographical areas of the market
Gambardella and McGahan (2010)	Business model innovation occurs when a firm adopts a new approach, for the purpose of commercializing its underlying assets
Yunus et al. (2010)	Business model innovation refers to the generation of new sources of profit, finding a new value proposition or new combinations of a value constellation
Sorescu et al. (2011)	A change beyond current practices in one or more elements of a retail sales business model (for example, retail format, activities and governance) and their interdependences, contributing in this way to changing the retailer's organizational logic, in terms of creating and appropriating value
Amit and Zott (2012)	Redefinition of the business model regarding: (i) content (adding new activities); (ii) structure (connecting activities differently); and (iii) governance (changing the parts that perform the activities)
Bucherer et al. (2012)	Process that deliberately changes a firm's principle elements, as well as its business logic
Abdelkafi et al. (2013)	Modification or improvement of at least one of the business dimensions for generating value
Aspara et al. (2013)	Change in the perceived logic of how the firm creates value, concerning the links established between different firms, favoring value creation, following a time logic
Berglund and Sandström (2013)	Introduction of a new business model aiming to create commercial value
Casadesus-Masanell and Zhu (2013)	The search for new operating logics for the firm and new ways to create and capture value for its stakeholders, focusing primarily on the discovery of new paths to generate income and define value propositions for customers, suppliers and partners
Khanagha et al. (2014)	Set of incremental changes in the individual components of business models, including enlargement of the existing business model and the introduction of parallel business models, or even a break with the existing business model, which may potentially imply replacing the existing model with a different one.
Foss and Saebi (2016)	Business model innovation, which in itself can be a new source of innovation (complementing the traditional ones of product, process, organizational, marketing forms, etc.) and building a sustained competitive advantage.

Source: Elaborated based on Foss and Saebi (2016)

applied terms, the challenges faced by executive managers in the demanding task of implementing new business models. Despite recording a growing number of studies on how a firm (re)configures itself in relation to other actors, a gap remains, as little is known about the changes to operate, above all internally. Here, the study by Zott and Amit (2010) should be highlighted, in that it is one of the few to underline the importance of internal governance as a key component of the business model structure. However, other important facets of a firm's internal organizational structure in relation to the surrounding environment are not duly dealt with in the literature, for example, the systems, processes, activators of absorptive capacity, styles of working, human resources and connection factors.

Returning to the view of Birkinshaw (2012) and Birkinshaw and Ansari (2015), a firm's management model corresponds to decision-makers' set of choices concerning the different ways to: perform the work; coordinate activities; make decisions; set objectives; and motivate employees. All these facets, added to absorptive capacity and the strategic option of open innovation, have a direct relationship with business model innovation and its implementation, considering intrinsic (internal) factors and connecting (external) factors.

This is the motivation, in the scope of this book, for paying special attention to the transactional structure of the business model, in the context of open innovation and strategic coopetition, in this way integrating the fourth focus area devoted to investigating business model innovation (cf. presented in Table 1.5), assessing its implications, in organizational (internal and external) terms and regarding innovative performance represented by the capacity to generate innovation.

1.4.4 Organizational (re)configuration in Open Innovation

Returning to the transaction costs approach, if the costs of open innovation are not greater than the costs of internal organization of production, then it will be advantageous to implement open innovation schemes.

However, organizations that intend to implement open innovation should have a certain organizational flexibility and be interested in restructuring their business models, for better absorption of the impacts of open innovation strategies (Chesbrough and Schwartz 2007; van der Meer 2007; Hienerth et al. 2011; Keinz et al. 2012).

Therefore, the option to adopt an open innovation business model requires the organization to follow an orientation of open innovation, with reflections on its internal structure and its external relations.

As mentioned by Foss and Saebi (2015), there is a gap in the literature of reference regarding the link between business models and open innovation. Therefore, additional research efforts and understanding are required in relation to how organizations in general and firms in particular should be structured, in order to implement a strategy of open innovation with their preferred partners and in this way strengthen their capacity to absorb innovation in organizational terms.

The open innovation business model must ensure that the strategy's definition functions as an integrated whole. Therefore, such a model should be designed to safeguard the organization's specificities and the set of links with internal and external stakeholders.

From an organizational perspective, the business model is defined as being a mechanism of organizations' structuring and design, allowing configuration of organizational variables (Winter and Szulanski 2001), as well as adding value to the transactions established between the firm and stakeholders and having a positive impact on the organization's performance.

According to Foss and Saebi (2015), firms can design their business models in line with their strategic objectives. For example, in the commercial aviation sector, *Ryanair* follows a business model known by themes, including the no-frills model. In turn, *Apple*, *Nespresso* and *Delta* use the so-called customer lock-in model.

Van de Vrande et al. (2006) and Petroni et al. (2011) highlight the concept of open innovation entry, which covers different practices associated with open innovation, namely monitoring the external environment for ideas, acquisition of external technology, actively seeking crowdsourcing, innovation competitions, joint venture formation, involvement in R&D alliances, licensing university technology or participation in large-scale networks for the purpose of coordinating innovative activity.

These strategies of open innovation entry require different and customized business models, representing a recent tendency in studies which begin to address a critical topic, i.e., the different ways in which organizations can (re)design their business models, in order to better adjust their content, their structure and their governance to open innovation (Hienerth et al. 2011; Storbacka et al. 2012; Pereira and Leitão 2016).

In the line suggested by Hansen and Nohria (2004), in the open innovation context, when an organization depends heavily on external sources of knowledge, it is essential, as a complement, to implement internal networks which serve to facilitate access to and absorption of the knowledge acquired in the receiving organization's innovation processes. Those internal networks represent the realignment of the organizational structure, favoring the development of new capacities in terms of knowledge and organizational practices.

According to Foss et al. (2011), organizations can make use of other organizational and management practices. These are the cases, for example, of delegation, horizontal and vertical communication, and attributing rewards for the share of knowledge.

Salge et al. (2012) complement the previous perspective, highlighting other instruments such as specific incentive systems for innovation, developing the internal research capacity and cross-functional collaboration between departments devoted to innovation.

Revisiting the paradigm of open innovation defined by Chesbrough et al. (2006), a given organization should be able to identify and manage inward flows of knowledge, in order to strengthen internal innovation and develop markets for the purpose of external use of innovation. In this connection, firms can and must use

external knowledge and internal and external ways to access the market when they come to develop their own technology.

Contrary to the vision of a closed innovation system, this paradigm is based on a dynamic process combining both internal and external ideas in systems that use open innovation business models, for the purpose of defining those same systems' requirements.

Aiming to create value added, those business models combine internal and external knowledge, defining and implementing internal mechanisms to correspond to the defined objective.

Chesbrough et al. (2006) consider R&D activities as an open system, since they include knowledge that can be valued, whether it is obtained internally or captured from external sources.

The same authors propose that open innovation involves all the knowledge considered useful that can be channeled through a series of multiple sources and can be created not only inside the organization but can also originate in a complex set of agents (from the individual researcher/inventor to universities, laboratories and research centers, manufacturing and prototype laboratories or technology-based start-ups), in which context R&D organizations should identify, connect and lever external sources of knowledge, from a logic of an open process focused on innovation.

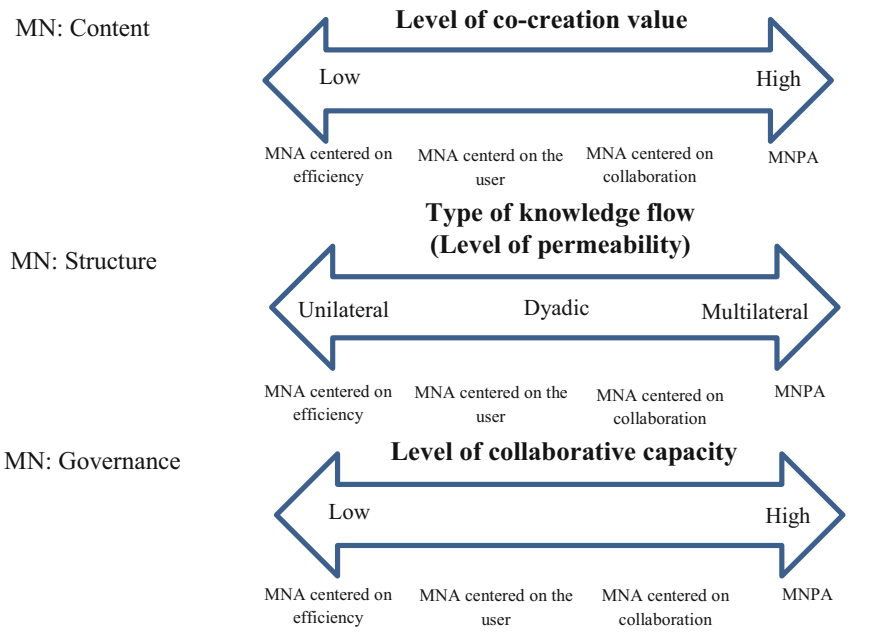
According to Dahlander and Gann (2010), interaction between organizations is fundamental, since to innovate any organization has to be involved with different types of partners, in order to acquire ideas and resources from the external environment, namely alternative ways to access talent, new results of intellectual property, innovative technology that can be licensed or transferred permanently, or new forms of collaboration in geographically distant locations.

van de Vrande et al. (2006) and Petroni et al. (2011) emphasize the importance of inward flows of open innovation, which involve different practices associated with open innovation, namely surveillance of the external environment to identify ideas, the acquisition of external technology, actively seeking sources of ideas (of the crowdsourcing type), competitions for ideas, formation of joint ventures, involvement in R&D alliances, licensing technology from universities and participation in international networks to coordinate innovative activities. The inward flows associated with open innovation strategies require the definition of different and customized business models.

Other authors, for example Kirschbaum (2005), stress the importance of creating open innovation business units or task forces, while Huston and Sakkab (2006) underline the need to form cross-functional teams especially designated to capture external sources of knowledge.

Chiaroni et al. (2010) also studied the effects of attributing new organizational roles, namely through defining the person responsible for changing the paradigm of closed innovation to that of open innovation, or nominating those responsible for supervising the links between the firm and external stakeholders.

According to Foss et al. (2011), firms must use alternative organizational and management practices. These, for example, are the cases of extensive delegation of



Legend: MN=Business model; MNA=Open business model; MNPA=Business model with open platform.

Fig. 1.1 Continuum of open business models. Source: Adapted from Foss and Saebi (2015)

intensive communication, both laterally and vertically, as well as giving rewards for knowledge-sharing.

For Foss and Saebi (2015), as presented in Fig. 1.1 below, a continuum (or uninterrupted sequence) of "openness" should be followed throughout the three dimensions of the business model: (i) content; (ii) structure; and (iii) governance. In addition, as a contingency, consideration should be given to implementation of different strategies of open innovation, as a function of crossing the dimensions referred to above and the focus of action, namely market, crowd, collaboration or network (as presented in Table 1.6).

1.4.5 Identifying the Characteristics of Transactional Structure

In the literature on transactional structures, the most rigorous definitions of constructs concerning business models cover the themes of logistics and income generation (Mahadevan 2000).

The construct of the deductive nature proposed by Amit and Zott (2001) aims to explain the mechanisms for creating value in electronic business. According to the

Table 1.6 Open innovation business models: a contingency analysis tool

	Four strategies of open innovation			
	Market-based innovation strategy	Crowd-based innovation strategy	Collaboration-based innovation strategy	Network-based innovation strategy
Dimensions of the business model (BM)	BM Centered on efficiency	BM Centered on the user	BM Centered on collaboration	BM Centered on the open platform
(i) Content	Value proposition centered on efficiency, activated by reducing transaction costs and coordination	Value proposition centered on the user, with inward flows from user communities	Radical innovations and opening a new market segment	The business model functions as an innovation platform (of the open hub type) open to multiple stakeholders.
(ii) Structure	– Redefinition of the role of the internal R&D system – structure centered on efficiency	– Idea-forming stage of the innovation process externalized to the crowd.	– Competitors, users, suppliers and customers become key partners in the innovation process	– Reorganization of the production and distribution system – Need to organize a complementary internal network
(iii) Governance	– Monetary reward to the supplier of external knowledge – Use of "integration of experts" to absorb the knowledge available in the market.	– Monetary prizes to recognize external suppliers of knowledge – Incentives to engage and manage user communities, for the employees themselves	– Based on contracts, sharing rewards with the external supplier of knowledge – Incentives for the employees themselves to engage with leading users and alliance partners	– Providing incentives for the employees themselves to become involved with a multiplicity of partners (individuals, firms and communities) – Redistribution of risks and rewards

Source: Own elaboration based on Foss and Saebi (2015)

authors' proposal, the business model is a mechanism of unification that describes the content, structure and governance of transactions (cf. Table 1.3, presented in Sect. 1.4.2).

The firm's performance is a function of the business model's specific characteristics (Zott and Amit 2007), as well as of the degree of adjustment between business models and strategy (Zott and Amit 2008). The conjugation of these perspectives has usually come to be applied to activities involving electronic business, particularly in the development of cluster type solutions and business typologies that contribute to deconstructing the traditional characteristics of exchange (Bienstock et al. 2002).

Definition of the business model based on the transactional structure of exchange is particularly attractive, as it is grounded on observation of the firm's behavior,

combines elements of entrepreneurship with strategy and presents a spectrum of opportunities for building theory and empirical applications.

Fiet and Patel (2008) argue that some business models have been marked by a transfer of transactions with a risk for external resources, without assuring appropriate compensation.

The transactional approach of Amit and Zott (2001) underwent various developments, namely through assessment of the results of strategic investment in growth, in the dot-com post-crisis scenario (Eisenmann 2006) and value creation through the acquisition of firms in the internet sector (Uhlenbruck et al. 2006).

The research topic of the transactional nature of the business model has so far been explored through diverse applications, above all in more technological areas, but needs to be deepened in terms of building theory and developing empirical applications that contrast different sectors of economic activity.

For George and Bock (2011), the organizational structures of the business model present three dimensions: resource structure; transactional structure; value structure. Firstly, resource structure relates to the static architecture structure of the firm's organization, technology production and the resources employed to serve customers. Secondly, transactional structure corresponds to the organizational configuration that determines key transactions with the different partners and stakeholders. Thirdly, value structure represents the system of rules, expectations and mechanisms that determine the activities of creating and capturing value.

Regarding the characteristics of the business model's transactional structure, according to the research carried out by the same authors based on content analysis, in the definition of both a generic business model and a specific business model, a substantial majority of participants in the study mention the following as characteristic elements: the product; production technology; and the type of resource used; which is adjusted, to a certain extent, to a contingency approach, as firms with similar products and production technology also tend to present business models with similar characteristics.

Nevertheless, the resource structure of the business model should be identified, broken down and deepened in relation to the characteristics of the transactional structure, considering that the latter is formed of the resources able to provide value differentiation for the firm.

Returning to the perspective of George and Bock (2011), the resource structure of a business model corresponds to the organizational configuration of resources, capacities and activities, irrespective of the value generated, in subjective or objective terms, from those resources.

That perspective has the advantage of forming a way to improve routines, activities or business models based on flows.

Firstly, a business model drawn up as an independent package of routines (Winter and Szulanski 2001) is in truth a map of the basic level of the firm's activities, which does not ensure the necessary correspondence with the demanding level of practical business model implementation.

Secondly, although the main value-generating activities are intrinsically linked to organizational structures, in the small firm context, the growth of administrative

structures found especially in small and medium-sized enterprises (SME), creates a need for greater coordination of those activities, favoring a greater distance between the specific characteristics of activities and the characteristics of the business model.

Thirdly, the area of work that deals with routines and analysis based on activities is greatly concentrated on large, mature organizations (Nelson and Winter 1982), which clearly opens the field for new applications of the business model construct, of the type centered on opportunity and especially in the SME context.

Therefore, and following the suggestion of George and Bock (2011), the elements underlying resource structure form the general basis: of the organizational structure; of the nature of the firm's primary production systems; of the structures to support development and accumulation of critical resources to reinforce value; as well as of the whole range of aspects implicit in organizational structure, for example, the culture that coordinates activities. Each of these elements can be broken down into a variety of organizational components, but some of them will reveal interesting characteristics of a resource structure that operate and serve, holistically, the underlying opportunity.

The strategic option to open up the organic structure, rather than the traditional choice of closing the organization in on itself, for example, with the exclusive development of internal R&D activities, should be based on designing a business model of open innovation, and so not be only a question of a decision-making process about resources.

For Foss and Saebi (2016), an organizational architecture that penetrates the lowest levels of the structure and endangers the so-called casual hierarchy, conjugated with a cooperative culture, are key components of the resource structure that evolve simultaneously with the organization's linked packages of (internal and external) resources and activities.

All these characteristics of the transactional structure can then strengthen the business's strategic position in a market which, although apparently saturated, can be penetrated through a selected focus based on previous identification of a relevant market and corresponding segment(s).

Therefore, resource structure provides the architecture in which firms' strategic resources should be strategically incorporated, without the obligation to derive necessarily from any decision or statement of the strategic plan, to be able to implement contingency allocation and management.

For the above reasons, the need becomes clear to deepen research efforts and understanding of how resource structure and strategy can evolve, simultaneously and contingently.

Giving continuity to the suggestions of Zott and Amit (2007) and George and Bock (2011), this book intends to contribute to advancing understanding of the importance of transactional structure in open innovation business models, including the interactions established between the firm and internal and external stakeholders.

It should be noted that this task is particularly demanding, as despite the transactional nature of the main elements (see Table 1.3, of Sect. 1.4.2) of business models: the value proposition; income and costs; the system of activity; relationship with the customer; and partners; forming the basis of the macro level of

organizational architecture, it is rare to find methodologies and evidence in the literature that allow us to establish a direct link between the above elements and the results obtained by the firm, regarding value-creation.

Fulfilment of this task is particularly important to differentiate the growing variety of business models, above all those that resort to new information and communication technologies, especially in multi-sided markets, using technological platforms and user communities, with multiple roles and functions simultaneously.

Referring to the theoretical basis that serves as the grounding for this new perspective, the literature provides a set of teachings on the characteristics of transactional structures that are based, fundamentally, on transaction cost economics (Williamson 1979) and on pioneering research into business models (Zott and Amit 2007); and highlights, above all, the need for better characterization of those structures, rather than focusing on the content of transactions.

Consequently, the differences in terms of cost and supply structure (whether of raw material and subsidiaries or of knowledge) linked to the supply of a specific product/service, can differentiate the resource structures of the firms involved, although many of the components of these same firms' transactional structure may be almost the same.

Until now, in this area of work, the most substantial research efforts have been focused on electronic business with a transactional structure centered on efficiency and blocking (Zott and Amit 2007; George and Bock 2011), but additional studies are necessary to reveal the transactional nature at the intra-firm level (for example, focusing on the internal factors of innovation), as well as at the inter-business (i.e., addressing the factors linking firms) and inter-institutional level (i.e., incorporating the factors linking with institutions of the scientific-technological system), in a context of more open and integrative organizational behavior, which contemplates simultaneous analysis of the complex strategic scenario of co-existing cooperation and competition.

Value-creation is a common denominator between the concerns of researchers and managers interested in business models. In this respect it should be underlined that the value associated with the business model incorporates the transactional structure of value-creation, as well as the contingency analysis of detecting business opportunity.

For George and Bock (2011), the transactional structure of value is the organizational system that defines, supports and controls the processes of creating and capturing value. That structure serves as a facilitator between the nature of the underlying opportunity and the actual activation of that opportunity, via transactional resources and elements.

In this domain, it is the differentiating nature of entrepreneurial co-creation that establishes the limits for action and activates the mechanisms of entrepreneurial action, functioning as a mediator between opportunity and different perceptions of opportunity.

As the firm acts toward exploiting the opportunity, the elements of creating and capturing value adjust with a high probability to resource development and transactional elements, in the area of transaction possibilities. Identification and deepening

of the transactional structure of value can provide a capacity to anticipate in terms of strategic management, in this way providing high-level lines of action that will connect the entrepreneur's perception of the available value to the set of strategic and contingency decisions that aim to maximize the value created and captured over time.

1.5 Conceptual Model—Open Innovation Bridge: Tangram Model

Taking as a reference the review of the literature on absorptive capacity and revisiting the model proposed by Zahra and George (2002), a conceptual model is now proposed, to design, identify and deepen the nature of the transactional structure of open innovation business models, using internal and liaison factors, as well as absorptive capacity and coopetition relationships, in order to strengthen ultimately businesses' innovative capacity, understood here as a mechanism to create and capture value.

An alternative to the model by Zahra and George (2002) is proposed, integrating the vision of Vega-Jurado et al. (2008), using different dimensions of absorptive capacity and considering two groups of factors, namely internal factors and liaison factors.

Combining in an innovative way the approach of Dana et al. (2008) on the symbiotic basis of business innovative capacity with a typical organizational system approach, it is considered plausible to couple the typology proposed by George and Bock (2011), regarding definition of the elements forming the transactional structure of value, i.e., transactional resources and elements.

Next, referring to what is set out in the literature of reference, and using a creative design approach, Fig. 1.2 presents a pentagon representing the symbiotic process of elements of the business model's transactional structure, in a graphic approach according to the book plan and the following interactive nexus: Open innovation +Absorptive capacity + Coopetition -» Business innovation capacity.

Taking the previous symbiotic process as a reference, it becomes possible to develop a gamification-type approach, which considers the five (5) components of the symbiotic process of the elements of the business model's transactional structure, represented by seven (7) decision pieces, which can be grouped as follows:

- Component A: Absorptive capacity

  (A1) Internal factors (resources);
  (A2) Liaison factors (transactional elements);

- Component B: Open innovation

  (B3) Internal R&D activities (resources);
  (B4) External R&D activities (transactional elements);

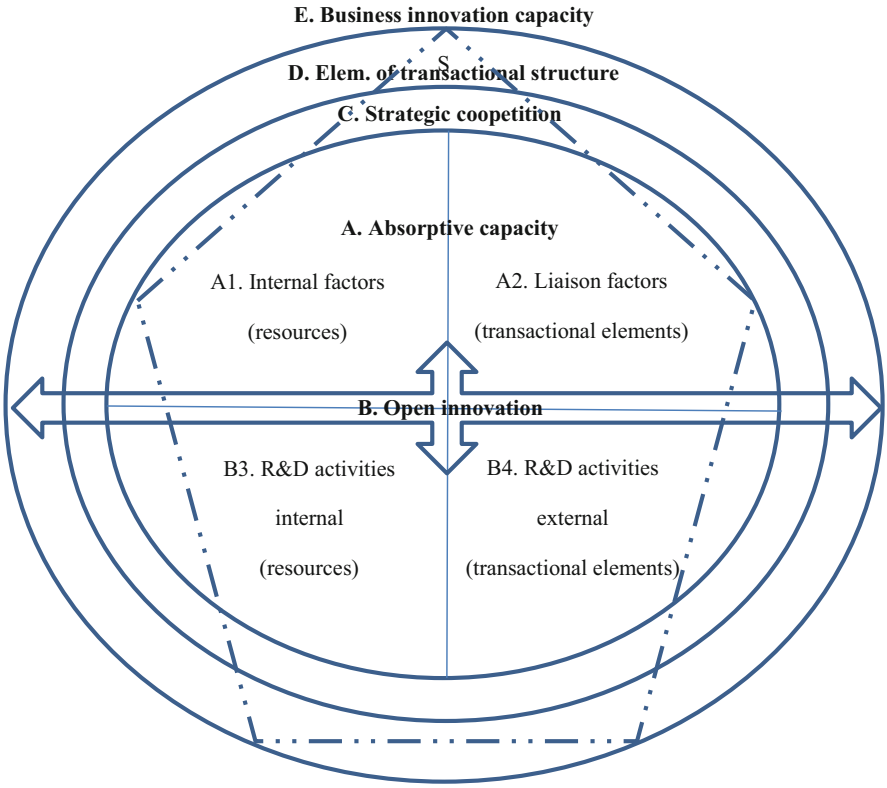


Fig. 1.2 Pentagon of the symbiotic process of resources and transactional elements of the business model. Source: Own elaboration

- Component C:

  (C5) Strategic coopetition;

- Component D:

  (D6) Critical elements of transactional structure (significant resources and transactional elements);

- Component E:

  (E7) Business innovation capacity.

Concerning component A, referring to internal factors (i.e., resources), and considering the availability of data from CIS 2010—*Community Innovation Survey*, the first includes, on one hand, variables representing internal factors (A1) of the absorptive capacity construct, namely: acquisition of other external knowledge (A11); acquisition of equipment, software and licenses (A12); employees' academic qualifications (A13); and employees' training to carry out innovation activities

(A14). In addition, it includes variables representing the liaison factors (A2) of the same absorptive capacity (i.e., transactional elements), namely: cooperation links with consultants (A21); cooperation links with universities (A22); and cooperation links with laboratories (A23). In turn, component B concerning the open innovation construct is represented by two variables, namely, internal R&D activities (i.e., resources) (B3) and external R&D activities (i.e., transactional elements) (B4). As for component C regarding strategic coopetition, this is represented by the variable referring to cooperation links with other competing firms (C5). Concerning component D, representing the critical elements of transactional structure (D6), this results from estimating a logistic regression model presented in Sect. 1.4. Empirical application, analysis and discussion. Component E regarding the business innovation capacity construct (E7) is represented through the dependent (or response) variable of the model identified above, i.e., product/service innovation.

Figure 1.3 presents the next conceptual model in the scope of the game entitled: Open innovation bridge—Tangram model. In this gamification approach, an old Chinese riddle is revisited, which allows the 5 previously identified components to be coupled, using the design and placing of the 7 decision pieces proposed.

In the context of open innovation, the game of the open innovation bridge represents the importance of identifying resources and transactional elements, to activate innovation of the business model, the ultimate goal being to renew business innovation capacity.

Resources should be identified in terms of the internal factors (A1) that determine the firm's absorptive capacity, as well as the internal R&D activities (B3), that influence the firm's strategic positioning as regards open innovation.

In turn, transactional elements can be detected in terms of liaison factors (A2), where the different cooperation links with external stakeholders predominate, namely consultants, universities and laboratories. In addition, these elements are intrinsically linked to external R&D activities (B4) that are developed in order to access external sources of knowledge.

The visual metaphor of the bridge-building task of open innovation aims to give added importance to the decision piece: strategic coopetition (C5); which is founded on the cooperation links with other competing firms. However, this task would not be completed if it was not possible to identify the critical elements of the transactional structure (D6) of the business model, so that, in the end, renewal of business innovation capacity (E7) is processed.

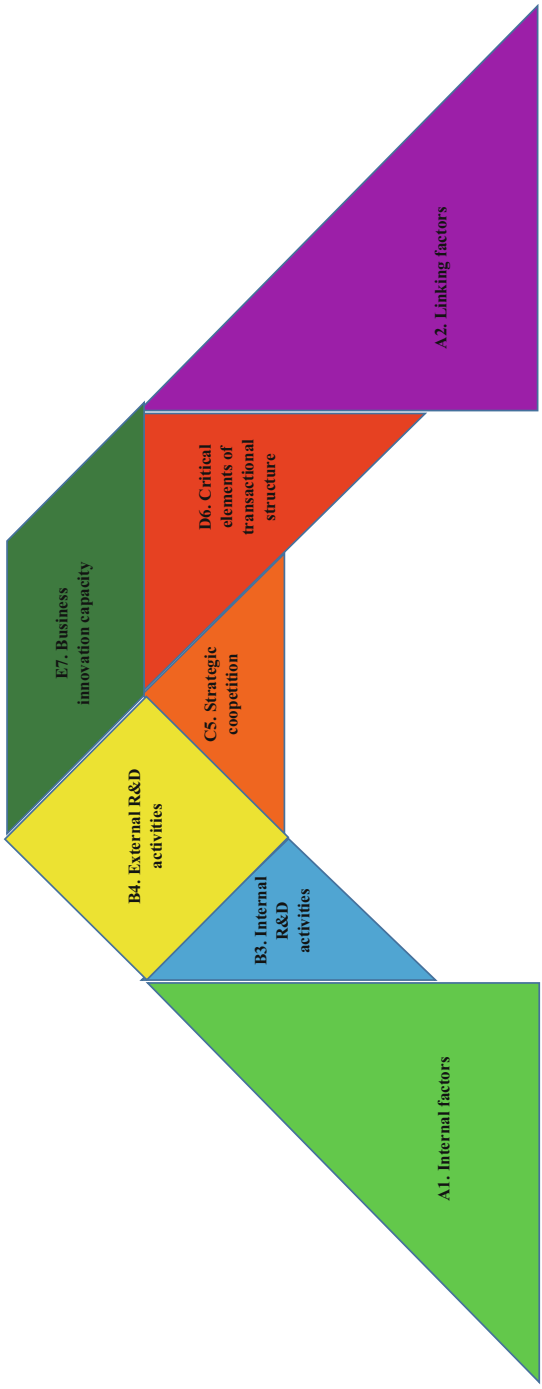


Fig. 1.3 Open innovation bridge: Tangram model. Source: Own elaboration

References

Abdelkafi, N., Makhotin, S., & Posselt, T. (2013). Business model innovations for electric mobility—What can be learned from existing business model patterns? *International Journal of Innovation Management, 17*, 1–42.

Abernathy, W., & Utterback, J. (1975). A dynamic model of process and product innovation. *Omega, 3*(6), 639–656.

Achtenhagen, L., Melin, L., & Naldi, L. (2013). Dynamics of business models—strategizing, critical capabilities and activities for sustained value creation. *Long Range Planning, 46*, 427–442.

Afuah, A., & Tucci, C. (2003). *Internet business models and strategies*. Boston: McGraw Hill.

Afuah, A. (2000). How much do your co-opetitors' capabilities matter in the face of technological change? *Strategic Management Journal, 21*(3), 397–404.

Alt, R., & Zimmermann, H. (2001). Introduction to special section on business models. *Electronic Markets, 11*(1), 3–9.

Amburgey, T., & Rao, H. (1996). Organizational ecology: Past, present and future directions. *Academy of Management Journal, 39*(5), 1265–1286.

Amit, R., & Zott, C. (2001). Value creation in E-business. *Strategic Management Journal, 22*(6/7), 493–520.

Amit, R., & Zott, C. (2012). Creating value through business model innovation. *MIT Sloan Management Review, 53*, 41–49.

Anderson, J., & Kupp, M. (2008). Serving the poor: Drivers of business model innovation in mobile. *Information, 10*, 5–12.

Aoki, R., & Schiff, A. (2008). Promoting access to intellectual property: Patent pools, copyright collectives and clearinghouses. *R&D Management, 38*, 189–204.

Applegate, L. (2001). *Emerging e-business Models: Lessons from the Field*, *HBS No. 9-801-172*. Harvard: Business School, Boston, MA.

Arora, A., & Gambardella, A. (1994). Evaluating technological information and utilizing it: Scientific knowledge, technological capability, and external linkages in biotechnology. *Journal of Economic Behavior and Organization, 24*, 91–114.

Aspara, J., Hietanen, J., & Tikkanen, H. (2010). Business model innovation vs. replication: Financial performance implications of strategic emphases. *Journal of Strategic Marketing, 18* (1), 39–56.

Aspara, J., Lamberg, J.-A., Laukia, A., & Tikkanen, H. (2013). Corporate business model transformation and inter-organisational cognition: The case of Nokia. *Long Range Planning, 46*, 459–474.

Bagshaw, M., & Bagshaw, C. (2001). Co-opetition applied to training—a case study. *Industrial and Commercial Training, 33*(4/5), 175–177.

Baptista, R., & Leitão, J. (2015). *Entrepreneurship, human capital and regional development*, International Studies in Entrepreneurship. USA: Springer . isbn:978-3-319-12870-2.

Baptista, R., Karaöz, M., & Mendonça, J. (2007). Entrepreneurial backgrounds, human capital and start-up success. (*Jena Economic Research Papers*, #2007-045, pp. 1–39).

Baumard, P. (2009). An asymmetric perspective on coopetitive strategies. *International Journal of Entrepreneurship and Small Business, 8*(1), 6–22.

Bean, R., & Radford, R. (2001). *The business of innovation: Managing the corporate imagination for maximum results*. New York: AMACOM.

Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research policy, 33*, 1477–1492.

Bell, M., & Pavitt, K. (1993). Technological accumulation and industrial growth: Contrasts between developed and developing countries. *Industrial and Corporate Change, 2*(2), 157–210.

Bengtsson, M., & Kock, S. (2000). Coopetition in business networks—to cooperate and compete simultaneously. *Industrial Marketing Management, 29*(5), 411–426.

Bengtsson, M., & Kock, S. (2003). Tension in co-opetition. *Academy of Marketing Science Annual Conference*, May 28–31, Washington DC.

Bengtsson, M., & Raza-Ullah, T. (2016). A systematic review of research on coopetition: Toward a multilevel understanding. *Industrial Marketing Management, 57*, 23–39.

Berglund, H., & Sandström, C. (2013). Business model innovation from an open systems perspective: Structural challenges and managerial solutions. *International Journal of Product Development, 18*, 274–285.

Bienstock, C., Gillenson, M., & Sanders, T. (2002). The complete taxonomy of web business models. *Quarterly Journal of Electronic Commerce, 3*(2), 173–186.

Birkinshaw, J., & Ansari, S. (2015). Understanding management models. In N. Foss & T. Saebi (Eds.), *Business model innovation: The organizational dimension*. Oxford: Oxford University Press.

Birkinshaw, J. (2012). *Reinventing management. Smarter choices for getting work done*. San Fransisco: John Wiley.

Bock, A., Opsahl, T., George, G., & Gann, D. (2012). The effects of culture and structure on strategic flexibility during business model innovation. *Journal of Management Studies, 49*, 279–305.

Bohnsack, R., Pinkse, J., & Kolk, A. (2014). Business models for sustainable technologies: Exploring business model evolution in the case of electric vehicles. *Research Policy, 43*, 284–300.

Bonaccorsi, A., Giannangeli, S., & Rossi, C. (2006). Entry strategies under competing standards: Hybrid business models in the open source software industry. *Management Science, 52*, 1085–1098.

Bonel, E., & Rocco, E. (2007). Coopeting to survive: Surviving coopetition. *International Studies of Management & Organization, 37*(2), 70–96.

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of the art and steps towards a research agenda. *Journal of Cleaner Production, 45*, 9–19.

Bouncken, R., & Fredrich, V. (2012). Coopetition: Performance implications and management antecedents. *International Journal of Innovation Management, 16*(5), 12500281–125002828.

Bouncken, R., & Kraus, S. (2013). Innovation in knowledge-intensive industries: The double-edged sword of coopetition. *Journal of Business Research, 66*(10), 2060–2070.

Bouncken, R., Gast, J., Kraus, S., & Bogers, M. (2015). Coopetition: A systematic review, synthesis, and future research directions. *Review of Management Science, 9*(3), 577–601.

Brandenburger, A., & Nalebuff, B. (1996). *Co-opetition*. Doubleday, New York: Currency.

Brolos, A. (2009). Innovative coopetition: The strength of strong ties. *International Journal of Entrepreneurship and Small Business, 8*(1), 110–134.

Brousseau, E., & Penard, T. (2006). The economics of digital business models: A framework for analyzing the economics of platforms. *Review of Network Economics, 6*(2), 81–110.

Bucherer, E., Eisert, U., & Gassmann, O. (2012). Towards systematic business model innovation: Lessons from product innovation management. *Creativity & Innovation Management, 21*, 183–198.

Camisón, C., & Forés, B. (2010). Knowledge absorptive capacity: New insights for its conceptualization and measurement. *Journal of Business Research, 63*(7), 707–715.

Casadesus-Masanell, R., & Ricart, J. (2010). From strategy to business models and onto tactics. *Long Range Planning, 43*(2-3), 195–215.

Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. *Strategic Management Journal, 34*, 464–482.

Cassiman, B., & Valentini, G. (2016). Open innovation: Are inbound and outbound knowledge flows really complementary? *Strategic Management Journal, 37*(6), 1034–1046.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in the innovation strategy: Internal R&D and external knowledge acquisition. *Management Science, 52*, 68–82.

Cassiman, B., Di Guardo, M., & Valentini, G. (2009). Organising R&D projects to profit from innovation: Insights from co-opetition. *Long Range Planning, 42*(2), 216–233.

Cassiolato, J., & Lastres, H. (2005). Sistemas de inovação e desenvolvimento: as implicações de política. *São Paulo em Perspectiva, 19*(1), 34–45.

Cavalcante, S. (2014). Preparing for business model change: The 'prestage' finding. *Journal of Management & Governance, 18*, 449–469.

Chesbrough, H., & Bogers, M. (2014). Explicating open innovation: Clarifying an emerging paradigm for understanding innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *New Frontiers in Open Innovation* (pp. 3–28). Oxford: Oxford University Press.

Chesbrough, H., & Rosenbloom, R. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change, 11*(3), 529–555.

Chesbrough, H., & Schwartz, K. (2007). Innovating business models with co-development partnerships. *Research & Technology Management, 50*(1), 55–59.

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

Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning, 43*, 354–363.

Chesbrough, H., Kim, S., & Agogino, A. (2014). Chez Panisse: Building an open innovation ecosystem. *California Management Review, 56*(4), 144–171.

Chesbrough, H., Vanhaverbeke, W., & West, J. (2006). *Open innovation: Researching a new paradigm*. New York: Oxford University Press.

Chiaroni, D., Chiesa, V., & Frattini, F. (2010). Unravelling the process from closed to open innovation: Evidence from mature, asset-intensive industries. *R&D Management, 40*(3), 222–245.

Chien, T., & Peng, T. (2005). Competition and cooperation intensity in a network—A case study in Taiwan simulator industry. *Journal of American Academy Business, 7*, 150–155.

Chin, K., Chan, B., & Lam, P. (2008). Identifying and prioritizing critical success factors for coopetition strategy. *Industry Management Data System, 108*(4), 437–454.

Cohen, W., & Levinthal, D. (1989). Innovation and learning: The two faces of R&D. *Economic Journal, 99*, 569–596.

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

Cohen, W., Nelson, R., & Walsh, J. (2002). Links and impacts: The influence of public research on industrial R&D. *Management Science, 48*, 1–23.

Coriat, B., & Weinstein, O. (2002). Organizations, firms and institutions in the generation of innovation. *Research Policy, 31*(2), 273–290.

Corso, M., Martini, A., Paolucci, E., & Pellegrini, L. (2003). Knowledge management configurations in Italian small-to-medium enterprises. *Integrated Manufacturing Systems, 14*(1), 46–57.

Cucculelli, M., & Bettinelli, C. (2015). Business models, intangibles and firm performance: Evidence on corporate entrepreneurship from Italian manufacturing SMEs. *Small Business Economics, 45*, 329–350.

Dagnino, G., & Rocco, E. (2009). *Coopetition strategy: Theory, experiments and cases*. New York: Routledge.

Dahl, J., Kock, S., & Lundgren, E.-L. (2016). Conceptualizing coopetition strategy as practice: A multilevel interpretative framework. *International Studies of Management and Organization, 46*, 94–109.

Dahlander, L., & Gann, D. (2010). How open is innovation? *Research Policy, 39*(6), 699–709.

Dahlander, L., O'Mahony, S., & Gann, D. (2016). One foot in, one foot out: How does individuals' external search breadth affect innovation outcomes? *Strategic Management Journal, 37*(2), 280–302.

Dana, L., Etemad, H., & Wright, R. (2008). Toward a paradigm of symbiotic entrepreneurship. *International Journal of Entrepreneurship and Small Business, 5*(2), 109–126.

De Reuver, M., Bouwman, H., & MacInnes, I. (2009). Business models dynamics for start-ups and innovating e-businesses. *International Journal of Electronic Business, 7*, 269–286.

Demil, B., & Lecocq, X. (2010). Business model evolution: In search of dynamic consistency. *Long Range Planning, 43*(2/3), 227–246.

Denicolai, S., Ramirez, M., & Tidd, J. (2014). Creating and capturing value from external knowledge: The moderating role of knowledge intensity. *R&D Management, 44*(3), 248–264.

Deshler, R., & Smith, K. (2011). Making business model innovation stick. *People & Strategy, 34* (4), 18–23.

Devezas, T., Leitão J., & Sarygulov, A. (2017), *Industry 4.0 – Entrepreneurship and structural change in the new digital landscape*, Studies on Entrepreneurship, Structural Change and Industrial Dynamics, Heidelberg, Germany: Springer isbn:978-3-319-49603-0.

Dmitriev, V., Simmons, G., Truong, Y., Palmer, M., & Schneckenberg, D. (2014). An exploration of business model development in the commercialization of technology innovations. *R&D Management, 44*(3), 306–321.

Dosi, G. (1988). The nature of the innovative process. In G. Dosi, C. Freeman, R. Nelson, G. Silverberg, & L. Soete (Eds.), *Technical change and economic theory* (pp. 221–238). London: Pinter Publishers.

Dowling, M., Roering, W., Carlin, B., & Wisnieski, J. (1996). Multifaceted relationships under coopetition description and theory. *Journal of Management Inquiry, 5*(2), 155–167.

Doz, Y., & Kosonen, M. (2010). Embedding strategic agility: A leadership agenda for accelerating business model renewal. *Long Range Planning, 43*(2/3), 370–382.

Drucker, P. (1994, September–October). Theory of the business. *Harvard Business Review* (pp 95–106), Boston, MA.

Dunford, R., Palmer, I., & Benviste, J. (2010). Business model replication for early and rapid internationalisation: The ING direct experience. *Long Range Planning, 43*(5/6), 655–674.

Dussauge, P., Garrette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal, 21*, 99–126.

Economist Intelligence Unit. (2005, February). Business 2010: Embracing the challenge of change. *White paper, Economist Intelligence Unit*, New York.

Eisenmann, T. (2006). Internet companies' growth strategies: Determinants of investment intensity and long-term performance. *Strategic Management Journal, 27*(12), 1183–1204.

Enberg, C. (2012). Enabling knowledge integration in coopetitive R&D projects—the management of conflicting logics. *International Journal of Project Management, 30*(7), 771–780.

Enkel, E., & Mezger, F. (2013). Imitation processes and their application for business model innovation: An explorative study. *International Journal of Innovation Management, 17*(1), 1–34.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&D Management, 39*(4), 311–316.

Enkel, E., Heil, S., Hengstler, M., & Wirth, H. (2016). Exploratory and exploitative innovation: To what extent do the dimensions of individual level absorptive capacity contribute? *Technovation, 60*, 29–38.

Eppler, M., & Hoffman, N. (2012). Does method matter? An experiment on collaborative business model idea generation in teams. *Innovation: Management, Policy & Practice, 14*(3), 388–403.

Eppler, M., Hoffmann, N., & Bresciani, S. (2011). New business models through collaborative idea generation. *International Journal of Innovation Management, 15*(6), 1323–1341.

Escribano, A., Fosfuri, A., & Tribó, J. (2009). Managing external knowledge flows: The moderating role of absorptive capacity. *Research Policy, 38*(1), 96–105.

Evans, J., & Johnson, R. (2013). Tools for managing early-stage business model innovation. *Research Technology Management, 56*(5), 52–56.

Fiet, J., & Patel, P. (2008). Forgiving business models for new ventures. *Entrepreneurship Theory and Practice, 32*(4), 749–761.

Foss, N., & Saebi, T. (2015). Business models and business model innovation: Bringing organization into the field. In N. Foss & T. Saebi (Eds.), *Business model innovation: The organizational dimension*. Oxford: Oxford University Press.

Foss, N., & Saebi, T. (2016). Fifteen years of research on business model innovation: How far have we come? And where should we go? *Journal of Management, 43*, 200–227.

Foss, N., Laursen, K., & Pedersen, T. (2011). Linking customer interaction and innovation: The mediating role of new organizational practices. *Organization Science, 22*(4), 980–999.

Frankenberger, K., Weiblen, T., Csik, M., & Gassmann, O. (2013). The 4I-framework of business model innovation: A structured view on process phases and challenges. *International Journal of Product Development, 18*(3), 249–273.

Freeman, C. (1979). The determinants of innovation. *Futures, 11*, 206–215.

Freeman, C. (1995). The national system of innovation in historical perspective. *Cambridge Journal of Economics, 19*(1), 5–24.

Gambardella, A., & McGahan, A. (2010). Business-model innovation: General purpose technologies and their implications for industry structure. *Long Range Planning, 43*(2/3), 262–271.

Gambardella, A. (1992). Competitive advantages from in-house basic research. *Research Policy, 21*(5), 391–407.

García-Morales, V., Bolívar-Ramosa, M., & Martín-Rojasb, R. (2015). Technological variables and absorptive capacity's influence on performance through corporate entrepreneurship. *Journal of Business Research, 67*(7), 1468–1477.

García-Morales, V., Jiménez Barrionuevo, M., & Gutiérrez Gutiérrez, L. (2012). Transformational leadership influence on organizational performance through organizational learning and innovation. *Journal of Business Research, 65*(7), 1040–1050.

García-Morales, V., Ruiz-Moreno, A., & Lloréns-Montes, F. (2007). Effects of technology absorptive capacity and technology proactivity on organizational learning, innovation and performance: An empirical examination. *Technology Analysis & Strategy Management, 19*(4), 527–558.

Garraffo, F. (2002). Types of coopetition to manage emerging technologies. In *2nd Annual Conference, Innovative Research in Management*, Stockholm, Sweden.

Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of open innovation. *R&D Management, 40*(3), 213–221.

Gast, J., Filser, M., Gundolf, K., & Kraus, S. (2015). Coopetition research: Towards a better understanding of past trends and future directions. *International Journal of Entrepreneurship and Small Business, 24*(4), 492–521.

George, G., & Bock, A. (2011). The business model in practice and its implications for entrepreneurship research. *Entrepreneurship Theory and Practice, 35*, 83–111.

Geroski, P. (2003). *The evolution of new markets*. Oxford: Oxford University Press.

Giesen, E., Berman, S., Bell, R., & Blitz, A. (2007). Three ways to successfully innovate your business model. *Strategy & Leadership, 35*(6), 27–33.

Girotra, K., & Netessine, S. (2013). Business model innovation for sustainability. *Manufacturing & Service Operations Management, 15*(4), 537–544.

Girotra, K., & Netessine, S. (2014). Four paths to business model innovation. *Harvard Business Review, 92*(7/8), 96–103.

Gnyawali, D., & Park, B. (2009). Co-opetition and technological innovation in small and medium-sized enterprises: A multilevel conceptual model. *Journal of Small Business Management, 47*(3), 308–330.

Gnyawali, D., & Park, B. (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. *Research Policy, 40*(5), 650–663.

Gordijn, J. (2002). *Value-based requirements engineering–Exploring innovative and commerce ideas*. Amsterdam: Nl, Vrije Universiteit.

Grimaldi, M., Corvello, V., Mauro, A., & Scarmozzino, E. (2017). A systematic literature review on intangible assets and open innovation. *Knowledge Management Research & Practice, 15*, 90–100. https://doi.org/10.1057/s41275-016-0041-7.

Günzel, F., & Holm, A. (2013). One size does not fit all—Understanding the front-end and backend of business model innovation. *International Journal of Innovation Management, 17*(1), 1340002-1–1340002-34.

Hakanen, T. (2014). Co-creating integrated solutions within business networks: The KAM team as knowledge integrator. *Industrial Marketing Management, 43*(7), 1195–1203.
Hall, N., & Wagner, M. (2012). Integrating sustainability into firms' processes: Performance effects and the moderating role of business models and innovation. *Business Strategy and the Environment, 21*, 183–196.
Hamel, G. (2000). *Leading the revolution*. Boston, MA: Harvard Business School Press.
Hansen, M., & Nohria, N. (2004). How to build collaborative advantage. *Sloan Management Review, 46*(1), 22–30.
Hienerth, C., Keinz, P., & Lettl, C. (2011). Exploring the nature and implementation process of user-centric business models. *Long Range Planning, 44*(5-6), 344–374.
Huang, H.-C., Lai, M.-C., Lin, L.-H., & Chen, C.-T. (2013). Overcoming organizational inertia to strengthen business model innovation: An open innovation perspective. *Journal of Organizational Change Management, 26*, 977–1002.
Hung, S.-W., & Chang, C.-C. (2012). A co-opetition perspective of technology alliance governance modes. *Technology Analysis & Strategic Management, 24*(7), 679–696.
Huston, L., & Sakkab, N. (2006). Connect and develop. *Harvard Business Review, 84*(3), 58–66.
Iansiti, M. (1998). *Technology integration: Making critical choices in a dynamic world*. Boston, MA: Harvard Business School Press.
IBM Global Business Services Survey. (2006). *Expanding the innovation Horizon: The global CEO study 2006*. Accessed in October 2016 from: http://www-07.ibm.com/sg/pdf/global_ceo_study.pdf.
Isenberg, D. (2010). How to start an entrepreneurial revolution. *Harvard Business Review, 88*(6), 41–50.
Itami, H., & Nishino, K. (2010). Killing two birds with one stone: Profit for now and learning for the future. *Long Range Planning, 43*(2010), 364–369.
Janszen, F. (2000). *The age of innovation: Making business creativity a competence. Not a coincidence*. New Jersey: Prentice Hall.
Jarzabkowski, P. (2005). *Strategy as practice: An activity based approach*. London: SAGE.
Jiang, H., & Chen, J. (2000). Integrated innovation patterns. *Management of Science and Research (Chinese Journal), 21*(5), 31–39.
Johnson, M., Christensen, C., & Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review, 86*(12), 50–59.
Jong, J., & Marsili, O. (2006). The fruit flies of innovations: A taxonomy of innovative small firms. *Research Policy, 35*, 213–229.
Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal, 45*(6), 1183–1194.
Katila, R. (2002). New product search over time: Past ideas in their prime? *Academy of Management Journal, 45*(5), 995–1010.
Kaufmann, A., & Tödtling, F. (2001). Science-industry interaction in the process of innovation: The importance of boundary-crossing between systems. *Research Policy, 30*(5), 791–804.
Keinz, P., Hienerth, C., & Lettl, C. (2012). Designing the organization for user-driven innovation. *Journal of Organizational Design, 1*(3), 20–36.
Khanagha, S., Volberda, H., & Oshri, I. (2014). Business model renewal and ambidexterity: Structural alteration and strategy formation process during transition to a Cloud business model. *R&D Management, 44*, 322–340.
Kim, L. (2001). Absorptive capacity, co-opetition, and knowledge creation: Samsung's leapfrogging in semiconductors. In I. Nonaka & T. Nishiguchi (Eds.), *Knowledge emergence: Social, technical, and evolutionary dimensions of knowledge creation* (pp. 281–297). New York: Oxford.
Kim, S., & Min, S. (2015). Business model innovation performance: When does adding a new business model benefit an incumbent? *Strategic Entrepreneurship Journal, 9*(1), 34–57.
King, A., & Lakhani, K. (2011). The contingent effect of absorptive capacity: An open innovation analysis. *Harvard Business School Working Paper*: 11–102.

Kirschbaum, R. (2005). Open innovation in practice. *Research Technology Management, 48*(4), 24–28.

Kline, S., & Rosenberg, N. (1986). An overview of innovation. In R. Laudau & N. Rosenberg (Eds.), *The positive sum strategy: Harnessing technology for economic growth*. Washington: National Academy Press.

Koen, P., Bertels, H., & Elsum, M. (2011). The three faces of business model innovation: Challenges for established firms. *Research Technology Management, 54*, 52–59.

Kostopoulos, K., Papalexandris, A., Papachroni, M., & Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research, 64(12*, 1335–1343.

Kuhn, T. (1961). The function of measurement in modern physical science. *Isis, 52*(168), 161–193.

Lane, P., Balaji, R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review, 31*(4), 863–883.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal, 27* (2), 131–150.

Leitão, J. & Baptista, R. (2009), *Public policies for fostering entrepreneurship: A European Perspective*, Series: International Studies in Entrepreneurship, 22, Springer, July 2009., USA.

Leitão, J., & Baptista, R. (2011). Inward FDI and ICT: Are they a joint technological driver of entrepreneurship? *International Journal of Technology Transfer and Commercialization, 10* (3/4), 268–288.

Leitão, J., Alves, H., Krueger, N., & Park, J. (Eds.). (2018). *Entrepreneurial, innovative and sustainable ecosystems—Best practices and implications for quality of life*, *Applying Quality of Life Research: Best Practices*. Cham, Switzerland: Springer.

Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal, 13*(S1), 111–125.

Levy, M., Loebbecke, C., & Powell, P. (2003). SMEs, co-opetition and knowledge sharing: The role of information systems. *European Journal of Information Systems, 12*(1), 3–17.

Li, X. (2011). Sources of external technology, absorptive capacity, and innovation capability in Chinese state-owned high-tech enterprises. *World Development, 39*(7), 1240–1248.

Lin, R., Che, R., & Ting, C. (2012). Turning knowledge management into innovation in the high-tech industry. *Industrial Management & Data System, 112*(1), 42–63.

Linder, J., & Cantrell, S. (2001). Changing Business Models: Surveying the landscape (*Working Paper, Accenture Institute for Strategic Change*).

Liu, R. (2013). Cooperation, competition and coopetition in innovation communities. *Prometheus, 31*(2), 91–105.

Lucena, A., & Roper, S. (2016). Absorptive capacity and ambidexterity in R&D: Linking technology alliance diversity and firm innovation. *European Management Review, 13*, 159–178. https://doi.org/10.1111/emre.12074:1740-4762.

Lundvall, B.-Å. (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*. London: Pinter Publishers.

Luo, X., & Slotegraaf, R. (2006). Cross-functional coopetition: The simultaneous role of cooperation and competition within firms. *Journal of Marketing, 70*(2), 67–80.

Luo, X., Rindfleisch, A., & Tse, D. (2007). Working with rivals: The impact of competitor alliances in financial performance. *Journal of Marketing Research, 44*(1), 73–83.

Luo, Y. (2004). A coopetition perspective of MNC-host government relations. *Journal of International Management, 10*(4), 431–451.

Magretta, J. (2002). Why business models matter. *Harvard Business Review, 80*(5), 86–92.

Mahadevan, B. (2000). Business models for Internet-based e-commerce: An anatomy. *California Management Review, 42*(4), 55–69.

Markides, C. (2006). Disruptive Innovation: In need of better theory'. *Journal of Product Innovation Management, 23*(1), 19–25.

Markides, C. (2008). *Game-changing strategies: How to create new market space in established industries by breaking the rules*. New York: Jossey-Bass.

Martín-de Castro, G. (2015). Knowledge management and innovation in knowledge-based and high-tech industrial markets: The role of openness and absorptive capacity. *Industrial Marketing Management, 47*, 143–146.

McGrath, R. (2010). Business models: A discovery-driven approach. *Long Range Planning, 43*, 247–261.

Mezger, F. (2014). Toward a capability-based conceptualization of business model innovation: Insights from an explorative study. *R&D Management, 44*, 429–449.

Mitchell, D., & Coles, C. (2004). Business model innovation breakthrough moves. *Journal of Business Strategy, 25*, 16–26.

Mitchell, D., & Coles, C. (2003). The ultimate competitive advantage of continuing business model innovation. *Journal of Business Strategy, 24*, 15–22.

Moingeon, B., & Lehmann-Ortega, L. (2010). Creation and implementation of a new business model: A disarming case study. *Management, 13*, 266–297.

Monitor Group. (2009). *Paths to prosperity: Promoting entrepreneurship in the 21st century*. Monitor Group, Accessed in October 2016, http://www.compete.monitor.com/App_Themes/MRCCorpSite_v1/DownloadFiles/NED_re port_final.pdf.

Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur.s business model: Toward a unified perspective. *Journal of Business Research, 58*(6), 726–735.

Myers, S., & Marquis, D. (1969). *Successful industrial innovation: A study of factors underlying innovation in selected firms*. Washington DC: National Science Foundation, NSF 69-17.

Nambisan, S., & Baron, R. (2013). Entrepreneurship in innovation ecosystems: Entrepreneurs' self-regulatory processes and their implications for new venture success. *Entrepreneurship Theory and Practice, 37*(5), 1071–1097.

Nelson, R., & Winter, S. (1982). *An evolutionary theory of the firm*. Cambridge, MA: Harvard University Press.

Nelson, R. (1959). The simple economics of basic scientific research. *Journal of Political Economy, 67*(3), 297–306.

Nieto, M., & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation, 27*(6-7), 367–377.

Noblet, J., Simon, E., & Parent, R. (2011). Absorptive capacity: A proposed operationalization. *Knowledge Management Research & Practice, 9*, 367–377.

Nooteboom, B., Berger, H., & Noorderhaven, N. (1999). Effects of trust and governance on relational risk. *Academy of Management Journal, 40*(2), 308–338.

Omidvar, O. (2013). Revisiting absorptive capacity: Literature review and a practice-based extension of the concept. *35th DRUID Celebration Conference 2013*, Barcelona, Spain, 17–19, June.

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*. Hoboken NJ: John Wiley & Sons.

Osterwalder, A. (2004), *The business model ontology—A proposition in a design science approach*. Dissertation 173, University of Lausanne, Switzerland

Osterwalder, A., Pigneur, Y., & Tucci, C. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the Association for Information Systems, 16*, 1–25.

Padula, G., & Dagnino, G. (2007). Untangling the rise of coopetition. *International Studies and Management & Organization, 37*(2), 32–52.

Park, S., & Russo, M. (1996). When competition eclipses cooperation: An event history analysis of joint venture failure. *Management Science, 42*(6), 875–890.

Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy, 13*, 343–373.

Pellegrin-Boucher, E., Le Roy, F., & Guräu, C. (2013). Coopetitive strategies in the ICT sector: Typology and stability. *Technology Analysis & Strategic Management, 25*(1), 71–89.

Pereira, D., & Leitão, J. (2016). Absorptive capacity, coopetition and product innovation: Contrasting Italian and Portuguese manufacturing firms. *International Journal of Technology Management, 71*(1/2), 10–37.

Petroni, G., Venturini, K., & Verbano, C. (2011). Open innovation and new issues in R&D organization and personnel management. *The International Journal of Human Resource Management, 23*(1), 147–173.

Pohle, G., & Chapman, M. (2006). IBM's global CEO report 2006: Business model innovation matters. *Strategy & Leadership, 34*, 34–40.

Porter, M., & Kramer, M. (2011). Creating shared value. *Harvard Business Review, 89*(1–2), 63–70.

Pynnonen, M., Hallikas, J., & Ritala, P. (2012). Managing customer-driven business model innovation. *International Journal of Innovation Management, 16*, 1–18.

Qingrui, X., Chen, J., Xie, Z., Liu, J., Zheng, G., & Wang, Y. (2007). Total innovation management: A novel paradigm of innovation management in the 21st century. *Journal of Technology Transfer, 32*(1-2), 9–25.

Quintana-Garcia, C., & Benavides-Velasco, C. (2004). Cooperation, competition, and innovative capability: A panel data of European dedicated biotechnology firms. *Technovation, 24*(12), 927–938.

Rappa M. (2001). *Business models on the web*. Accessed in October 2016, http://digitalenterprise.org/models/models.html

Rayna, T., & Striukova, L. (2015). Open innovation 2.0: Is co-creation the ultimate challenge? *International Journal of Technology Management, 69*(1), 38–53.

Richter, M. (2013). Business model innovation for sustainable energy: German utilities and renewable energy. *Energy Policy, 62*, 1226–1237.

Ritala, P., & Hurmelinna-Laukkanen, P. (2009). What's in it for me? Creating and appropriating value in innovation-related coopetition. *Technovation, 29*(12), 819–828.

Ritala, P., & Hurmelinna-Laukkanen, P. (2013). Incremental and radical innovation in coopetition—the role of absorptive capacity and appropriability. *Journal of Product Innovation Management, 30*(1), 154–169.

Ritala, P., Golnam, A., & Wegmann, A. (2014). Coopetition-based business models: The case of Amazon.com. *Industrial Marketing Management, 43*, 236–249.

Rodrigues, F., Souza, V., & Leitão, J. (2011). Strategic Coopetition of Global Brands: A game theory approach to 'Nike + iPod Sport Kit' Co-branding. *International Journal of Entrepreneurial Venturing, 3*(4), 435–455.

Rothaermel, F., & Alexandre, M. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science Archive, 20*(4), 759–780.

Rothwell, R., & Zegveld, W. (1981). *Industrial innovation and public policy*. London: Frances Pinter.

Roy, P., & Yami, S. (2009). Managing strategic innovation through coopetition. *International Journal of Entrepreneurship and Small Business, 8*(1), 61–73.

Rusko, R. (2011). Exploring the concept of coopetition: A typology for the strategic moves of the Finnish forest industry. *Industrial Marketing Management, 40*(2), 311–320.

Salge, T., Bohne, T., Farchi, T., & Piening, E. (2012). Harnessing the value of open innovation: The moderating role of innovation management. *International Journal of Innovation Management, 16*(03), 1–26.

Salter, A., Criscuolo, P., & ter Wal, A. (2014). Coping with open innovation: Responding to the challenges of external engagement in R&D. *California Management Review, 56*(2), 77–94.

Salvetat, D., Géraudel, M., & D'Armagnac, S. (2013). Interorganizational knowledge management in a coopetitive context in the aeronautic and space industry. *Knowledge Management Research & Practice, 11*(3), 265–277.

Sánchez, P., & Ricart, J. (2010). Business model innovation and sources of value creation in low-income markets. *European Management Review, 7*, 138–154.

Sánchez-Sellero, P., Rosell-Martíneza, J., & García-Vázquez, J. (2014). Absorptive capacity from foreign direct investment in Spanish manufacturing firms. *International Business Review, 23*(2), 429–439.

Santos, J., Spector, B., & Van der Heyden, L. (2009). Toward a theory of business model innovation within incumbent firms (*INSEAD Working Papers #16*).

Santos, J., Spector, B., & van der Heyden, L. (2015). Toward a theory of business model change. In N. Foss & T. Saebi (Eds.), *Business model innovation: The organizational dimension*. Oxford: Oxford University Press.

Schmookler, J. (1966). *Invention and economic growth*. Cambridge, MA: Harvard University Press.

Schneider, S., & Spieth, P. (2013). Business model innovation: Towards an integrated future research agenda. *International Journal of Innovation Management, 17*, 134–156.

Schumpeter, J. (1911). *The theory of economic development, 1934 translation*. New Jersey: Transaction Books.

Schumpeter, J. (1942). *Capitalism, socialism and democracy* (5th ed.). London: George Allen & Unwin.

Shapiro, S. (2001). *24/7 Innovation: A blueprint for surviving and thriving in an age of change*. New York: McGraw Hill.

Sikimic, U., Chiesa, V., Frattini, F., & Scalera, V. (2016). Investigating the influence of technology inflows on technology outflows in open innovation processes: A longitudinal analysis. *Journal of Product Innovation Management, 33*(6), 652–669.

Silva, M., & Leitão, J. (2009). Cooperation in innovation practices among firms in Portugal: Do external partners stimulate innovative advances? *International Journal of Entrepreneurship and Small Business, 7*(4), 391–403.

Sombart, W. (1928). *O capitalismo moderno*. Munique and Leipzig: Duncker and Humblot.

Sorescu, A., Frambach, R., Singh, J., Rangaswamy, A., & Bridges, C. (2011). Innovations in retail business models. *Journal of Retailing, 87*, 3–16.

Sosna, M., Trevinyo-Rodriguez, R., & Velamuri, S. (2010). Business model innovation through trial-and-error learning: The Naturhouse Case. *Long Range Planning, 43*, 383–407.

Stieglitz, N., & Foss, N. (2009). Opportunities and new business models: Transaction cost and property rights perspectives on entrepreneurship. In J. Nickerson & B. Silverman (Eds.), *Economic Institutions of Strategy*, *Advances in Strategic Management* (Vol. 26, pp. 67–96). Bingley, UK: Emerald Group Publishing Limited.

Stokes, D. (2005). *O Quadrante de Pasteur: a ciência básica e a inovação tecnológica*. Campinas: Unicamp.

Storbacka, K., Frow, P., Nenonen, S., & Payne, A. (2012). Designing business models for value creation. *Review of Marketing Research, 9*, 51–78.

Suddaby, R. (2010). Editor's comments: Construct clarity in theories of management and organization. *Academy of Management Journal, 35*, 346–357.

Teece, D. (2010). Business models, business strategy and innovation. *Long Range Planning, 43* (2/3), 172–194.

Tether, B. (2002). Who co-operates for innovation, and why: An empirical analysis. *Research Policy, 31*(6), 947–967.

Tidd, J., Bessant, J., & Pavitt, K. (2001). *Managing innovation: Integrating technological, market, and organizational change*. New York: John Wiley & Sons.

Tigre, P. (1998). Inovação e teorias da firma em três paradigmas. *Revista de Economia Contemporânea, 3*, 67–111.

Tigre, P. (2005). Paradigmas tecnológicos e teorias econômicas da firma. *Revista Brasileira de Inovação, 4*(1), 187–224.

Tikkanen, H., Lamberg, J.-A., Parvinen, P., & Kallunki, J.-P. (2005). Managerial cognition, action and the business model of the firm. *Management Decision, 43*(6), 789–809.

Timmers, P. (1998). Business models for electronic markets. *Electronic Markets, 8*(2), 3–8.

Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review, 32*(3), 774–786.

Tsai, W. (2002). Social structure of coopetition within a multiunit organization, competition and intraorganizational knowledge sharing. *Organization Science, 13*(2), 179–190.

Tucker, R. (2002). *Driving growth through innovation: How leading firms are transforming their futures*. San Francisco: Berrett-Koehler Publishers Inc..

Uhlenbruck, K., Hitt, M., & Semadeni, M. (2006). Market value effects of acquisitions involving Internet firms: A resource-based analysis. *Strategic Management Journal, 27*(10), 899–913.

van de Vrande, V., Lemmens, C., & Vanhaverbeke, W. (2006). Choosing governance modes for external technology sourcing. *R&D Management, 36*(3), 347–363.

van der Borgh, M., Cloodt, M., & Romme, A. (2012). Value creation by knowledge-based ecosystems: Evidence from a field study. *R&D Management, 42*(2), 150–169.

van der Meer, H. (2007). Open innovation—the Dutch treat: Challenges in thinking in business models. *Creativity and Innovation Management, 6*(2), 192–202.

Vasudeva, G., & Anand, J. (2011). Unpacking absorptive capacity: A study of knowledge utilization from alliance portfolio. *The Academy of Management Journal, 54*(3), 611–623.

Vega-Jurado, J., Gutiérrez-Garcia, A., & Fernández-de-Lucio, I. (2008). Analyzing the determinants of firm's absorptive capacity. *R&D Management, 38*(4), 392–405.

Velu, C., & Jacob, A. (2014). Business model innovation and owner-managers: The moderating role of competition. *R&D Management, 46*(3), 451–463. https://doi.org/10.1111/radm.12095.

Visnjic Kastalli, I., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management, 31*, 169–180.

Voelpel, S., Leibold, M., & Tekie, E. (2004). The wheel of business model reinvention: How to reshape your business model to leapfrog competitors. *Journal of Change Management, 4*, 259–276.

Volberda, H., Foss, N., & Lyles, M. (2010). Absorbing the concept of absorptive capacity: How to realize its potential in the organization field. *Organization Science, 21*, 931–951.

Von Hippel, E. (1988). *The sources of innovation*. New York: Oxford University Press.

Vrontis, D., Thrassou, A., Santoro, G., & Papa, A. (2016). Ambidexterity, external knowledge and performance in knowledge-intensive firms. *Journal of Technology Transfer, 42*, 374–388. https://doi.org/10.1007/s10961-016-9502-7.

Walley, K. (2007). Coopetition—an introduction to the subject and an agenda for research. *International Studies of Management & Organization, 37*(2), 11–31.

Wei, Z., Yang, D., Sun, B., & Gu, M. (2014). The fit between technological innovation and business model design for firm growth: Evidence from China. *R&D Management, 44*, 288–305.

Weill, P., Malone, T., D'Urso, V., Herman, G., & Woerner, S. (2005). Do some business models perform better than others? A study of the 1000 largest US firms. *MIT Sloan School of Management Working Paper N.º226*, Sloan School of Management Massachusetts Institute of Technology.

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

Wheatley, M. (2001). We are all innovators. In F. Hesselbein, M. Goldsmith, & I. Somerville (Eds.), *Leading for innovation: And organizing for results* (pp. 11–21). San Francisco: Jossey-Bass.

Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law and Economics, 22*(2), 233–261.

Winter, S., & Szulanski, G. (2001). Replication as strategy. *Organization Science, 12*(6), 730–743.

Wirtz, B., Pistoia, A., Ullrich, S., & Göttel, V. (2016). Business Models: Origin, development and future research. *Long Range Planning, 49*(1), 36–54.

Wirtz, B., Schilke, O., & Ullrich, S. (2010). Strategic development of business models: Implications of the Web 2.0 for creating value on the Internet. *Long Range Planning, 43*(2/3), 272–290.

Wright, R., & Dana, L. P. (2003). Changing paradigms of international entrepreneurship strategy. *Journal of International Entrepreneurship, 1*, 135–152.

Wu, A., & Voss, H. (2015). When does absorptive capacity matter for international performance of firms? Evidence from China. *International Business Review, 24*(2), 344–351.

Xu, Q., & Chen, Z. (2001). *The basic law and pattern of firm's business management*. Hangzhou: Zhejiang University Press.

Xu, Q., Chen, J., & Guo, B. (1997). A theoretic model and an empirical analysis of technology innovation portfolio. *Science and Research Management (Chinese Journal), 18*(3), 29–35.

Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010). Building social business models: Lessons from the Grameen experience. *Long Range Planning, 43*(2/3), 308–325.

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

Zahra, S., & Hayton, J. (2008). The effect of international venturing on firm performance: The moderating influence of absorptive capacity. *Journal of Business Venturing, 3*(2), 195–220.

Zott, C., & Amit, R. (2007). Business model design and the performance of entrepreneurial firms. *Organization Science, 18*(2), 181–199.

Zott, C., & Amit, R. (2008). The fit between product market strategy and business model: Implications for firm performance. *Strategic Management Journal, 29*(1), 1–26.

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning, 43*(2), 216–226.

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent developments and future research. *Journal of Management, 37*(4), 1019–1042.

Part II
Empirical Application of Open Innovation Business Models

Chapter 2
Methodological Design and Empirical Findings

2.1 Sample, Database and Model

This empirical application aims to assess the influence of internal and liaison factors, characterized by different resources and transactional elements on business innovation capacity, contrasting industrial firms and service firms, in the context of open innovation with strategic coopetition.

Therefore, using the CIS 2010—*Community Innovation Survey* database, to which access was gained through the inter-institutional protocol signed between the National Statistics Institute and the Instituto Superior Técnico (IST) of the University of Lisbon, data on Portuguese firms were collected and combined. The sample is formed of 1133 firms, of which 562 are industrial and 571 services.[1] After confirming the statistical validity of both sub-samples, they are submitted to an estimation process, resorting to a logistic regression, in order to estimate the probability associated with different determinant factors of business innovation capacity.

A logistic regression is justified as this empirical application involves the modeling of response variables, of the binary type. Binary data are very common in the typology of categorical data, their modeling being included in the category of linear regression models (McCullagh and Nelder 1989).

This type of regression is appropriate to analyze the relationship between a categorical variable and one or more predictive variables (Peng and So 2002). Logistic regression is a method with simplified use, inasmuch as it facilitates substantive interpretation of parameters, as well as forecasting probable locations of occasional events, which have not yet been observed (Agresti 1996).

[1]Division of the sample was according to the 2nd revision of NACE—Statistical Nomenclature of Economic Activities from Eurostat, as regards coding by sector of activity: http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf

© Springer International Publishing AG, part of Springer Nature 2019

J. Leitão, *Open Innovation Business Modeling*, Contributions to Management Science, https://doi.org/10.1007/978-3-319-91282-0_2

It should be noted that the database was treated in order to eliminate situations of missing data, since logistic regression does not allow treatment of this type of situation (Zhang et al. 2014).

Therefore, a selected specification of a logistic regression model was used to forecast the influence of a set of binary variables on the binary response variable regarding product/service innovation, irrespective of being an industrial or service firm, considering the residual term (ε_k).

The estimation process is based on application of the maximum likelihood procedure and takes into consideration the specification of the following model[2]:

$$Logit\,(CIE_i) = \beta_0 + \beta_1 FI_{1j} + \beta_2 FL_{2k} + \beta_3 I\&D\text{int}_{3l} + \beta_4 I\&Dext_{4m} + \beta_5 Coop_{5n} + \varepsilon_k \quad (2.1)$$

where: CIE_i = Business innovation capacity (E7); FI_{1j} = Internal factors (A1); FL_{2k} = Liaison factors (A2); $I\&Dint_{3l}$ = Internal R&D activities (B3); $I\&Dext_{4m}$ = External R&D activities (B4); $Coop_{5n}$ = Strategic coopetition (C5); and ε_k = Error term; with: $i = 1,\ldots,1133$ *firms*; $j = 1,\ldots,4$; $k = 1,\ldots,3$; $l = m = n = 1$.

The logistic regression functions are calculated considering the logarithm of probabilities: logit(P) = log P/(1−P). As recommended by Finney (1947), despite the possibility of representing the relationship between a logit-type or probit-type model by the following:

$$Logit \approx \left(\pi/\sqrt{3}\right) \cdot Probit; \quad (2.2)$$

the use of logit-type models is preferable in the presence of extreme levels of independent variables or when we have databases with a high number of observations, which is adjustable to the present empirical application.

2.2 Variables

2.2.1 Dependent Variable

In the context of this empirical application, interest is centered on identification of the critical elements of the component referring to the transactional structure (D6) of the open innovation business model, using the (internal and liaison) factors activating absorptive capacity that can affect the component representing the innovation capacity of industrial or service firms (E7). Therefore, the dependent (or response) variable represents product/service innovation (in this application, a new variable

[2]Hereafter, to facilitate comprehension of the articulation between the proposal: Open innovation bridge—Tangram model; and the empirical application; the identification codes referring to the components of the conceptual model proposed in Sect. 2.5 will appear in parentheses.

was calculated capturing whether the firm created product innovations and/or service innovations), which is a binary variable corresponding to product/service innovation (i.e., equal to *1* for a firm that introduced a product/service innovation to the market, and equal to *0* otherwise). That variable excludes new products/services acquired from other firms or simple esthetic improvements. The dependent variable is used as a proxy to assess business innovation capacity, in the molds previously applied by Tether (2002), Quintana-Garcia and Benavides Velasco (2004), Rusko (2011) and Pereira and Leitão (2016), according to the data available on the CIS Survey.

2.2.2 Independent Variables

A set of independent variables was selected to represent the component referring to absorptive capacity (A). Firstly, consideration was given to internal factors (or resources) (A1) that determine business innovation capacity, namely: acquisition of another type of external knowledge (A11); acquisition of equipment, software and licenses (A12) (Nelson and Winter 1982; March 1991; Lundvall and Johnson 1994; Van den Bosch et al. 1999; Johnson et al. 2002; Zahra and George 2002; Nerkar and Roberts 2004; Vinding 2004; Miller et al. 2007; Rothaermel and Alexandre 2009; Heras 2014; Pereira and Leitão 2016); employees' academic qualifications (A13) (Cohen and Levinthal 1989, 1990, 1994; Rothwell and Dodgson 1991; Mangematin and Nesta 1999; Narula 2004; Vinding 2000, 2004; Giuliani and Bell 2005); and employees' training to develop innovation activities (A14) (Nelson and Winter 1982; March 1991; Delaney and Huselid 1996; Koch and McGrath 1996; Nerkar and Roberts 2004; Miller et al. 2007; Heras 2014). Secondly, regarding the liaison factors (or transactional elements) (A2), these included cooperation links with consultants (A21), universities (A22) and laboratories (A23) (Jaffe 1989; Cockburn and Henderson 1998; Cohen et al. 2002; Kostopoulos et al. 2011; Li 2011; Vasudeva and Anand 2011; Pereira and Leitão 2016).

Thirdly, the open innovation component (B3), considers a variable referring to internal R&D activities (Cohen and Levinthal 1989; Gambardella 1992; Cassiman and Veugelers 2006; Li 2011; Pereira and Leitão 2016). Fourthly, the variable representing external R&D activities is used (Nelson and Winter 1982; March 1991; Lundvall and Johnson 1994; Van den Bosch et al. 1999; Johnson et al. 2002; Zahra and George 2002; Nerkar and Roberts 2004; Vinding 2004; Miller et al. 2007; Rothaermel and Alexandre 2009; Heras 2014; Pereira and Leitão 2016).

As for the component related to strategic coopetition (C5), an informative variable about cooperation with competing firms is considered (Lundvall 1988; Jaffe 1989; Freeman 1991, 1994; Sako 1994; Shaw 1994; Brandenburger and Nalebuff 1996; Coombs et al. 1996; Dussauge et al. 2000; Garraffo 2002; Tether 2002; Cohen et al. 2002; Quintana-Garcia and Benavides-Velasco 2004; Rusko 2011; Pereira and Leitão 2016).

Table 2.1, below, presents a concise description of the variables, using the descriptive statistics and the corresponding coefficients of linear correlation.

Table 2.1 Descriptive statistics and linear correlation coefficients

Tangram model	Variables	Description	Mean	Stand. Dev.	CIE	Resources					Transactional elements				CE			
					E7	A11	A12	A13	A14	B3	A21	A22	A23	B4	C5	Cont_1	Cont_2	Cont_3
CIE	Product/service innovation (E7)	Creation of new products or services, if yes *1*, if no *0*	0.808	0.394	1.000													
Resources	Acquisition of other external knowledge (A11)	Acquisition of external knowledge, if yes *1*, if no *0*	0.555	0.497	0.160	1.000												
	Acquisition of equipment, software and licenses (A12)	Acquisition of equipment, software and licenses, if yes *1*, if no *0*	0.206	0.404	0.092	0.288	1.000											
	Employees' academic qualifications (A13)	Employees with a university degree, if yes *1*, if no *0*	0.682	0.466	0.125	0.411	0.295	1.000										
	Employees' training to develop innovation activities (A14)	Employees with training in innovation, if yes *1*, if no *0*	0.211	0.408	0.086	0.179	0.170	0.204	1.000									
	Internal R&D activities (B3)	Internal R&D activities, if yes *1*, if no *0*	0.447	0.622	0.158	0.180	0.161	0.182	0.140	1.000								
Transactional elements	Cooperation links with consultants (A21)	Firm cooperates with consultants, if yes *1*, if no *0*	0.433	0.595	0.132	0.159	0.132	0.175	0.081	0.486	1.000							
	Cooperation links with universities (A22)	Firm cooperates with universities, if yes *1*, if no *0*	0.536	0.535	−0.019	−0.235	−0.105	−0.500	0.080	0.145	0.210	1.000						
	Cooperation links with laboratories (A23)	Firm cooperates with laboratories, if yes *1*, if no *0*	0.595	0.491	0.110	0.049	0.144	−0.049	0.100	0.147	0.135	0.211	1.000					
	External R&D activities (B4)	External R&D activities, if yes *1*, if no *0*	0.603	0.490	0.145	0.369	0.296	0.422	0.141	0.133	0.148	−0.222	0.123	1.000				
Strategic coopetition	Strategic coopetition (C5)	Firm coopetes with competing firms, if yes *1*, if no *0*	0.275	0.548	0.125	0.213	0.226	0.259	0.675	0.304	0.216	0.029	0.080	0.167	1.000			

Controls	NACE (Cont_1)	Classification of sector of activity	50.202	21.624	−0.032	−0.206	−0.089	−0.454	−0.001	−0.123	−0.065	0.369	0.117	−0.240	−0.084	1.000		
	Size (Cont_2)	1: 10–49 employees ; 2: 50–249 employees; 3: + 250 employees.	1.740	0.798	0.074	0.077	0.083	0.171	−0.018	0.145	0.118	−0.022	0.131	0.142	0.004	0.058	1.000	
	Sector (Cont_3)	Firm's sector of activity, if services *1*, if industrial *0*	1.496	0.500	0.020	0.309	0.167	0.574	0.014	0.161	0.114	−0.449	−0.127	0.332	0.152	−0.767	0.089	1.000

Total number of observations (N): 1133
Source: Own elaboration

2.2.3 Control Variables

For control purposes, the classification of economic activities mentioned above is used: NACE Eurostat; including two-digit disaggregation by sector of activity (the sector codes available on the CIS 2010 database).

Therefore, a dichotomic variable was calculated, this having been disaggregated into industrial firms and service firms. In addition, size was used as a control variable, since this is an instrumental variable commonly used in the literature containing empirical applications on entrepreneurship, open innovation, business innovation capacity and SME management. Here, the number of employees was divided in three intervals, namely: [1; 49]; [50; 249]; and $\geq$250 employees.

2.3 Results

2.3.1 Descriptive Statistics and Multicollinearity Analysis

Table 2.1 presents a set of descriptive statistics for a database that includes 1133 firms. The database is of a considerable size, making it a real asset to ensure the robustness of the estimators obtained in this analysis. Concerning the sample formation, service firms account for 50.4%, while industrial firms make up 49.6% of the total.

Referring to the descriptive statistics presented in Table 2.1, on average, firms are observed to have between 0 and 49 employees. Furthermore, 81% of firms created product innovation, and it stands out that regarding resources: 56% usually acquired other external knowledge (A11); 21% acquired equipment, software and licenses (A12); 68% had employees with higher education (A13); 21% of firms organized training actions for employees in areas related to innovation (A14); and 45% carried out internal R&D activities (B3). In addition, concerning transactional elements: 43% formed cooperation relationships with consultants (A21); 54% with universities (A22); 60% with laboratories (A23); and 60% also carried out external R&D activities (B4). As for carrying out actions of strategic coopetition (C5), 28% showed coopetition relationships with other competing firms.

Table 2.2 presents the VIF (*Variance Inflation Factor*) coefficients obtained for the above-mentioned variables, which are situated between 1 and 5, indicating the existence of some linear correlation between the variables, although not sufficient to cause a problem of multicollinearity.

Table 2.2 Multicollinearity analysis

Tangram model	Variables	Standard coefficients	Sig.	VIF
CIE	Product/service innovation (E7)	0.07	0.23	1.14
Resources	Acquisition of other external knowledge (A11)	0.00***	0.00	1.22
	Acquisition of equipment, software and licenses (A12)	−0.01	0.93	1.98
	Employees' academic qualifications (A13)	0.06	0.20	2.11
	Employees' training to develop innovation activities(A14)	0.06	0.76	2.21
	Internal R&D activities (B3)	0.07**	0.03	1.38
Transactional elements	Cooperation links with consultants (A21)	0.05**	0.01	1.45
	Cooperation links with universities (A22)	−0.04	0.16	1.77
	Cooperation links with laboratories (A23)	−0.16	0.34	3.15
	External R&D activities (B4)	0.10**	0.03	1.35
CE	Strategic coopetition (C5)	0.09	0.12	1.47
Controls	NACE (Cont_1)	−0.07***	0.00	2.57
	Size (Cont_2)	0.04	0.14	1.13
	Sector (Cont_3)	−0.07***	0.00	2.57

N = 1133; *P ≤ .10; **P ≤ .05; ***P ≤ .01
Source: Own elaboration

2.3.2 Synthesis and Contrast of the Empirical Evidence

The empirical evidence is now summarized and contrasted, with reference to operationalization of the decision pieces included in the Tangram model: Open innovation bridge; already presented in the conceptual model proposed (see Fig. 1.3), regarding the effects of resources, transactional elements and strategic coopetition on business innovation capacity.

Remember that the generic objective of this application is to identify the critical elements of the component related to the transactional structure (D6) of the open innovation business model, using the (internal and liaison) factors activating absorptive capacity that can affect the component representing the innovation capacity of industrial or service firms (E7), as well as analyzing whether those elements vary according to the firm being industrial or a service.

From the results presented below in Table 2.3 for 'All firms' and considering as dependent (or response) variable: business innovation capacity; it is concluded that, for the firms analyzed, using the Chi-squared test, the likelihood ration is 89.053, with a probability value (p) of 0.000, confirming that the estimated model is statistically significant, in global terms.

Therefore, for the total sample, and concerning resources, acquisition of other external knowledge (A11) is seen to have a positive and significant effect on business innovation capacity. The empirical evidence obtained here confirms the results obtained in previous studies, such as Nelson and Winter (1982), March

Table 2.3 Logit model: all firms—Dependent (or response) variable: Product/service innovation

Tangram model	Dependent variable: Product/service innovation (E7)	Coefficient	Standard deviation	z	P>z
Resources	**Acquisition of other external knowledge (A11)**	**0.528*** **	**0.182**	**1.695**	**0.004**
	Acquisition of equipment, software and licenses (A12)	0.013	0.245	1.013	0.959
	Employees' academic qualifications (A13)	0.322	0.253	1.379	0.203
	Employees' training to develop innovation activities(A14)	−0.304	0.322	0.738	0.345
	Internal R&D activities (B3)	**0.353****	**0.166**	**1.423**	**0.034**
Transactional elements	**Cooperation links with consultants (A21)**	**0.508*** **	**0.184**	**1.662**	**0.006**
	Cooperation links with universities (A22)	0.259	0.181	1.296	0.152
	Cooperation links with laboratories (A23)	−0.239	0.227	0.788	0.293
	External R&D activities (B4)	**0.411****	**0.185**	**1.509**	**0.026**
CE	**Strategic coopetition (C5)**	**0.627****	**0.292**	**1.872**	**0.032**
Controls	NACE (Cont_1)	−0.009	0.006	0.991	0.118
	Size (Cont_2)	0.152	0.109	1.164	0.164
	Sector (Cont_3)	**1.039*** **	**0.310**	**2.826**	**0.001**

N = 1133; *P ≤ .10; **P ≤ .05; ***P ≤ .01
Source: Own elaboration

(1991), Lundvall and Johnson (1994), Van den Bosch et al.(1999), Johnson et al. (2002), Zahra and George (2002), Nerkar and Roberts (2004), Vinding (2004), Miller et al.(2007), Rothaermel and Alexandre (2009) and Heras (2014). Furthermore, a positive and significant effect of internal R&D activities (B3) is also found, which agrees with the results obtained in previous studies (Cohen and Levinthal 1989; Gambardella 1992; Cassiman and Veugelers 2006; Li 2011; Leitão and Pereira 2016).

As for transactional elements, the empirical evidence obtained here confirms a positive and significant effect of cooperation links formed with consultants (A21) on determination of business innovation capacity. This evidence is also consistent with and confirms the earlier work by Jaffe (1989), Cockburn and Henderson (1998), Cohen et al. (2002), Kostopoulos et al. (2011), Li (2011), Vasudeva and Anand (2011) and Pereira and Leitão (2016). There is also a positive and significant effect of the acquisition of external R&D activities (B4), agreeing with the results obtained in earlier studies, such as Nelson and Winter (1982), March (1991), Lundvall and Johnson (1994), Van den Bosch et al.(1999), Johnson et al. (2002), Zahra and George (2002), Nerkar and Roberts (2004), Vinding (2004), Miller et al.(2007), Rothaermel and Alexandre (2009), Heras (2014) and Pereira and Leitão (2016).

The empirical test of the hypothetical influence exercised through the variable representing strategic coopetition (C5), based on development of coopetitive

Table 2.4 Logit model: industrial firms—Dependent (or response) variable: Product/service innovation

Tangram model	Dependent variable: Product/service innovation (E7)	Coefficient	Standard deviation	z	P>z
Resources	**Acquisition of other external knowledge (A11)**	**0.576****	**0.244**	**1.780**	**0.018**
	Acquisition of equipment, software and licenses (A12)	0.197	0.289	1.217	0.496
	Employees' academic qualifications (A13)	0.215	0.509	1.240	0.673
	Employees' training to develop innovation activities (A14)	**−2.081*****	**0.785**	**0.125**	**0.008**
	Internal R&D activities (B3)	0.062	0.239	1.064	0.795
Transactional elements	Cooperation links with consultants (A21)	0.101	0.203	1.106	0.620
	Cooperation links with universities (A22)	−0.349	0.217	0.705	0.108
	Cooperation links with laboratories (A23)	0.174	0.281	1.190	0.536
	External R&D activities (B4)	0.029	0.270	1.030	0.914
CE	**Strategic coopetition (C5)**	**1.939*****	**0.715**	**6.948**	**0.007**
Controls	NACE (Cont_1)	0.001	0.006	1.001	0.902
	Size (Cont_2)	−0.100	0.152	0.905	0.511
	Sector (Cont_3)	0.001	0.006	1.001	0.902

N = 562; *P ≤ .10; **P ≤ .05; ***P ≤ .01
Source: Own elaboration.

activities with competing firms, also shows a positive and significant effect on business innovation capacity, in line with previous studies (Lundvall 1988; Jaffe 1989; Freeman 1991, 1994; Sako 1994; Shaw 1994; Brandenburger and Nalebuff 1996; Coombs et al. 1996; Dussauge et al. 2000; Cohen et al. 2002; Garraffo 2002; Tether 2002; Quintana-Garcia and Benavides-Velasco 2004; Vega-Jurado et al. 2008; Rusko 2011; Pereira and Leitão 2016). Regarding the control variables, sector of activity, and especially the service sector, is found to produce a positive and significant effect on business innovation capacity.

Now the total sample of firms is divided into two sub-samples: industrial firms; and service firms; in order to contrast the results. For industrial firms (see Table 2.4 below), through application of the Chi-squared test, a likelihood ratio of 27.69 is obtained, with a probability value p of 0.006, confirming that the model is statistically significant overall.

For the sub-sample of industrial firms, regarding resources, a positive and significant effect of acquisition of other external knowledge (A11) is found on business innovation capacity. This evidence is in line with the results obtained previously by Nelson and Winter (1982), March (1991), Lundvall and Johnson (1994), Van den Bosch et al.(1999), Johnson et al. (2002), Zahra and George (2002), Nerkar and Roberts (2004), Vinding (2004), Miller et al.(2007), Rothaermel and Alexandre

Table 2.5 Logit model: service firms—Dependent (or response) variable: Product/service innovation

Tangram model	Dependent variable: Product/service innovation (E7)	Coefficient	Standard deviation	z	P>z
Resources	**Acquisition of other external knowledge (A11)**	**0.532***	**0.319**	**1.702**	**0.096**
	Acquisition of equipment, software and licenses (A12)	−0.462	0.515	0.630	0.369
	Employees' academic qualifications (A13)	0.135	0.446	1.144	0.763
	Employees' training to develop innovation activities (A14)	0.269	0.560	1.308	0.631
	Internal R&D activities (B3)	**0.602****	**0.258**	**1.826**	**0.020**
Transactional elements	**Cooperation links with consultants (A21)**	**1.630*****	**0.514**	**5.103**	**0.002**
	Cooperation links with universities (A22)	**1.557*****	**0.474**	**4.747**	**0.001**
	Cooperation links with laboratories (A23)	0.022	0.478	1.023	0.963
	External R&D activities (B4)	**0.707****	**0.302**	**2.029**	**0.019**
CE	Strategic coopetition (C5)	0.611	.0.590	1.842	0.301
Controls	**NACE (Cont_1)**	**−0.075*****	**0.026**	**0.928**	**0.005**
	Size (Cont_2)	**0.392****	**0.179**	**1.480**	**0.029**
	Sector (Cont_3)	**−0.075*****	**0.026**	**0.928**	**0.005**

N = 571; *P ≤ .10; **P ≤ .05; ***P ≤ .01
Source: Own elaboration

(2009) and Heras (2014). Nevertheless, for industrial firms, there is a negative and significant effect of the variable representing provision of training related to innovation (A14) on business innovation capacity, contrasting with the results obtained previously by Nelson and Winter (1982), March (1991), Delaney and Huselid (1996), Koch and McGrath (1996), Nerkar and Roberts (2004), Miller et al. (2007), Heras (2014) and Pereira and Leitão (2016), which indicate an expected positive effect.

It is also highlighted that for industrial firms, there is no empirical evidence to support the hypothetical significance of the transactional elements of the open innovation business model in the innovation capacity of this type of firm. However, for the set of results obtained for industrial firms, there is a positive and significant effect of the variable representing strategic coopetition (C5), based on developing coopetitive activities with competing firms, contributing to confirmation of the results of previous analyses.

Considering the set of results for the sub-sample of service firms (see Table 2.5 below), for the firms analyzed, using the Chi-squared test, the likelihood ratio is 145.341, for a probability p of 0.000, which confirms that the model is significant overall.

Considering the results obtained for the service firm sub-sample, concerning resources, business innovation capacity is influenced positively and significantly by the acquisition of other external knowledge (A11), for a 10% level of statistical significance, as well as by development of internal R&D activities (B3), for 5% significance, which is in line with previous empirical evidence.

Regarding transactional elements, standing out are the positive and significant effects associated with cooperation linkages formed with consultants (A21) and universities (A22) on business innovation capacity, revealing that service firms are more likely to establish links with their stakeholders in relation to R&D activities, compared to industrial firms. A positive and significant effect of external R&D activities (B4) is also detected, in agreement with previous empirical evidence. As for the control variables, for this sub-sample of service firms, there is a negative and significant effect of the NACE code variable and the sector of activity variable on business innovation capacity, for a 1% level of statistical significance. In addition, firm size has a positive and significant effect on innovation capacity.

Table 2.6 presents a brief summary, contrasting the literature of reference and the empirical evidence obtained here using the Tangram model.

Briefly, using the Tangram model, it is possible to identify two levels of critical elements of the transactional structure of the open innovation business model, namely resources and transactional elements. Firstly, regarding resources, the positive influence of acquiring external knowledge (A11) stands out, for both industrial and service firms, whereas internal R&D activities only show a positive and significant effect in the case of service firms.

Secondly, concerning transactional elements, the advanced state of service firms' open innovation business model is highlighted, in which cooperation links with consultants (A21) and universities (A22), as well as external R&D activities, are of significant importance in determining business innovation capacity.

As for strategic coopetition, the significant importance of cooperation relationships formed by industrial firms with their rivals should also be underlined, but this needs to be deepened in order to raise those firms' absorptive capacity, based on strategic mapping of internal and liaison factors, connected to innovative performance.

In comparing the results obtained for the two sub-samples of industrial and service firms, it also becomes possible to provide a set of implications for R&D managers and public policy-makers concerning the determinant factors of business innovation capacity, namely:

I. Internal factors (A1):

   a. For industrial firms, the external acquisition of R&D has a positive and significant association with the creation of innovation; whereas the provision of training in areas related to innovation has a negative and significant effect on business innovation capacity;
   b. It is recommended that public policy decision-makers draw up innovative programs of open training in the laboratory and industrial context, in

Table 2.6 Literature versus Empirical evidence from the Tangram model

Literature	Tangram Model Component	Dependent variable: Business innovation capacity			
		All firms		Industrial firms	Service firms
		SE	SO		
Component A: Absorptive capacity A1—Internal factors (resources)					
Nelson and Winter (1982), March (1991), Lundvall and Johnson (1994), Van den Bosch et al. (1999), Johnson et al. (2002), Zahra and George (2002), Nerkar and Roberts (2004), Vinding (2004), Miller et al. (2007), Rothaermel and Alexandre (2009), Heras (2014).	Acquisition of external knowledge (A11)	(+)	**0.528*** **	**0.576** **	**0.532***
	Acquisition of equipment, software and licenses (A12)	(+)	0.013	0.197	−0.462
Cohen and Levinthal (1989, 1990, 1994), Rothwell and Dodgson (1991), Mangematin and Nesta (1999), Narula (2004), Vinding (2000, 2004), Giuliani and Bell (2005), Fosfuri and Tribó (2008), Vega-Jurado et al. (2008).	Employees' academic qualifications (A13)	(+)	0.322	0.215	0.135
Nelson and Winter (1982), March (1991), Delaney and Huselid (1996), Koch and McGrath (1996), Nerkar and Roberts (2004), Miller et al. (2007), Heras (2014), Pereira and Leitão (2016).	Employees' training to develop innovation activities (A14)	(+)	−0.304	**−2.081*** **	0.269
Component A: Absorptive capacity A2—Liaison factors (transactional elements)					
Jaffe (1989), Cockburn and Henderson (1998), Cohen et al. (2002), Kostopoulos et al. (2011), Li (2011), Vasudeva and Anand (2011), Pereira and Leitão (2016).	Cooperation links with consultants (A21)	(+)	**0.508*** **	0.101	**1.630*** **
	Cooperation links with universities (A22)	(+)	0.259	−0.349	**1.557*** **
	Cooperation links with laboratories (A23)	(+)	−0.239	0.174	0.022
Component B: Open innovation B3—Internal R&D activities (resources)					
Cohen and Levinthal (1989), Gambardella	Internal R&D activities (B3)	(+)	**0.353** **	0.062	**0.602** **

(continued)

Table 2.6 (continued)

Literature	Tangram Model Component	Dependent variable: Business innovation capacity			
		All firms		Industrial firms	Service firms
		SE	SO		
(1992), Cassiman and Veugelers (2006), Li (2011), Pereira and Leitão (2016).					
Component B: Open innovation B4—External R&D activities (transactional elements)					
Nelson and Winter (1982), March (1991), Lundvall and Johnson (1994), Van den Bosch et al. (1999), Johnson et al. (2002), Zahra and George (2002), Nerkar and Roberts (2004), Vinding (2004), Miller et al. (2007), Rothaermel and Alexandre (2009), Heras (2014), Pereira and Leitão (2016).	External R&D activities (B4)	(+)	**0.411****	0.029	**0.707****
Component C: Strategic coopetition					
Lundvall (1988), Jaffe (1989), Freeman (1991, 1994), Sako (1994), Shaw (1994), Brandenburger and Nalebuff (1996), Coombs et al. (1996), Dussauge et al. (2000), Cohen et al. (2002), Garraffo (2002), Tether (2002), Quintana-Garcia and Benavides-Velasco (2004), Vega-Jurado et al. (2008), Rusko (2011), Pereira and Leitão (2016).	Strategic coopetition (C5)	(+)	**0.627****	**1.939*****	0.611
Total number of observations			1133	562	571
Wald			363.850***	187.846***	175.901***
Chi^2			89.053***	27.693***	145.341***

N = 1133; *P ≤ .10; **P ≤ .05; ***P ≤ .01
SE (sign expected); SO (sign obtained).
Source: Own elaboration.

production and prototyping formats, in order to increase the skills of firms' human resources and intensify open innovation;

c. For service firms, the external acquisition of R&D activities and internal R&D capacities have a positive and significant association with the generation of innovation;

d. It is suggested that public policy decision-makers should create industrial consortium programs that intensify the servitization of industry, especially through incentives destined to establishing more industrial consortium contracts between service and industrial firms and registering patents in co-ownership with industrial partners.

II. Liaison factors (A2):

a. For industrial firms, establishing cooperation links with other competing firms has a positive and significant effect on generation of innovation;
b. For public policy decision-makers, the launching of tax benefit programs is recommended, with a reduction of Company Income Tax (IRC), to benefit competing industrial firms that develop coopetition initiatives in R&D, production, logistics and distribution and sales;
c. For service firms, cooperation links with consultants and universities have a positive and significant effect on the generation of innovation;
d. It is suggested that public policy decision-makers create technical-scientific consultancy programs for service firms, through the entry and installation of specialized consultants in universities, in order to provide services of business coaching, project development and respective mechanisms of application to, and management of the flow of approved projects.

III. Open innovation (B3 & B4):

a. For service firms, the development of internal and external R&D activities has a positive and significant effect on business innovation capacity;
b. For industrial firms, the creation of specific R&D budgets is recommended, as well as R&D and innovation departments, through hiring high-potential Ph.D. holders, with the aim of differentiating their production and scaling the value chain;
c. It is recommended that public policy-makers should create tax benefits associated with investment in R&D and create consortia of industrial and service firms, in order to accelerate the learning process of corporate R&D and industry servitization.

IV. Strategic coopetition (C5):

a. For industrial firms, the development of coopetitive activities has a positive and significant effect on business innovation capacity, but the transactional elements of the open innovation business model require deepening;
b. It is suggested that public policy-makers should launch lines of finance for investment projects in production activities with cross-fertilization, joining competing industrial firms with service firms to allow implementation of coopetitive business models, tending toward greater vertical integration and greater competitive strengthening of the associated value chain.

2.4 Remarks, Implications, Limitations and Research Avenues

Previous research on absorptive capacity has shown a gap to be filled concerning the identification and analysis of the antecedents of absorptive capacity, namely the specific characteristics of the firm or the critical elements of the transactional structure of the relationships firms form, so as to be able to absorb the knowledge originating in important external sources, since this is related mainly to firms' R&D activities.

Cohen and Levinthal (1990) opened up this avenue of research, and the subsequent contributions of Zahra and George (2002) and Vega-Jurado et al. (2008) should also be underlined, showing the need to deepen this subject according to an eclectic and interdisciplinary approach involving organizational engineering and management.

This book is anchored theoretically in the model of absorptive capacity by Zahra and George (2002), taking it to another level of detail, through presentation of a proposed model, Tangram: Open innovation bridge; which considers a set of internal factors an organization deals with in the complex task of assimilating knowledge and the leverage provided by the critical elements of the transactional structure of its relations, adding the liaison factors considered by firms in order to benefit from knowledge spillovers.

In the empirical application a database covering a total of 1133 Portuguese firms is used, divided in two sub-samples of 562 industrial firms and 571 service firms, aiming to analyze the effects of the selected variables that represent internal factors, liaison factors and strategic coopetition on business innovation capacity, following an innovative approach centered on the transactional structure of open innovation business models.

In this way, the conceptual approach of reference proposed by Zahra and George (2002) is revisited, aiming to deepen knowledge about internal factors, in the firm, which give rise to competences that raise its ability to detect, absorb and exploit external knowledge, as well as the liaison factors, which in this context favor the connection to external sources of knowledge and the necessary complementarity, besides strengthening the capacity to generate innovation.

The conceptual model proposed here is innovative in that it considers not only R&D activities but also the firm's specific characteristics, namely employees' education and training in innovation activities, as well as the efforts to acquire external knowledge and assure the complementarity of its resources and capacities, through establishing connecting relationships, in the context of open innovation and strategic coopetition.

The proposal in this book contributes to introducing a dimension of openness to the model by Zahra and George (2002), inserting the firm in an open system, in which a new understanding of innovation implies implementing an open innovation business model, enabling the firm to watch out for and detect in advance external sources of knowledge. In this way, the firm will be able to assure the link to renewed

sources of external knowledge, as well as absorb and exploit knowledge to transform it into new products and/or services.

The design approach and gamification of the Open innovation bridge: Tangram model; is particularly innovative, also showing a great potential for the future development of a system of technological and competitive surveillance and performance measurement (innovative and economic), based on the introduction of key-performance indicators (KPIs) to support the decision to invest in R&D, applicable at the national and firm level.

It is also underlined that the review of the theoretical framework presented previously allowed detection of a gap in the literature on absorptive capacity models, inasmuch as previous studies do not consider, in isolation, the effects associated with determinant factors of absorptive capacity, based on the links between firms and external sources of knowledge.

Therefore, this book filled that gap, by analyzing a set of internal factors and liaison factors, and their hypothetical influence on determining business innovation capacity, following an innovative approach to the transactional structure of open innovation business models.

With this purpose, a comparative analysis was made, which let us contrast the empirical evidence obtained on internal factors and liaison factors, for both industrial and service firms, applying the typology of resources and transactional elements drawn up in the scope of the Tangram model proposed here.

Summarizing, the empirical evidence points toward firms having to be able to watch out for, detect, assimilate and exploit diverse sources of knowledge, and so it is fundamental to know the critical elements of the transactional structure of their open innovation business model.

Therefore, firms must detect external sources of knowledge and develop their own internal capacities and links with external stakeholders, in order to assure a positive correspondence with the specific needs inherent to their economic activity. That line of strategic action must be based on the design considered fundamental for small and medium-sized firms, consisting of drawing up and continuously adapting the structure of the open innovation business model, aiming for the exploitation of external knowledge, inward licensing or development of industrial consortia, which contribute to strengthening their competitive and coopetitive capacity.

2.4.1 Implications for R&D Managers and Public Policy-makers

R&D managers must develop mechanisms of watchfulness and competitive intelligence that unequivocally identify the set of determinant factors (i.e., resources and transactional elements) that orient two capacities, that of absorption and that of business innovation, so that they can prepare and refine those factors, in order to

exploit external knowledge and promote the generation of innovation, following a paradigm of open innovation.

Through deepening understanding of the forces that orient the firm's capacity to detect and assimilate knowledge spillovers, considering the surrounding environment, the factors related to resources, at the firm level, for example, the acquisition of external knowledge, equipment, software and licenses, human resource competences and training in innovation activities, as well as internal R&D activities, managers will be in a position to manage better the transactional structure of the open innovation business model, through designing adjusted and customized solutions that will allow the leverage of internal factors and absorption of liaison factors.

It is also of note that the transactional elements of the liaison factors and external R&D activities are particularly important to intensify business innovation capacity, above all in small and medium-sized firms that follow open innovation business models in a context of strategic coopetition.

Concerning implications for public policies on innovation and competitiveness, from the insights derived from this book it is suggested policies should be directed to renewal of absorption capacity and strengthening the dynamics of business cooperation, according to the open innovation paradigm, including competing firms and the scientific community, as well as ensuring the formation of formal channels and mechanisms to develop joint innovation.

Those mechanisms are at a stage of dissemination, namely through direct action by the European Commission, aiming to strengthen joint R&D efforts, especially through innovation valleys, co-promotion projects, individual projects and the creation of nuclei of Research and Technological Development (R&TD) in the business sector, in the context of the European policy and financing instrument of *Horizon 2020*, and the national policy instrument of Portugal 2020.

Increasingly at the center of European concerns, open innovation has come to be present in the various financing instruments (*Horizon 2020*; *Cosme 2014–2020*) and program documents (*Innovation Union*; *Digital Agenda for Europe*; *Industrial Policy*).

In the European domain, for example, the *SME Instrument* initiative stands out, aiming to stimulate open innovation activities in SMEs, contemplating three phases: I. Concept Trial (to explore the technical or scientific viability of the idea, its potential for commercialization and innovation, i.e., support for developing a Business Plan); II. Development and Demonstration (involving financial support for operationalizing the Business Plan supported in Phase I, including the development, test and prototyping of new products, services and processes); and III. Market entry (consisting of financial support for market entry/commercialization of the products, services or processes developed in the previous phase). The financial support forecast in each of these phases can be directed toward acquiring services and/or technology from external bodies (for example, from Specialized Consultants, Technological Intermediaries, Technological Centers, Universities, etc.), as well as supporting the development of innovative business models and open mechanisms of disruptive innovation.

Nevertheless, those instruments should be improved, given greater knowledge of the transactional structure involving the factors that activate firms' absorption capacity, internally, and the liaison factors, externally, as well as through a more advanced level of requirement and formalization concerning presentation of the open innovation business model, for the purpose of participating, validating and approving access to programs of SME financing and recapitalization.

The empirical application now presented, aimed to reveal the effects of the internal factors and liaison factors on firms' capacity to generate innovation. Consequently, the analysis contained in this book, setting out from a thorough and inclusive review of the literature on the subjects of innovation, coopetition, absorptive capacity and open innovation business models, allows the design of a new conceptual model entitled: Open innovation bridge—Tangram model; which aims to facilitate identification of the transactional structure of open innovation business models, as well as supplying empirical evidence that provides an analysis framework for opening up a research avenue on the still little-explored subject of open innovation business models applicable to industrial or service activities.

In addition, the results presented in this book can be useful in designing new guidelines for public policy regarding tax incentives for developing (internal and external) R&D activities, as well as for increasing firms' capacity to strengthen open innovation flows and thereby ensure the well-judged assimilation of what is really important to meet their specific needs regarding R&D and organizational (re)configuration, from effective exploration of external sources of knowledge and leveraging their resources and capacities.

In sum, the empirical evidence obtained should be taken as a starting point that can help innovation managers interested in the tasks of technological forecasting and surveillance to identify the transactional structure of their business models, in harmony with carrying out corporate R&D projects, through coopetition agreements to be formed with partners, even if they are (direct or indirect) competitors, in order to improve the efficiency of bi-directional flows of technology transfer, and consequently stimulate the creation and subsequent spread of product and/or service innovations. They can also regulate effectively their protection mechanisms so that they can be used as appropriability regimes.

2.4.2 Limitations and Future Research

The main limitation of this study lies in the lack of additional microdata about firms' innovation capacity, particularly concerning appropriability regimes, for example, registering and licensing patents, or other intellectual property rights, such as copyright and brands. That limitation is obvious in the origins of the database used in the analysis contained in this book, namely the *Community Innovation Survey* (CIS) 2010, which reveals the almost non-existence of microdata on firms' innovative performance, on the subject of intellectual property, and falls short regarding additional data about patents, copyright and other intellectual property rights. It is of

note that the only reference to products or services created, internally, by the firm, which can be subject to appropriation, through the use of formal mechanisms to protect intellectual property is that which corresponds to the variable of product or service innovation. Despite the limitations regarding data availability, it would also be interesting to make a comparative analysis, including other countries with different profiles of innovation and technological intensity. Other data to add would be those related to the components of the open innovation business models practised by firms, particularly SMEs.

In this line of reasoning, future research on open innovation business models and absorptive capacity, in the context of strategic coopetition, following an organizational engineering and management approach, could explore the factors motivating firms to behave, alternatively, in terms of business models applicable to R&D activities, based on customizing their open innovation business models, in a regime of co-creation, following approaches centered on partners (competitors or not) or on consumers (users).

Furthermore, the modeling of firms' open innovation strategy and their absorptive capacity could be enhanced through analyzing various linking strategies to absorb external knowledge and establish differentiating activities and practices of technology transfer, such as cross-licensing, inward licensing and outward licensing, as well as forecasting and surveillance projects, both competitive and technological.

Finally, firms' innovation capacity based on implementing strategies of intellectual property, as well as the characteristics influencing coopetition agreements, should also be subject to future research, following multi-level approaches, particularly to determine the importance of various as yet unexplored factors in the literature of reference, such as the entrepreneurial profile, the education and religion of founders and CEOs, intellectual capital, the management team education, family structure, corporate governance structure, orientation toward exports, capital structure, the presence of foreign partners and capital, external finance, the presence of risk capital, public finance or increased capital via equity-based crowdfunding.

References

Agresti, A. (1996). *An introduction to categorical data analysis*. New York: John Wiley & Sons.

Brandenburger, A., & Nalebuff, B. (1996). *Co-opetition*. Doubleday, New York: Currency.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in the innovation strategy: Internal R&D and external knowledge acquisition. *Management Science, 52*, 68–82.

Cockburn, I., & Henderson, R. (1998). Absorptive capacity, co-authoring behavior, and the organization of research in drug discovery. *The Journal of Industrial Economics, 46*(2), 157–183.

Cohen, W., & Levinthal, D. (1989). Innovation and learning: The two faces of R&D. *Economic Journal, 99*, 569–596.

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

Cohen, W., & Levinthal, D. (1994). Fortune favors the prepared firm. *Management Science, 40*, 227–251.

Cohen, W., Nelson, R., & Walsh, J. (2002). Links and impacts: The influence of public research on industrial R&D. *Management Science, 48*, 1–23.

Coombs, R., Richards, A., Saviotti, P., & Walsh, V. (1996). *Technological collaboration: The dynamics of cooperation in industrial innovation*. Cheltenham: Edward Elgar.

Delaney, J., & Huselid, M. (1996). The impact of human resource management practices on perceptions of organizational performance. *Academy of Management Journal, 39*, 949–964.

Dussauge, P., Garrette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal, 21*, 99–126.

Finney, D. (1947). *Probit analysis*. Cambridge, England: Cambridge University Press.

Fosfuri, A., & Tribó, J. (2008). Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. *Omega: The International Journal of Management Science, 36*, 173–187.

Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research Policy, 20*, 499–514.

Freeman, C. (1994). The economics of technical change. *Cambridge Journal of Economics, 18*, 463–514.

Gambardella, A. (1992). Competitive advantages from in-house basic research. *Research Policy, 21* (5), 391–407.

Garraffo, F. (2002). Types of coopetition to manage emerging technologies. In *2nd Annual Conference, Innovative Research in Management*, Stockholm, Sweden.

Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation: Evidence from a Chilean wine cluster. *Research Policy, 34*(1), 47–68.

Heras, M. (2014). Building product diversification through contractual R&D agreements. *R&D Management, 44*(4), 384–397.

Jaffe, A. (1989). Real effects of academic research. *American Economic Review, 79*(5), 957–970.

Johnson, B., Lorentz, E., & Lundvall, B.-Å. (2002). Why all this fuss about codified and tacit knowledge? *Industrial and Corporate Change, 11*(2), 245–262.

Koch, M., & McGrath, R. (1996). Improving labor productivity: Human resource management policies do matter. *Strategic Management Journal, 17*, 335–354.

Kostopoulos, K., Papalexandris, A., Papachroni, M., & Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research, 64(12*, 1335–1343.

Li, X. (2011). Sources of external technology, absorptive capacity, and innovation capability in Chinese state-owned high-tech enterprises. *World Development, 39*(7), 1240–1248.

Lundvall, B.-Å., & Johnson, B. (1994). The learning economy. *Journal of Industry Studies, 1*(2), 23–42.

Lundvall, B.-Å. (1988). Innovation as an interactive process: From use-producer interaction to the national system of innovation. In G. Dosi, C. Freeman, R. Nelson, G. Siverbert, & L. Soete (Eds.), *Technical change and economic theory*. London: Pinter.

Mangematin, V., & Nesta, L. (1999). What kind of knowledge can a firm absorb? *International Journal of Technology Management, 18*, 149–172.

March, J. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*, 71–87.

McCullagh, P., & Nelder, J. (1989). *Generalised Linear Models* (2nd ed.). London: Chapman & Hall.

Miller, D., Fern, M., & Cardinal, L. (2007). The use of knowledge for technological innovation within diversified firms. *Academy of Management Journal, 502*, 308–326.

Narula, R. (2004). *Understanding absorptive capacities in an "innovation systems" context: Consequences for economic growth*. MERIT-Infonomics Research Memorandum series 2004–003.

Nelson, R., & Winter, S. (1982). *An evolutionary theory of the firm*. Cambridge, MA: Harvard University Press.

Nerkar, A., & Roberts, P. (2004). Technological and product-market experience and the success of new product introductions in the pharmaceutical industry. *Strategic Management Journal, 25*, 779–799.

Peng, C., & So, T. (2002). Logistic regression analysis and reporting: A primer. *Understanding Statistics, 1*(1), 31–70.

Pereira, D., & Leitão, J. (2016). Absorptive capacity, coopetition and product innovation: Contrasting Italian and Portuguese manufacturing firms. *International Journal of Technology Management, 71*(1/2), 10–37.

Quintana-Garcia, C., & Benavides-Velasco, C. (2004). Cooperation, competition, and innovative capability: A panel data of European dedicated biotechnology firms. *Technovation, 24*(12), 927–938.

Rothaermel, F., & Alexandre, M. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science Archive, 20*(4), 759–780.

Rothwell, R., & Dodgson, M. (1991). External linkages and innovation in small and medium-sized enterprises. *R&D Management, 21*, 125–137.

Rusko, R. (2011). Exploring the concept of coopetition: A typology for the strategic moves of the Finnish forest industry. *Industrial Marketing Management, 40*(2), 311–320.

Sako, M. (1994). Supplier relationships and innovation. In M. Dodgson & R. Rothwell (Eds.), *The handbook of industrial innovation*. England: Edward Edgar.

Shaw, B. (1994). User/Supplier links and innovation. In M. Dodgson & R. Rothwell (Eds.), *The handbook of industrial innovation*. England: Edward Edgar.

Tether, B. (2002). Who co-operates for innovation, and why: An empirical analysis. *Research Policy, 31*(6), 947–967.

van den Bosch, F., Volberda, H., & de Boer, M. (1999). Co-evolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities. *Organization Science, 10*, 551–568.

Vasudeva, G., & Anand, J. (2011). Unpacking absorptive capacity: A study of knowledge utilization from alliance portfolio. *The Academy of Management Journal, 54*(3), 611–623.

Vega-Jurado, J., Gutiérrez-Garcia, A., & Fernández-de-Lucio, I. (2008). Analyzing the determinants of firm's absorptive capacity. *R&D Management, 38*(4), 392–405.

Vinding, A. (2000). *Absorptive capacity and innovative performance: A human capital approach*. Denmark: Department of Business Studies, DRUID/IKE Group. Aalborg University.

Vinding, A. (2004). Human resources: Absorptive capacity and innovative performance. In J. Christensen & B.-Å. Lundvall (Eds.), *Product innovation, interactive learning and economic performance*. Oxford: Elsevier.

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

Zhang, D., Agterberg, F., Cheng, Q., & Zuo, R. (2014). Response to comment by Helmut Schaeben on "A Comparison of Modified Fuzzy Weights of Evidence, Fuzzy Weights of Evidence, and Logistic Regression for Mapping Mineral Prospectivity". *Mathematical Geosciences,* © International Association for Mathematical Geosciences 2013. https://doi.org/10.1007/s11004-013-9496-8.

Part III
Gaming and Design of Open Innovation Business Models

Chapter 3
Concepts, Methodologies and Tools of Gamification and Design Thinking

3.1 From the Entrepreneur to Technology-Based Entrepreneurship

First of all, this item revisits a selection of the main theoretical concepts being taught (see Fig. 3.1), in an introductory way, in the scope of a course on technological entrepreneurship designing, namely: entrepreneur; challenge; entrepreneurial opportunity; team; creativity, resilience and leadership; and technological entrepreneurship (entrepreneurial and intrapreneurial route); considering the set of modular lists proposed by Byers et al. (2015) in the fourth edition of the book entitled: *Technology Ventures: From Idea to Enterprise*; which serves as a basic reference in terms of the course's design, planning, structuring and functioning. The reason for this lies in the need to present a coherent sequence of concepts considered basic in this course, proceeding later to presentation of the tools used to identify, explore and work on the business idea tending towards the creation of a technology-based firm (entrepreneurial route) or implementation of an entrepreneurial and innovative project (intrapreneurial route), using a new methodology named: Pentagon of opportunity exploitation, which uses an approach crossing gamification and design thinking.

In most areas of activity which, in a wide spectrum, range from environmental sustainability to safety; from transport to communications; or even from information and communication technology (ICT) to healthcare and social inclusion; there is a vast array of opportunities for individuals to be able to develop actions with a high economic and social impact on the well-being of society in general.

The **entrepreneur** is an individual who identifies and finds: (i) solutions to problems; (ii) possibilities among needs; and (iii) opportunities among challenges. Consequently, entrepreneurs aim to reach a given objective, by launching an organization that will correspond to the needs of society and the market. In addition, they are prepared to rise to a challenge, overcome obstacles and build a business which aims to be sustainable.

© Springer International Publishing AG, part of Springer Nature 2019

J. Leitão, *Open Innovation Business Modeling*, Contributions to Management Science, https://doi.org/10.1007/978-3-319-91282-0_3

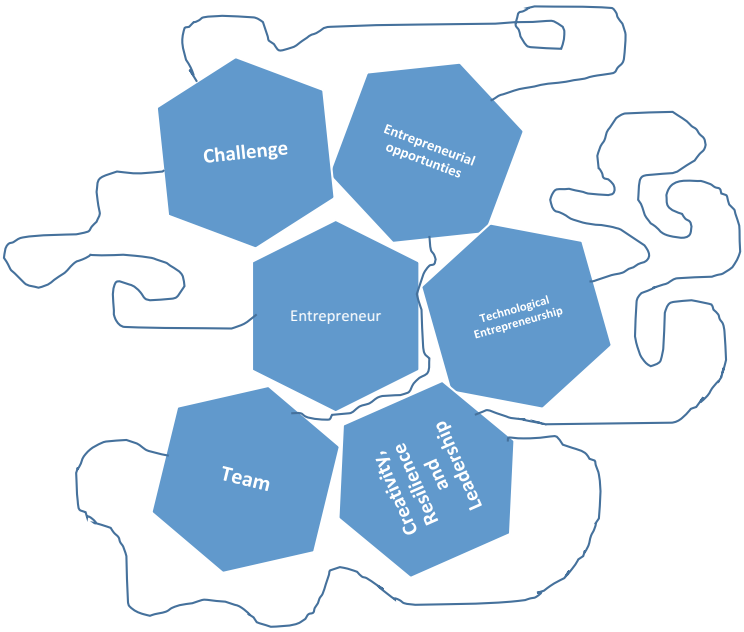


Fig. 3.1 Principle theoretical concepts of the Technological Entrepreneurship Designing course. Source: Own elaboration

Returning to the idea of Schumpeter (1934), the entrepreneur is considered to be an economic actor who introduces new combinations to the economic system, being the cause of economic growth. The entrepreneur's main function is to innovate, although this depends on non-standardized distribution of both the entrepreneurial talent and the competences required to develop an entrepreneurial initiative with success, based on previous identification of an entrepreneurial opportunity.

Joining here the knowledge filter proposed by Audretsch and Keilbach (2005), the perception of an opportunity is configured by a strong ability to anticipate the trade-off between costs and benefits, to become an entrepreneur. In this area, the importance of attitudes and personal characteristics is underlined, these including motivation, self-effectiveness, collective effectiveness and social norms.

Regarding conceptualization, an entrepreneur can be defined as an individual who has the ability to conceive and formalize an idea, through applying their own knowledge filter to an entrepreneurial opportunity, whose exploitation is revealed to be commercially successful.

In turn, entrepreneurship is positioned as a process through which individuals and teams join together the resources necessary to exploit entrepreneurial opportunities, and thereby create wealth, social benefits, prosperity and well-being (Byers et al. 2015).

Concerning critical actions to be carried out by entrepreneurs (see key-points of learning in Table 3.1), it is emphasized that they create and develop firms or projects,

Table 3.1 Critical actions of the entrepreneur

Key-points of learning to retain	
Entrepreneur's actions	• Identify problems or needs and execute solutions
	• Form the essence of the entrepreneurial activity that is the endogenous motor of economic growth
	• Use knowledge to create innovations and new firms
	• Act positively according to a combination of entrepreneurial capital and intellectual capital, tending towards productivity and prosperity
	• Identify and develop opportunities; acquire resources; and launch organizations
	• No need to be born as an entrepreneur, as this can be learned

Source: Adapted from Byers et al. (2015)

aiming to create prosperity and wealth for all participants in the process, namely, investors, customers, suppliers, employees and themselves, using a combination of intellectual capital and entrepreneurial processes in relation to their resources and dynamic capacities. It is highlighted that in the scope of this book intellectual capital is understood to be a dominant combination of a triad of capitals, namely human capital, social capital and organizational capital (Pedro et al. 2018); which will be dealt with more deeply in exploring the course's modular lists (see Sect 3.2).

From the entrepreneur's point of view, a **challenge** is a call to respond to a difficult task and commitment to carry out that undertaking. For that reason, an entrepreneur must be resilient, attacking challenging problems and determined to find a solution. They also combine important capacities and competences with their interests, passions, emotions and commitments.

In turn, an **entrepreneurial opportunity** is a favorable combination of circumstances with a high probability of success or progress. Attractive opportunities combine good timing with realistic and feasible solutions, corresponding to important problems in favorable contexts. One of the entrepreneur's tasks is to locate new ideas, and determine whether they are opportunities. If so, they can be set in motion, considering the ideal point (see the diagram presented in Fig. 3.2).

It should be underlined, however, that entrepreneurship is not an easy activity. On the contrary, it is extremely demanding and requires dedication, commitment and perseverance, as only a third of new firms survive the first three years of activity. As an agent of change, the entrepreneur accepts failure as a potential result of the business initiative. Nevertheless, whether the right opportunity has appeared or not, an individual can learn to act as an entrepreneur, gaining experience through carrying out a low-cost entrepreneurial activity. To avoid days of dreams and fantasy, an individual needs to initiate entrepreneurial practice, so as to experiment, test and learn to be an entrepreneur at their own expense (Ibarra 2002).

Ideally, the entrepreneur should respect the following sequence of steps: firstly, do, and secondly reflect on what has been done. Operationally, the first step is to identify the hypotheses associated with an idea: what premises are being considered to conclude that a given problem identified really is a problem and is the proposed solution indeed a good and realistic solution? The second step should consist of

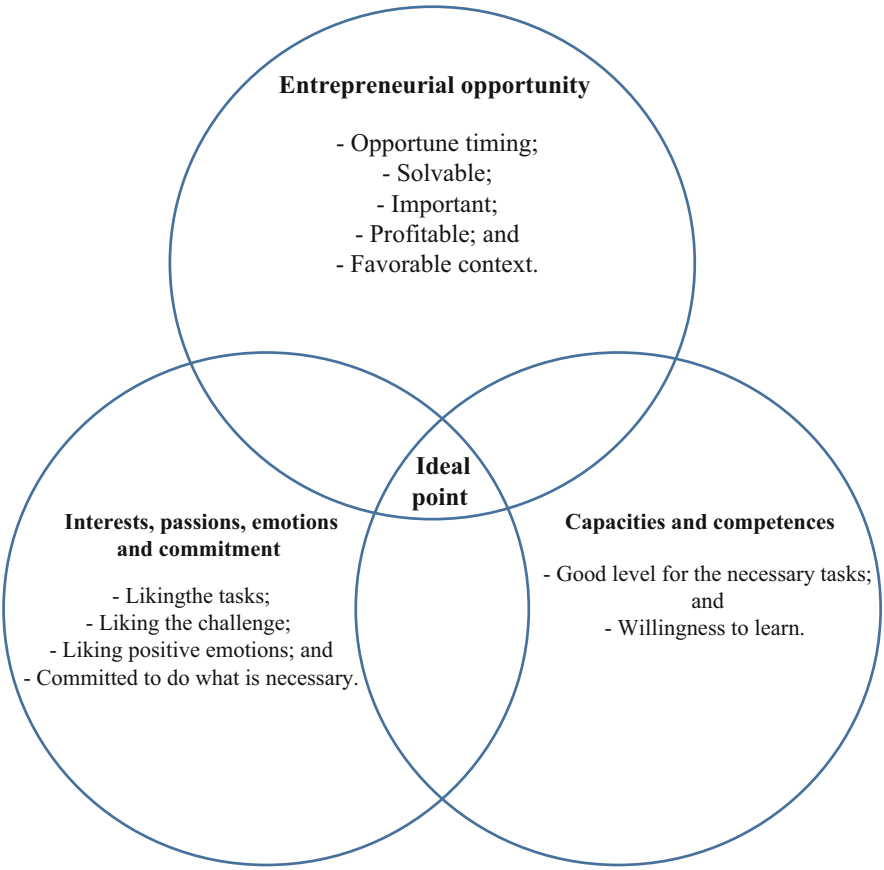


Fig. 3.2 Selecting the right opportunity and identifying the ideal point. Source: Elaborated based on Byers et al. (2015)

testing the hypotheses raised, through involvement with customers, employees and other partners. Through these small experiments, the entrepreneur may not only develop contacts and form links with mentors considered key elements in carrying out the idea (Baer 2012), but also learn more about the opportunity and about what is necessary to change to ensure the viability and ability to lead the idea to fruition.

From the perspective of Sarasvathy and Venkataraman (2011), entrepreneurial activity comes close to the scientific method, in that the entrepreneur tries to gather data connected to the hypotheses raised, and then works on the ideas based on the discoveries made.

However, the essence of success lies in the entrepreneur's effective capacity to join a team with good elements, motivated to do something people are willing to pay for, but spending the smallest amount of money possible, while processing validation in the market and ensuring acceptance of the product/service by consumers,

Table 3.2 Process of identifying and exploiting an entrepreneurial opportunity by the founding team

Steps	Team actions
1	• Possess the necessary competences or acquire them.
2	• Identify the opportunity that is attractive and corresponds to competences; and • Create a solution to correspond to the opportunity identified.
3	• Possess or acquire the physical and financial resources necessary to launch the business, through identifying investors and partners.
4	• Form an agreement or contractual arrangement with partners and investors; and • Launch the business and share ownership and the wealth generated among members of the founding team.

Source: Adapted from Byers et al. (2015)

understood as key pieces for the sustainability of entrepreneurial activities (Graham 2005).

If team members are able to identify an opportunity that is attractive to consumers, and which simultaneously can be answered by the formers' competences, they will then have to obtain the necessary resources to implement the intended solution. This is followed by launching the organization and its growth, which may have a substantial impact on the market, if it has the management capacity necessary to execute the steps and actions corresponding to the sequence presented in Table 3.2. However, this does not dispense with the need for a resilient and persevering attitude on the part of the entrepreneur and the team, being prepared to repeat these steps as often as necessary to validate an entrepreneurial and innovative activity, following a non-linear process of adjustment and learning,. This is why it is so important to innovate also at this level, following a *gamification* and *design thinking* approach, conjugating creativity, innovation and entrepreneurship.

At this point, it is worth highlighting that in recent years special emphasis has been given to the identification and exploitation of entrepreneurial opportunities, i.e., those previously unexploited. However, entrepreneurism is not only within reach of those who are predestined due to their genetic make-up or past experience, since this is a systematic, organized and rigorous discipline that can be learned and improved (Drucker 2002), respecting its multi-disciplinary basis and eclectic nature.

It is in this line of reasoning that it is interesting to underline the importance of deepening knowledge about basic personal characteristics (that can be learned) of the entrepreneur, understood as critical factors for exploiting the entrepreneurial opportunity successfully, namely the tripartite basis formed of: **creativity; resilience; and leadership**.

For Baumol (2002), the entrepreneur is someone with a behavior that deviates from the normal pattern, demonstrating courage and imagination in the business methods and practices established, continuously trying to find entrepreneurial opportunities to commercialize new products, technology and processes, as well as forming partnerships and contractual arrangements that are different from the usual patterns.

Table 3.3 Combination of key activities and resources, capacities and competences by the entrepreneur

Key points of learning to retain	
Key activities	Resources, capacities and competences
	• Capacity to deal with uncertainty and ambiguity; • Flexibility in adapting to changeable circumstances and competitors; • Assessment and mitigation of the risks inherent to continued business activity; • Creating a vision of the firm to communicate the entrepreneurial opportunity to staff and allies; • Attract, train and retain highly qualified people able to produce multi-disciplinary insights; • Competence to sell ideas and possessing a wide network of potential partners; • Talent, knowledge and experience in the industry where the opportunity occurs; • Look for important opportunities with the corresponding challenges and the potential for a high return; • Capacity for timely selection of an opportunity in a short period of time; • Capacity to identify sources of knowledge and innovation outside; • Creativity to exploit a process that results in the concept of a high-value solution for a given problem or need; • Capacity to convert an opportunity into a workable firm with market value; and • The will to succeed, oriented towards winning and results.

Source: Adapted from Byers et al. (2015)

Consequently, entrepreneurs achieve greater prosperity when they manage to make an innovative response to challenges and try to find unconventional solutions to problems. Therefore, entrepreneurs use creativity, create visions and build stories that explain their visions and then act as part of the solution. Entrepreneurs open up new paths, run risks, face uncertainty, but turn failures into a source of learning, always seeking success with resilience and perseverance. Entrepreneurs also stand out due to their capacity to accumulate and manage knowledge, as well as through their capacity to mobilize resources in order to attain a specific business or social objective (Kuemmerle 2002; Amabile and Khaire 2008).

Regarding the demanding task of combining the key activities entrepreneurs must undertake in the identification and subsequent exploitation of the entrepreneurial opportunity and the corresponding need for their resources, capacities and competences, this is summarized in Table 3.3, following the model already used for the key points of learning to retain.

Entrepreneurs are motivated by opportunities and work towards designing and implementing a strategy that can reasonably make that opportunity a success. Therefore, they seek new means or methods and are prepared to commit themselves to solving a business or social problem that will result in success. The entrepreneur is motivated and shows a passion to build a firm that will solve an important problem. They look for ways to express and validate their ideas, being creative, motivated and attracted by new ideas or opportunities. The entrepreneur shows robust confidence that can sometimes even mean they are overconfident (Hmieleski and Baron 2009).

Table 3.4 Capacity to overcome a challenge: critical elements

Critical elements of the entrepreneur's capacity
• Cope with a series of difficult matters
• Create solutions and work towards perfecting them
• Manage various tasks simultaneously
• Be resilient when faced with setbacks
• Be willing to work hard and not expect easy solutions
• Have well-developed problem-solving skills
• Be able to learn and acquire the necessary competences for the tasks in hand
• Have the capacity to identify sources of knowledge and innovation outside the organization

Source: Adapted from Byers et al. (2015)

Entrepreneurs tend to show high self-effectiveness, in that they have a firm belief they can effectively organize and perform actions to achieve the desired objectives (Markman et al. 2002).

Furthermore, entrepreneurs with previous experience in the industry where the new firm carries out operations tend to be more successful, not only due to their technical competence but also due to their accumulated knowledge in relation to ways of promotion and the regulations of the sector they are part of (Chatterji 2009).

The best-qualified entrepreneur combines experience and talent, demonstrating flexibility and capacity to adapt to changeable conditions and reduce the risks associated with business activity. They are also resilient when faced with setbacks and able to take on multiple tasks, showing a good capacity to solve problems and overcome challenges (Eesley and Roberts 2012)

In addition, the entrepreneur is responsible for creating an inspiring and wide-ranging vision for the firm, to be able to use this to motivate employees, allies and those providing finance (Amabile and Khaire 2008). One of the entrepreneur's most important characteristics is the capacity to carry out the necessary tasks, correspond to objectives and inspire other resources to help perform those tasks, in order to overcome the challenge faced (see Table 3.4).

Summarizing, entrepreneurs are individuals with multiple talents, able to raise their capacities and interests, in order to exploit a given entrepreneurial opportunity, almost always with the help of an equally entrepreneurial team. That opportunity seems to be more favorable, due to the entrepreneur's intrinsic desire for independence. To lessen the risks, many entrepreneurs make a slow transition, keeping their original jobs and respective salaries (Folta et al. 2010).

Nevertheless, as proposed by Hayton and Zahra (2004), the above perspective does not prevent considering two alternative ways to fulfil an initiative of technological entrepreneurship, namely:

(i) creating new technology-based firms (though entrepreneurship); and
(ii) developing projects based on inventions or technology (new ways of combining production factors) in established firms/organizations (adopting intrapreneurship).

In this context, there is a definite need to develop personal characteristics (Sexton and Upton 1987; Ulijn et al. 2001) and competences (Schumpeter 1934; Venkataraman 1997; Zahra and George 2002) considered critical to achieve success in full development of any entrepreneurial initiative, including the capacity to identify sources of knowledge and innovation outside the organization (Amabile and Khaire 2008).

In the line defined by Byers et al. (2015), based on education, training and valuing personal characteristics and competences, "being an entrepreneur" can be (re) defined as corresponding to a style of commercial management and control that covers: identification and latent capitalization of the qualities of human resources involved in stimulating the entrepreneurial initiative; focus on profitable opportunities concentrated on technology; and management of greater growth and substantial risks and uncertainties.

3.2 From Thinking Design to the Pentagon of Exploiting the Opportunity

3.2.1 Modelling Open Innovation Business

The methodology of business model design emerges as a possibility of a systematic approach to all dimensions at the stage of creating an entrepreneurial opportunity, or at the stage of (re)configuring a given organization, in that definition of the so-called value proposition requires identification and valuation of relevant partners, resources, relations, customers and markets, and above all, internal organizational aspects.

According to Zott and Amit (2008, 2010) and Foss and Saebi (2015), a business model incorporates the content, structure and governance of transaction costs at the heart of a given organization, and between that organization and stakeholders, supporting the creation of a firm, and making it possible to effectively capture value.

From an organizational perspective, the business model is defined as being a mechanism to design and structure organizations that allows configuration of the organizational variables (Winter and Szulanski 2001), as well as adding value to the transactions established between the firm and stakeholders and having a positive impact on the organization's performance.

Landry et al. (2013) developed an approach based on business model typologies provided by different university technology transfer services, considering different aspects of the external organizational context. These authors also use an econometric approach to identify the services best adjusted to their customers' value chain, although various lines of research remained to be explored, particularly in terms of the factors determining the value created by universities' technology transfer services and the importance of open innovation strategies to stimulate value creation from those interfacing services.

Open innovation strategies that link universities' technology transfer services and firms can be governed by customized business models (of the demand pull type), in order to maximize the advantages arising from open innovation strategies.

Laursen and Salter (2006) refer to a set of advantages, among which they highlight optimizing use of external knowledge inputs, which give dynamics to internal innovations and thereby allow market expansion for the purpose of using the innovation produced internally in combination with external innovation.

Therefore, the option to adopt an open innovation model means the organization must follow an orientation of open innovation, reflecting on its internal structure and its external relationships.

The open innovation business model must ensure that definition of the strategy as an integrated whole is designed and customized by the organization choosing this path to develop its business. So this model will have to be designed in order to safeguard the organization's specificities and the set of connections with internal and external stakeholders.

Van de Vrande et al. (2006) and Petroni et al. (2011) underline the concept of open innovation entry, which covers different practices associated with open innovation, namely monitoring the external environment for ideas, acquiring external technology, actively seeking crowdsourcing, innovation competitions, forming joint ventures, involvement in R&D alliances, licensing technology from universities or participation in large scale networks in order to coordinate innovative activity.

These strategies for entering open innovation require different, customized business models, representing a recent trend in studies that begin to address a critical topic, i.e., different ways in which organizations can (re)design their business models for better adjustment of their structure and governance to open innovation (Hienerth et al. 2011; Storbacka et al. 2012; Pereira and Leitão 2016).

(Re)design helps organizations to become able to obtain benefits by capturing external sources of knowledge. In the line suggested by Hansen and Nohria (2004), when an organization depends heavily on external sources of knowledge, in the context of open innovation, at the same time there must be implementation of internal networks serving to facilitate access to and absorption of the knowledge acquired in the innovation processes of the receiving organization. That set of internal networks corresponds to realignment of the organizational structure and development of new capacities in terms of knowledge and organizational practices.

In this context, it is considered appropriate to introduce design thinking methodology in the process of identification, analysis, ideation, prototyping and exploratory testing of the entrepreneurial and innovative opportunity, whether in the context of nascent entrepreneurship or an evolutionary scenario of corporate entrepreneurship, through organizational (re)configuration, following an open innovation business model approach, to ensure the strengthening of intrinsic and relational competences underlying that opportunity.

3.2.2 Design Thinking: Business Modelling Tool

This book incorporates a differentiating facet, which lies precisely in including the methodology based on design thinking as a working tool in the scope of a course on Technological Entrepreneurship Designing, for two reasons; the first being through the understanding that it is a methodology based on gamification with creativity, serving as an appeal to entrepreneurs to discuss, analyze, imagine and work on their business ideas; the second is related to the opportunity to propose a new form of entrepreneurship education in engineering and management courses, traditionally designed for recurrent use of approaches of the type: identification of the problem and search for a solution; which need to be enhanced and complemented by designing additional solutions of creativity tending towards innovation, through the use of gamification and design thinking tools.

Looking back, design thinking emerged in the 1960s, when some designers intensified their efforts to develop a design methodology, also called design research, which established at the time a parallel with the approach used in natural sciences and aimed to understand and improve design processes and corresponding practices in a broad sense. For example, in 1969 Herbert Simon, publishing the work entitled *The Sciences of the Artificial,* tried to form so-called "design science", based on a theoretical body, partly formal, partly empirical, as a doctrine that could be taught through a seven-stage design model, which as will be seen later would influence the evolution of design thought.

In the 1970s, many designers rejected that previous notion of design methodology. Only at the beginning of the 1990s did Terry Winograd, together with David Kelley of the IDEO agency and Larry Leifer, initiate real advancement in operationalizing the different components of design thought, which was referenced in a pioneering way by Buchanan (1992).

Since then, the recognized IDEO agency has effectively supported and promoted the approach based on design thinking, particularly through organizing the "Design Thinking Research Symposia" from 1991. IDEO was also involved in creating the d. school[1] (Design School) founded by Stanford University in 2005.

In the same year, Hasso Plattner, the co-founder of SAP, made a personal donation of US$ 35 million, in order to found that *d.school*, which was officially called the "Hasso Plattner Institute of Design at Stanford". Two years later, in October 2007, the D-School was founded, located in the HPI of Potsdam, Germany.

The design thinking training programmes administered in both institutions are characterised by close collaboration between students from different faculties, emphasizing mutual respect and linguistic communication without the burden of business language. In November 2008, Stanford University and HPI launched a research programme on innovation.

The second decade of the twenty-first century has been marked by a real boom in design thought, with this becoming a major buzzword in the business world. In

[1]For further information consult: http://dschool.stanford.edu/

addition, the change tried out recently towards new business sectors has opened a growing debate and a horizon of opportunities for rapid exploration of design thinking methodology as a useful tool in idealizing and prototyping new ideas in business, technology and innovation.

Unlike analytical thought, which is associated with "breaking ideals", design thought is a creative process based on the "construction" of ideas. As proposed by Baeck and Gremett (2011), analytical approaches focus on narrowing down design options, while design thought takes a broader approach, at least in the initial stages of the process.

In design thought, designers do not make any kind of untimely judgement about the quality of ideas. As a result, the fear of failure is minimized, with maximization of both the quantity of inputs and participation in brainstorming and subsequent stages of analysis, ideation and prototyping. Thinking "out of the box" (ideas in the wild state) is encouraged in the initial stages of the process, since it is believed this style of thinking can lead to creative solutions that would not emerge otherwise. Here, the motto is: "everyone's a designer"; giving a form to a user-centered approach that brings design to the heart of the business world.

According to Baeck and Gremett (2011), design thought is a more creative approach centred on the user, in order to look for solutions to problems, compared with traditional design methods. These authors underline that design thought challenges the obvious, adopting a more experimental approach. The heart of the method lies in perfect understanding of the customer, as all ideas and subsequent work are based on previous knowledge of the customer.

Design thought methodology is not only applied to design problems, since the former can be used in exploring and defining business problems, as well as in defining products and services. Furthermore, this methodology has been characterized as a discipline in which the designer's sensitivity and the methods provide a correspondence with people's needs, ensuring application of what is technically feasible and contemplating what a viable business strategy can convert into added value for the customer and for the purpose of exploiting a market opportunity.

As a methodology or style of thought, design thinking combines empathy in the context of a given problem, the creativity devoted to generating perceptions and solutions, and the rationality and feedback to analyze and adjust solutions for a given context. All this combined helps to find a solution that corresponds to the user's needs and at the same time generates income, i.e., it promotes business success.

According to Baeck and Gremett (2011), the main attributes of design thinking are as follows: ambiguity; collaboration; constructive; curiosity; empathy; holistic; iterative; non-judgmental; and open mentality. Table 3.5 presents the attributes, as well as a brief description and comment towards better understanding of each attribute.

According to Baeck and Gremett (2011), design thinking is not only a combination of those attributes, but also a cyclical progression of the activities involved in the different phases of the process.

Returning to the vision of Brown (2008), the executors of design thinking should have the following characteristics:

Table 3.5 Design thinking: attributes, definitions and comments

Attributes	Definitions	Comments
Ambiguity	Being comfortable when things are not clear or when the answer is not known	Design thinking deals with ill-defined problems or those difficult to solve
Collaborative	Working together with other disciplines	People design in the context of multidisciplinary teams
Constructive	Creating new ideas based on old ideas, which can be the most successful ideas	Design thinking is an approach based on the solution that aims for a better result in the future
Curiosity	Being interested in things that are not understood or perceiving them through a new lens	Time and effort is spent on clarifying requirements, with a great amount of activity devoted to seeking solutions to problems consisting of defining and deepening that problem
Empathy	Seeing and understanding things, from the customer's point of view	Focus is on the set of user needs (i.e., the context of the problem)
Holistic	Observing the greatest dimension possible of the context for the customer	Design thinking tries to correspond to the user's needs and lead to business success
Iterative	A cyclical process where improvements are carried out with a view to a solution or idea whatever the stage	The design thinking process is usually non-sequential and can include links of feedback and cycles
Non-judgmental	Creating ideas, with no place for judgement of the idea's creator or the idea itself	Particularly in the brainstorming stage, there is no place for untimely judgements
Open mind	Considering design thinking as an approach to any problem whatever the industry or application	The method encourages "thinking out of the box" (with "ideas in the wild state"), challenges the obvious and follows a more experimental approach

Source: Adapted from Baeck and Gremett (2011)

(i) Focus on human values and needs, having empathy towards people, asking them for feedback, for that feedback to be used subsequently in their designs;
(ii) Make experimentation an integral part of the design process, to be active executors, communicating through meaningful artefacts;
(iii) Collaborate with people from a variety of different backgrounds, respecting their points of view, to allow the advancement of ideas and solutions to emerge from diversity;
(iv) Have the capacity to deal with difficult problems, being curious and optimistic, as well as adopting a position of integrative (and holistic) thinkers able to look at the widest context possible for the customer; and
(v) Be conscious of the whole design thinking process, in relation to objectives and methods.

The process inherent to design thinking is based on the pioneering models proposed in the field of the so-called design process, usually covering between three and seven phases, which may be linear or circular, i.e., there is the possibility of returning to the starting point and beginning a new iteration. It can also include

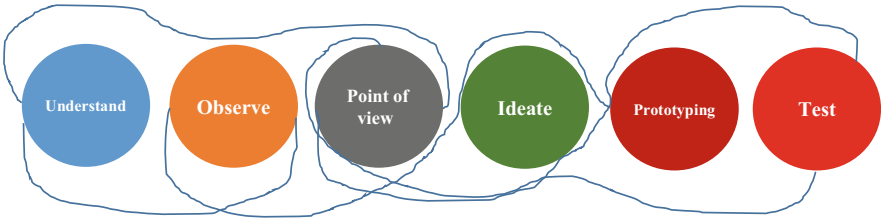


Fig. 3.3 Design thinking: the process. Source: Adapted from Kelley and Littman (2001)

various feedback links between the phases and allows several phases to run in parallel. Therefore, it is more useful to approach those phases as modes rather than sequential phases.

The work by Simon (1969) defined a pioneering model of design process, consisting of seven phases: definition; search; ideation; prototyping; choice; implementation; and learning. This model describes generally the prototype of the design thinking process.

According to Kelley and Littman (2001), integrating the seven above-mentioned phases in six phases that culminate in the testing activity designers can frame problems, raise the right questions, create more ideas and allow choosing the best answers. As shown in Fig. 3.3, the phases are not necessarily covered in a linear way, but may occur simultaneously or be subject to repetition.

In the most recent literature, different models have been proposed concerning the design thinking process (see summary presented in Table 3.6), including the so-called triangular process in three steps originally developed by Brown (2008) in the IDEO firm, as well as the proposal by Kelley and Littman (2001) already mentioned, which includes six sequential phases that can integrate various feedback links.

Table 3.6 presents the phases as defined by different (organizational) protagonists and authors of reference on design thinking, noting that those authors sometimes use different designations for the same phases.

Regarding the methodology of design thinking, a great variety of methods can be used, with no strict rules as to definition of the methods to employ. Some methods are typically used by designers, while others are more similar to those adopted in user-centred design approaches, as happens in more specialized training in creativity.

Table 3.7 presents a summarized list of the methods used and promoted by *d. schoolBootcampBootleg* (2010), contrasting them with the more traditional methods (commonly called ethnographic methods), for better illustration of the different types of methods that can be used in the design thinking process.

As observed in Table 3.7 above, despite the differences, there is a certain convergence in terms of defining the prototype phases covered by design thinking, namely:

Table 3.6 Summary of design thinking models

Prototyped phases	Simon (1969)	Set of tools IDEO	Tim Brown (IDEO)	d.school/ D-School (HPI)	d.schoolBootcamp Bootleg (HPI)—Modes	Baeck and Gremett (2011)	Mark Dziersk (Fast Company)
Understand the problem	Define	Discovery	Inspiration	Understand	Create empathy: observe, commitment and immersion	Define the problem to solve	(1) Define the problem
Observe users	Search			Observe		Seek inspiration	
Interpret results		Interpretation		Formulate point of view	Define (identify the problem)	–	
Generate ideas (Ideate)	Ideate	Ideation	Ideation	Ideate	Ideate	Ideate multiple ideas	(2) Create and consider many options
Prototyping, experiment	Prototype	Experimentation	Implementation	Prototype	Prototype	Generate prototypes	(3) Refine the selected directions; and if decided, repeat steps 2 and 3.
Test, implement, improve	Objectives/ Choose, implement and learn	Evolution		Test	Test (includes refining and improving solutions)	Request feedback from users	(4) Choose the winner and execute

Source: Adapted from Kelley and Littman (2001)

Table 3.7 Methods used in design thinking

Phases (modes)	Methods of *d. schoolBootcamp Bootleg* (2010)	Ethnographic methods
1. Immersion/inspiration Observe users (empathy)	• Assume a beginner's mentality • What? How? Why? • Study the user's perspective/vision • Interview (to generate empathy) • Extreme users • Analogous empathy • Capture and share of the history • "Torture"	• Define the state of the problem • Observe users (can include protocols for thinking aloud) • Carry out on-site visits (contextual survey with users who perform their tasks in the workplace) • Interview users and send out questionnaires
2. Analysis and synthesis Formulate point of view (synthesis and interpretation of results)	• Saturated and group space • Empathy map • Journey map • Composite character profile • 2×2 matrix • Stairway: Why-How? • *madlib* point of view • Point of view analogy • Announcing search for point of view • List of confirmation of critical reading • Design principles • Questions about: how could we do this?	• Models of contextual survey, including affinity diagrams, etc. • People and roles • Use of scales, scenarios, users' stories, everyday scenarios, etc.
3. Ideation Ideate (generate ideas)	• Brainstorming (more selection) • Confrontation • Imposition of restrictions	• Brainstorming • Focus and user groups

(continued)

Table 3.7 (continued)

Phases (modes)	Methods of *d. schoolBootcamp Bootleg* (2010)	Ethnographic methods
4. Prototyping Prototype Experiment	• Confrontation • Imposition of restrictions • Prototyping for empathy • Prototyping to test	• Prototyping, with low loyalty and high loyalty
5. Test Test and improve	• Test with users • Prototyping to decide • Identify a variable • Prototyping guided by the user • *Wizard-of-Oz* prototyping • Feedback-capturing framework	• Use laboratory tests (can include protocols for thinking aloud) • Tests of unlikely users • Tests of users in the field • Tests of informal users (for example, colleagues and friends, etc.) • Studies of Key-Performance Indicators (KPIs)
Others	• Storytelling • Shooting video (more editing) • I want; I like; What happens if?	• Storytelling • Classifying cards

Source: Adapted from Kelley and Littman (2001)

1. *Immersion/Inspiration*: When a team gathers to identify a problem. This includes visual systematization of the various perspectives and points of view (normally by attaching post-its of different colors). This can also include deeper immersion, resorting to interviews and fieldwork.
2. *Analysis and synthesis*: The data gathered are submitted to a phase of analysis and synthesis, so as to organize and create identifiable patterns, within a logic that allows understanding of the problem in question.
3. *Ideation*: The phase of sharing the idea. With the problem and target public defined, the debate is extended (brainstorming) to the various actors that can advance freely (uncensored) with bold ideas, including those difficult to put into practice.
4. *Prototyping*: Corresponds to the moment when abstract ideas gain the form of a draft. Unfeasible ideas are excluded and attention is paid to ideas more likely to be accepted by interested parties.
5. *Test*: Presentation of the prototype to interested parties. The aim is to understand if the solution solves the problem or if it is necessary to repeat the design thinking process.

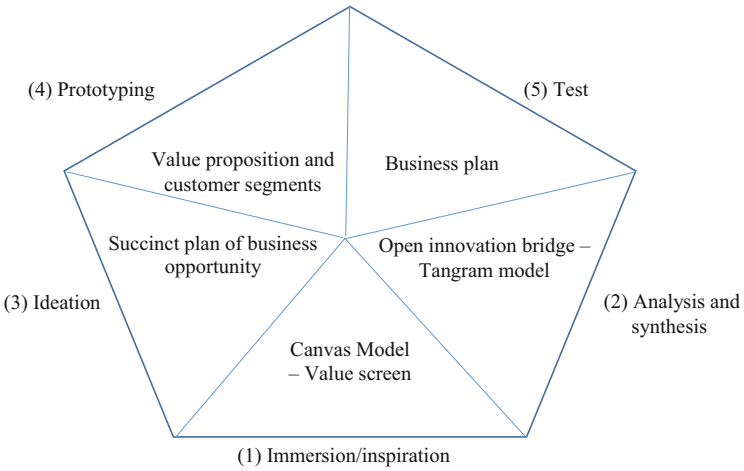


Fig. 3.4 Opportunity exploitation pentagon. Source: Own elaboration

Design thinking is the glue that can join different disciplines, aiming for the success of projects to create new business units or intra-entrepreneurial projects of an organizational (or institutional) nature.

Here, in the scope of the course in Technological Entrepreneurship Designing, the application of a new methodology called opportunity exploitation pentagon (see Fig. 3.4) is suggested, this being designed from the five prototype-phases of design thinking identified above, associating a tool with each one of them, with the strategic and operational purposes that are described in the subsequent five sub-points.

3.3 Business Model: Gaming and Designing

3.3.1 Immersion/Inspiration with the Canvas Model: Value Screen

In the immersion/inspiration phase, the team promoting the project is advised to meet to identify a problem and prepare a pitch structured in the form of a canvas, following a design approach serving fundamentally to systematize different perspectives and points of view, which if possible can be complemented with some fieldwork and market study, through holding interviews with business-people or others with experience in dealing with the problem identified.

This phase is also characterized by intensification of the vision-sharing exercise, with a strong visual component using post-its. This phase is critical to raise the entrepreneurial or innovative project/initiative from the paper. Here, the paradox lies in the fact that to raise it from the paper it becomes necessary to place it on paper, which is done by questioning, and ways of exploration and discussion around six

Table 3.8 Questioning in the immersion/inspiration phase

Questions	Description	Ways of exploration
1. How is it intended to solve the customer's problem?	The first step is to identify, exactly, what is offered. However, here it is necessary to avoid the common orientation of satisfying the customer, as that is the minimum level, and so it is necessary to go further, to achieve differentiation.	Answer questions such as: are we dealing with a product? a service? what is the added value? What is the main benefit the customer will obtain from your proposal, compared with what already exists on the market?
2. How to understand the customer?	If you already know what you have to offer, try to understand your potential customer.	Answer questions such as: what is their age group? what are their habits and where do they usually buy?
3. How to find the competitors?	Assess who your strongest competitors are and how they stand out in relation to customers. Also identify indirect competitors.	Answer questions, for example: What are unusual, but possible places for providing the product/service?
4. Where can the product/service be found?	If you have a point of sale, it will be necessary to ask whether the location chosen is visited by potential customers. If so, it will be necessary to assess whether there are competitors nearby.	Answer questions such as: Where can the product/service be found? Do you intend to have a point of sale? Will you sell on the internet? Do you intend to work from home? What is your strategy to attend to customers?
5. How to establish contact with good suppliers?	Based on the premises and the products, make an active search for suppliers. Talk a lot to the people involved.	Answer questions such as: What are the costs? What are the underlying market dynamics?
6. How to design the succinct business opportunity plan?	Based on all the visions and information gathered, design your succinct business opportunity plan.	Answer questions such as: How much will it be necessary to invest? over how long? with what flows? what are the risks involved? how long to break even?

Source: Own elaboration

questions considered fundamental are suggested, as presented in Table 3.8. Consequently, the questions and examples of ways of exploration should be understood as propaedeutic elements for carrying out brainstorming, in the third phase of ideation, where as seen in Sect. 3.3.3 (see Table 3.10, phase 3: ideation), elaboration of the succinct plan of business opportunity is recommended.

In the immersion/inspiration phase, which consists of sharing ideas, to begin with use of the Canvas model (also called the value screen) is suggested, as elaborated by Osterwalder and Pigneur (2009), inasmuch as this provides a far-reaching tool for creating and managing new products and services.

This model allows entrepreneurs, innovators, investors, financing bodies, managers of companies or projects with a social impact to understand and explain to others the functioning of your ideas, being a tool that stimulates creativity,

discussion, analysis and agreement. In addition, it allows definition of the problem and the target public, extending the debate and including bold ideas, whether or not they are difficult to apply. Consequently, it means the idea can be formalized and trained, with the subsequent actual successful construction of the entrepreneurial and innovative opportunity to be exploited, i.e., with commercial success.

For this purpose, Osterwalder and Pigneur (2010) configured the use of a working panel (or value screen) with nine blocks of activities representing the fundamental elements that a business model should be composed of.

Following the building games metaphor, this nine-block method allows all actors involved in the process to have the same perception of the question and set out from a common point using the same language. A business model is developed, capturing the logic of value creation and value added, allowing readjustments and reassessments both in terms of the model and in terms of its relations and assumptions, aiming for continuous improvement.

A possible starting point, following a marketing logic, is justifying the need to innovate, precisely via the demand noted through timely detection of an ill-satisfied need in customer segments. That need can take on a body and form through creating a new technology, product or service; improving a given market; creating a new process, business, product or service; or even to face and overcome a time of crisis.

The above-mentioned authors placed at the heart of the model, the axes of the added value propositions, and following an approach in accordance with an organizational vision of the human brain, placed on the left (rational) side, three blocks justifying costs, namely, partnerships, key activities and key resources, also aware of the critical importance for business success of endogenous resources and the project's capacities. In addition, they did not forget organization of the right (emotional) side, where three more blocks are placed, greatly related to behavior, namely customer relations, customer segments and communication and distribution channels, which originate sources of income.

To build the opportunity, those blocks must be filled in and ordered (see Fig. 3.5), so as to respect the value screen drawn up by Osterwalder and Pigneur (2010).

Still in the immersion/inspiration phase, for effective construction of the entrepreneurial and innovative opportunity, it is necessary to master the Canvas model completely and perform the following five activities:

1. Mobilization: join the team and sensitize them to the need to create a business model;
2. Understanding: collect data and information, to gather the greatest knowledge possible about the target market, identifying the needs and problems of potential customers;
3. Project: elaborate a business model appropriate to the type of business, based on market study;
4. Implementation: put the model obtained into practice; and
5. Monitoring: monitor continuously, in order to allow adaptations and transformations in the model, as found necessary from the reactions revealed by customer segments of the target market.

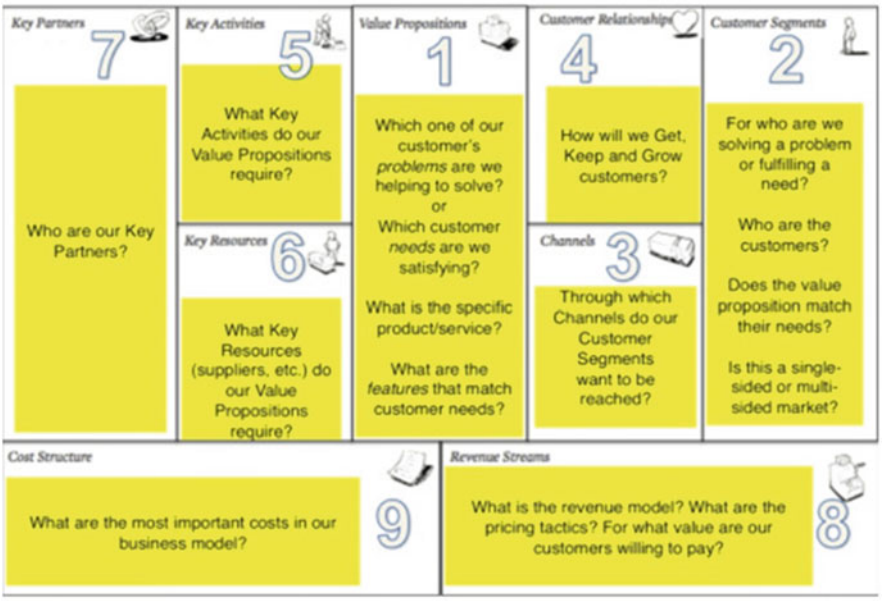


Fig. 3.5 Canvas Model: value screen design approach. Source: Adapted from Osterwalder and Pigneur (2010)

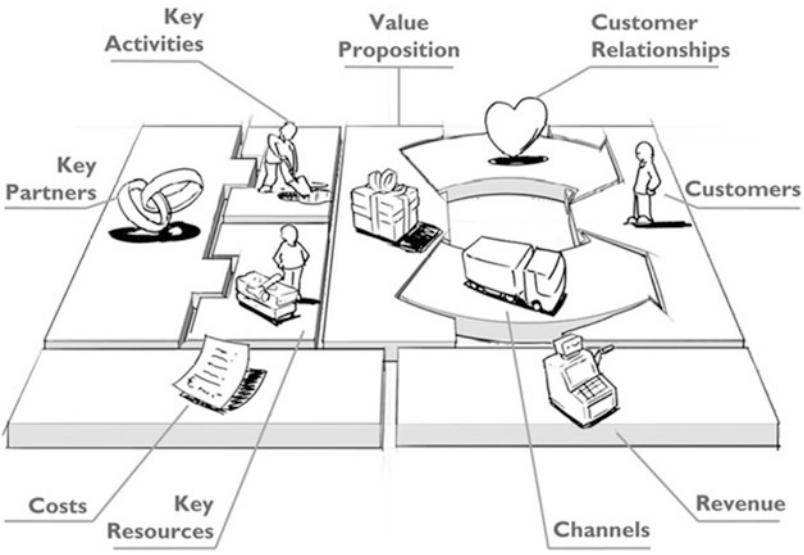


Fig. 3.6 Game of visual systematization of the business model. Source: Adpated from Osterwalder and Pigneur (2010)

The orienting tool for constructing the entrepreneurial and innovative opportunity can also identify a problem, give form to the idea and play a game of visual systematization of diverse perspectives and points of view (for example, using post-its), in the form of a first proposal of a business model, based on nine jigsaw pieces as presented in Fig. 3.6.

In the process of developing the business model, the Canvas model allows strategic construction of the opportunity using two hypothetical scenarios:

(i) The first deals with the customer and describes their different characteristics, how the product or service is used, and customers' wishes; and
(ii) The second concerns the environment in which the business model is developed. The aim is not to predict the future, but to ideate and anticipate future possibilities with detailed ideas.

For Leitão and Gomes (2014), customer segmentation and value propositions are the foundation of the Canvas model, and so the creation of a business model requires using the nine blocks that form it, as well as the aggregated concepts that are presented as follows:

1. Customer Segments
Who are we creating value for? Who are our most important customers?

Customer segments represent groups of individuals or organizations that the project or new firm intends to reach. To define their range and serve their interests better, various segments can be distinguished according to their needs, behavior or any other attribute (for example, distribution channels to achieve the price customers are willing to pay). If a certain market is the target, then the value proposition will be adapted to the specific needs of a duly identified customer-type, whose preferences regarding products or services vary according to the needs of each segment.

2. Value Propositions
What do we offer our customers? Do we help to solve our customers' problems? Which ones? Value propositions refer to all products and services offered by the firm to satisfy a need, creating value for a customer segment. The value can derive from quantitative (for example, price, speed of response, length of guarantee, energy labelling, etc.) and qualitative (design, quality certification, brand, fashion, customer service, after-sales service, etc.) characteristics.

3. Channels
What communication, distribution and sales channels are to be used to deliver our supply to customers? Distribution channels are the means used by the firm to deliver its value proposition, and these may be direct (for example, authorized outlets, retail network, own network of physical shops, online shops, etc.) or indirect (network of shops, retailers, partnerships, etc.). These must be defined according to the supply and the type of customer.

4. Customer Relations
What is the type of relationship intended with the customer? Where is this relationship identified in the business model?

First, it is necessary to determine the type of relationship intended with the customer. It is then essential to personify the relationship with the customer, through three types of interest: customer to capture; customer to retain; and customer to stimulate sales.

5. Income
How much will the customer be willing to pay for our value proposition? What is the preferred form of payment?

The income generated is different from one customer segment to another. There are different ways of generating income, namely, sale of goods; sale established according to the quantity consumed; crossed sale of goods and services; connected sales packages; conditioned subscription; commercial decoy of the loss leader pricing type; financial loan/renting, leasing among others, etc.

6. Resources
What are the key resources necessary for good functioning of the business model?

Those resources are the most important assets to ensure complete functioning of the business model, and can be classified as:

- Human: human capital lies in people, contemplating their education/training and experience;
- Financial: the business model requires capital, credit, financial means, etc. to buy or even hire services;
- Tangible: include assets such as buildings, vehicles, machinery, distribution network etc. that ensure activities' operation; and
- Intangible: include forms of intellectual property, such as patents, brands, design, copyright and similar.

7. Activities
What are the key activities for executing the business model?

The key activities to execute in order to ensure the success of the business model can vary according to the value added proposition of the project or firm, and can include different phases of the process of supply, production, distribution, commercialization, guarantee, post-sales and substitution, etc.

8. Partnerships
What partnerships are necessary to create and integrate a value proposition?

Partnerships allow firms to potentiate value creation, through management appropriate to the paradigm of open and integrative negotiation, which contributes to reducing transfer costs, and to greater sharing of resources and services, reducing the risk or costs associated with acquiring new resources and competences.

9. Costs
What are the most important costs related to operating the business model? What is the cost implied by the intended relationship with the customer? It is essential to determine the costs of the fundamental resources and activities for executing the business model, in order to define the cost structure of a business model and in this

way duly value the need to innovate always with the concern for efficiency and rationalization of costs.

Therefore, the business model corresponds to simplified representation of the complex processes of a project or new firm, in that it allows better management of how value is distributed to customers, through goods and services, thereby contributing to making a sustainable profit, i.e., over a longer period of time.

In the context of the paradigm of open and integrative negotiation, people are central to the process of building the opportunity, through definition of the business model, taking as the starting point the immersion/inspiration phase, which stimulates the sharing/discussion of different perspectives and visions. This is the true basis of the assets of modern, flexible, innovative and entrepreneurial organizations. It is through applying methods and techniques of creativity and knowledge management that projects or new firms are able to capture and incorporate people's tacit knowledge, making that knowledge explicit and facilitating its share among those involved, through developing an organizational culture that motivates innovation based on collaboration and teamwork, with a common purpose, which can be (financial, environmental and social) sustainability, fulfilling the mission, vision and values, as well as ensuring the social impact of the project or firm.

3.3.2 Analysis and Synthesis with the Open Innovation Bridge: Tangram Model

In the phase of analysis and synthesis, use of the tool designated as the open innovation bridge—Tangram model[2] (see Fig. 1.3, presented in Part I of this book) is suggested; in order to ensure organization of the data and information collected in the previous stage, and in this way create identifiable patterns, within a logic that allows greater understanding of the problem raised, identifying the critical resources and transactional elements, to prepare the design of an open innovation business model.

The game of the open innovation bridge represents the importance of identifying resources and transactional elements, in order to operate innovation of the business model, with the ultimate aim of renewing the business innovation capacity.

Resources are identified in terms of internal factors (A1) that determine the absorption capacity of the firm and of internal R&D activities (B3), which influence the firm's strategic positioning, in terms of open innovation.

Transactional elements are identifiable in terms of connecting factors (A2), where the different cooperative links with external stakeholders predominate, namely consultants, universities and laboratories. In addition, these elements are intrinsically

[2]For an example of empirical application of the open innovation bridge tool—Tangram model, consult Part II—Empirical application of open innovation business models in this book.

linked to external R&D activities (B4), which are developed so as to gain access to external sources of knowledge.

The visual metaphor of the task of designing the open innovation bridge aims to give added importance to the decision piece: strategic coopetition (C5); which is inserted in the cooperative links with other competing firms. However, this task would not be complete if it was not possible to identify the critical elements of the transactional structure (D6) of the business model, so that in the end renewal of the business innovation capacity is achieved (E7).

In this gamification approach, an old Chinese brain-teaser is revisited, allowing the coupling of the five components previously identified, using the design and placing of the seven colored decision pieces. Initially, there should be identification of the five principal components of the so-called symbiotic process of the elements of the business model's transactional structure, namely: (A) Absorptive capacity; (B) Open innovation; (C) Strategic coopetition; (D) Critical elements of the transactional structure; and (E) Business innovation capacity. In turn, these five components can be represented by seven decision pieces.

Therefore, in the design of the open innovation bridge (cf. Fig. 1.3), concerning component A, referring to internal factors (i.e., resources), it is necessary to list a set of items representing internal factors (A1: light green) of the absorption capacity construct, namely: acquisition of other external knowledge (A11); acquisition of equipment, software and licenses (A12); employees' academic qualifications (A13); and employees' training to develop innovation activities (A14). In addition, listing the items referring to linking factors (A2: purple) of the same absorptive capacity (i.e., transactional elements), namely cooperative links with consultants (A21), cooperative links with universities (A22) and cooperative links with laboratories (A23).

In turn, component B concerning the open innovation construct, requires listing the items referring to internal R&D activities, i.e., resources, (B3: blue) and external R&D activities, i.e., transactional elements (B4: yellow).

As for component C regarding strategic coopetition, this requires identification of the cooperative links with other competing firms (C5: orange).

Concerning component D representing the critical elements of the transactional structure (D6: red), this requires prioritizing the items listed in the previous identification of resources (A1; B3) and transactional elements (A2; B4) of the model. Component E referring to the construct of business innovation capacity (E7: dark green) can be represented by the type of innovation: radical; incremental; product; process; organizational; commercial, etc.

3.3.3 Ideation with the Succinct Plan of Business Opportunity

In the ideation phase, consisting of sharing ideas, the aim is for the team to be motivated and mobilized for joint preparation of the so-called succinct plan of business opportunity, which forms a first diagnosis of the viability of the business idea and the resources necessary for its implementation.

In the scope of the course in Technological Entrepreneurship Designing, the succinct plan of business opportunity should be designed taking the following preparatory elements into consideration:

- Description of the technology and its commercial applications;
- Definition of the market and target consumers;
- Definition of the competition and the competitive advantages that could allow the business idea to rise above the former;
- Financing needs and sources;
- Intellectual protection of the business idea;
- Profile of the elements of the business team; and
- Summary assessment of the opportunity.

Referring to results obtained in previous pedagogical experiences, a structured pitch should also be prepared, as creatively as possible, joining different visions and aiming for a convincing visual impact. However, incorporating the desirable degrees of freedom, without detracting from its degree of novelty, presentation can contain the following elements as a guide:

- Concept;
- Positioning: Vision and Mission;
- Human Resources;
- Marketing-mix;
- Target public;
- Study of the Market/ Competition;
- PESTE/SWOT/TOWS strategic analysis;
- Future scenarios; and
- Final considerations.

3.3.4 Prototyping with Value Proposition and Customer Segments

In the prototyping phase, where ideas begin to take shape, a process of choice is undertaken opting for the ideas that emerge as having the greatest chance of being accepted by the interested parties, namely, segmented customers forming the so-called relevant market.

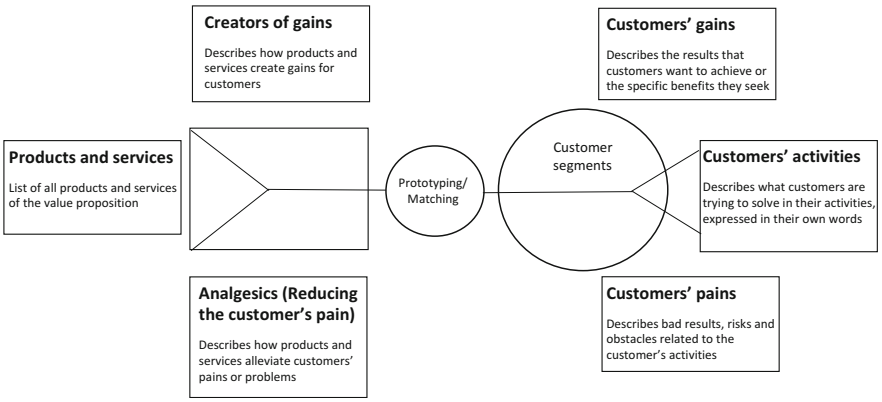


Fig. 3.7 New canvas of value proposition and customer segments. Source: Bernarda et al. (2014)

To do so, use of the tool developed by Bernarda et al. (2014) is suggested, abbreviated to value proposition and customer segments, which consists of a new value proposition canvas (see Fig. 3.7). This allows working on the complementarity between those two blocks and, to a certain extent, better prototyping of the ideas previously discussed and aligned, for the purpose of analysis and ideation.

In this canvas, Bernarda et al. (2014) first divide the value proposition block in three parts: products and services; creators of gains; and analgesics. Secondly, the customer segment block is also divided in three parts: customers' gains; customers' pains; and customers' activities. With this model, it will be possible to prototype and produce a new draft based on the active search for the best possible fit between the product/service and the market, in order to ensure that customers become really pleased with the value proposition. The hypotheses studied must be validated "on the street", as it is only possible to find out if customers really prefer a new variety if they are able to try it out and express their interest.

The new value proposition describes a set of products and services that create value for a specific customer segment considered representative of the relevant market. This value proposition aims, therefore, to solve customers' problems or satisfy their needs, through providing a set of benefits that a firm offers to its customers.

The products and services forming the value proposition and the way these reduce the "pain" of a certain customer segment and create added gains for customers, form a differentiating factor of the business.

The block referring to the customer segment, designed originally on the first value canvas, allows definition of the various groups of people or organizations that a firm aims to reach and serve (i.e., the customer typology). Therefore, when processing the prototyping phase based on adapting the business model, the innovative entrepreneur can group customers in different segments according to their common needs and behavior, or even other attributes considered appropriate to make the segmentation.

So prototyping will allow the design of a new (cumulative) value proposition, and customer segments should respond to the following questions: (i) what value do we deliver to customers?; (ii) among customers' problems, which ones will we help to solve?; (iii) what customer needs are we satisfying?; (iv) what product and service package are we offering to each customer segment?; (v) for whom is value being created?; and (vi) who are the most important customers?

The way these questions are answered defines a set of initial hypotheses, in the form of the new value proposition that will have to be validated on the ground, with potential customers, suppliers, partners or investors. This is followed by a fine-tuning process (adjusted to the interests of customer segments), which will necessarily include validation of that proposition on the ground, validating or reformulating the set of hypotheses, until there is a "perfect" match between the product/service and the market, i.e., when customers show they are really pleased with the value proposition of the project or the new firm.

3.3.5 Test with the Business Plan

In the test phase, which consists of presenting the prototype to interested parties, aiming to find out if the solution proposed contributes to solving the problem or if it is necessary to repeat the design thinking process, use of a well-known tool is recommended, namely the business plan. This does not do away with the need to carry out an economic-financial planning exercise, with the strategic, organizational, management, human capital, marketing and sales, forecasting and sensitivity analysis components, in order to determine the viability of the project or associated initiative.

Therefore, the business plan is considered a fundamental tool to test the project or new business initiative, in that it is a document allowing systematization of all the information related to a given business idea or innovation, which makes it possible to structure and assess the corresponding economic-financial viability (Siegel et al. 1993).

According to Barringer and Ireland (2006), to have a well drawn-up business plan, it is important to attend to the following aspects of formulation: (i) establish that the business makes sense (viability analysis); (ii) analyze how all the elements function as a whole; (iii) describe the integrated functioning of the participant network necessary to proceed with the business; and (iv) articulate the central strategy to stakeholders.

For Duarte and Esperança (2014), after defining the business plan, it is critical to contemplate a set of questions considered important, namely: (1) is the business realistic?; (2) is the participation of the partners necessary for the business guaranteed?; (3) if those partners participate, will they be motivated by the project?; (4) will customers by willing to acquire the goods/services?; (5) will the entrepreneur/innovator be able to motivate customers and partners in sufficient numbers to

Table 3.9 Structuring the business plan

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
Executive summary	The most important part of the business plan. Many investors decide to proceed to additional discussions based on this section which must be clear, concise, convincing, informative and appealing. The executive summary must contain the key positioning and the rationale that can be found in the different parts of the business plan. Both the vision and the mission must help to communicate a convincing entrepreneurial/ innovative opportunity.	• Why is that a major problem and why are customers willing to pay for solutions? • How can the project/ firm solve the customer's problem or need? • How is this project/firm in a unique position to do that? • How is the economic aspect attractive? Why is this an exciting growth opportunity? • What are the elements of the team and what are the main partnerships?	For a discussion on the history of business and the concept, the following chapters are suggested: 2. Opportunities; and19. Dealing with presentations and negotiating; and 20. Leading firms to success.
I. Opportunity and Market Analysis	Investors like to finance solutions to big problems, which represent big opportunities. A strong beginning implies demonstrating solid understanding of customers and why this problem (or pain) is important for customers. Segmenting customers will persuade those reading the business plan that the project/ entrepreneurial or innovative initiative can grow to the size of the attainable market.	• What is the need or the problem to be solved by the project/firm? • Who is the customer or customer segment(s)? • What is the total size of the attainable market and what is the market's growth rate? • Is the current market context favorable or not?	The following chapters are suggested: 2. Opportunities; 3. Business vision and model; and 4. Competitive strategy.
II. Solution and Concept	Many product descriptions lose credibility by being a "very big photograph", trusting in existing gaps in the market or being too focused on the product, in the hope that a pure and simple explanation of the technology is sufficient, due to the idea being extremely	• What is the product or service? • Describe a "day in the life" of the customer before and after adopting the solution. What is the value proposition for a customer, and why is it attractive? • Which customers validated the product and are willing to pay for it?	The following chapters are suggested: 3. Vision and business model; 4. Competitive strategy; 5. Innovation strategies; and 16. Profit and collection

(continued)

Table 3.9 (continued)

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
	valuable. It is important to balance the use of technical or specific language of the industry with common everyday language. In addition, by detailing the value proposition and the business model, this will ensure the business sounds good from the beginning.	• What is unique and defendable about the business? • What is the economic and business model? How attractive are the financial margins?	
III. Marketing and Sales	This section of the business plan must clearly communicate an understanding of how to commercialize successfully and sell the product/service to the customer segments previously identified. Understanding and communicating the particular strategy of customer development is as important as the strategy to develop the product/service. There should be perfect harmony with product/service development to increase the likelihood of success. The business model and the pricing strategy should also be perfectly articulated with the sales strategies selected.	• What are the most appropriate marketing means to reach customer segment(s)? • What is the most appropriate type of sales channel for the product (for example, direct sales versus indirect sales)? • Who serves as the customer's decision-maker with purchasing power, and who influences them to purchase? • What is the expected duration of the sales cycle? • Are there partnerships that can be leveraged to publicize and sell?	Suggested reading of chapters: 9. Marketing and sales; and 12. New business organization
IV. Product Development and Operations	In this part, the person reading the plan must be convinced that the business-people have identified an attractive market, as well as knowing ways to generate income. This part must concentrate on developing the product/service and on how this will be transformed into	• What is the current state of development of the product(s)/service (s)? • What resources will be necessary to finish and send the product? Be specific about what types of resources will be necessary (for example, engineering, tools, suppliers, material,	Suggested reading of chapters: 7. Risk and return; 8. Creativity and product development; 11. Intellectual property; and14. Operations management

(continued)

Table 3.9 (continued)

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
	something that can be commercialized. Any key technology to be used for development purposes should be clearly explained (for example, flow diagrams can be useful). In addition, continuous growth in income should be demonstrated, presenting the specific planning of goals per product/service, in the long-term. This part is largely responsible for stimulating the quantity and scheduling of the financial amounts necessary for the business, becoming a critical component of the financial model of the entrepreneurial or innovative project/initiative.	partners and customer involvement). • What are the development chronograms planned and the main goals to attain? • What are the main risks that will be mitigated with each goal attained? • What is the appearance of the value chain regarding the production and delivery of products? • Are there patents, commercial secrets or other defendable advantages? • Are there regulatory obstacles that must be eliminated?	
V. Team and Organization	Building a team is a critical aspect for anyone beginning a new entrepreneurial or innovative project/initiative, and thereby establishing more credible communication with third parties. Understanding how the current team fits with the vision of risk will help investors and partners to understand the roles that need to be filled and how they can potentially help.	• What are the antecedents and roles of the founders and the main key-workers? • Describe the team's passions and skills and why the team is committed to the opportunity. • What are the key-signings that must be made to complete the team? • What are the key-signings that can be made in each functional department? • Does the firm have advisors or board members that strengthen its history?	Suggested reading of chapters: 10. Types of firm; 12. New business organization; and 20. Leading firms to success

(continued)

Table 3.9 (continued)

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
VI. Risks	A new entrepreneurial or innovative project/initiative faces four main types of risk: technology/product; market/competition; management/team; and financial. Many of the specific risks of opportunity are interlinked in previous parts of the business plan. For example, potential competitive threats should be considered regarding both the product and the different types of market. In addressing the firm's specific risks, it is important to think clearly about how each risk factor can be managed in the following 1 or 2 years. Quantitative analysis can also help the reader to decide. It is fundamental to identify the risks that need to be reduced so that the reader is confident the business-people understand how to build a new entrepreneurial or innovative project/initiative.	• What are the main risks of developing products/services and external dependencies? • What is being done to lessen the risks of executing the product/service? • Who are your main competitors and how is your initiative differentiated from those first in the market? • Can big players enter the market easily? Are there product/service substitutes? • What customer, partner or product strategies can be used to lessen competitive threats?	Suggested reading of chapters: 4. Competitive strategy; 6. The history of business and the plan; and 7. Risk and return.
VII. Financial Plan and Investment Supply	Although the financial plan is considered last, the implications of financial decisions appear throughout the whole exercise of planning the entrepreneurial or innovative project/initiative. If the activities planned are carried out successfully regarding the development of products, marketing, sales and other firm functions, the financial	What financing is needed to cover market needs and goals regarding the product? What is the amount requested? • When should the project/initiative reach a positive cash flow of exploitation, in accumulative terms? • What is the growth opportunity for the project/initiative if it is commercially successful?	Suggested reading of chapters: 15. Acquisitions and global expansion; 16. Profit and collection; 17. Financial plan; 18. Sources of capital; 19. Dealing with presentations and negotiating; and 20. Leading firms to success.

(continued)

Table 3.9 (continued)

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
	results should be sufficiently attractive to make the investment. It is necessary to ensure the viability of financial assumptions and projected results, if possible using an analogous project/initiative. Investors want to know the amount of finance required, as well as the goals to be reached. Financing in stages allows investors and business-people to manage the associated risk better. It is necessary to include a chronogram of activities, with firm sales and product goals, planned financing events and position in terms of exploitation cash flow.	• What are the financial margins forecast, initially and with continued activities? • What other firms show similar margins and growth to this project/initiative? • What are the main financial assumptions?	
Appendix: Detailed Financial Plan	A more detailed set of financial projections and premises is generally included in an appendix. Suggested, for example, is a spreadsheet (unblocked) on the FINICIA program, provided by IAPMEI. The financial forecasts and premises will serve as a starting point for appreciation of the project/initiative. It is necessary to ensure that the methodology used to produce the detailed Financial Plan is transparent for the reader.	• Demonstrative and detailed exercise of exploitation cash flow for a period of five years, demonstration of results and balance sheet (annual data based on monthly calculation and forecast). • Financial assumptions considered in building financial estimates (for example, penetration rates by customer segment, pricing and circulating capital). • In this sector, are purchasing decisions cyclical?	Suggested reading of chapters: 16. Profit and collection; and 17. Financial plan;

(continued)

Table 3.9 (continued)

Parts	Description	Questions to raise	Byers et al. (2015) Suggested chapters
		• What are the greatest business costs (for example, development of engineering, certification, production, marketing, distribution, licensing, etc.)? • How do the costs of products/services and sales evolve as volume grows? • Were customer support and maintenance considered?	

Source: Elaborated from Byers et al. (2015)

ensure stability and income?; and (6) the business is innovative and what is the possibility of a multinational getting hold of the idea associated with the business?

According to Byers et al. (2015), a business plan aims to: (a) develop ideas with regard to how a given project/business should be led; (b) assess the expected performance of a project/business over time (being a forecasting tool of a prospective nature), requiring periodic review and consequent re-elaboration; and (c) create an instrument to obtain means of finance, becoming a powerful negotiating tool to gather and persuade potential allies or investors about the project or initiative.

According to the same authors, and since the book entitled: *Technology Ventures: From Idea to Enterprise*, 4th edition; is the manual proposed as the basic work to be followed in the scope of the course on *Technological Entrepreneurship Designing*, a non-exhaustive description follows of the main parts of the business plan (see Table 3.9), identifying the corresponding chapters of that book, so as to facilitate the structuring of this planning and prospecting document considered indispensable for successful testing of the entrepreneurial/innovative project or initiative.

Below is a proposal for a structure-type for the purpose of drawing up the business plan, whose main components should be the following:

1. Executive Summary
2. Presentation of the project's promoters
3. Presentation of the business

    3.1. Summarized presentation of the project/firm
    3.2. Concept
    3.3. Main products and services
    3.4. Business opportunity

4. The market
    4.1. Market analysis
    4.2. Structural analysis
    4.3. Competition
    4.4. Critical factors of market success
    4.5. PESTEL/SWOT analysis
5. Strategic positioning
    5.1. Strategic objectives and approach to the market
    5.2. Pricing policy
    5.3. Distribution policy
    5.4. Communication policy
    5.5. People
    5.6. Processes
    5.7. Physical trials
    5.8. Value chain
    5.9. Project's competitive advantages
    5.10. Critical factors of the project's success
    5.11. Organization and human resources
    5.12. TOWS Matrix
6. Economic-financial analysis
    6.1. General assumptions
    6.2. Investment
    6.3. Turnover
    6.4. Exploration costs
    6.5. Project/firm financing
    6.6. Provisional financial statements
    6.7. Analysis of the project's viability
    6.8. Sensitivity analysis
7. Contingency scenarios

3.4 Course Program

After describing the main concepts and methodologies of the course in *Technological Entrepreneurship Designing*, with a special focus on design methodology and the opportunity exploitation pentagon, it can be understood that the choices made, besides being innovative and creative, are intrinsically linked with the specificities of technological entrepreneurship, approached here from a perspective allowing both the preparation of intrapreneurial investment projects (of an organizational and institutional nature), and of projects aimed to exploit entrepreneurial and innovative opportunities, in the form of creating a new business unit.

The course program is structured and developed in order to draw students' attention to and explain the two specificities of the two types of projects referred to, allowing them to study and understand how both types allow the exploitation of technology-based business opportunities, whether in the context of an existing organization (i.e. intrapreneurship), or in a new organization to be created (i.e., qualified entrepreneurship).

According to the (proposed) number of hours for the subject (with a total of contact hours (C), on a weekly basis of 2 hours Theoretical + 2 hours Practical + 2 hours Tutorials – Coaching), and considering the educational objectives and competences aimed for, namely: professional intervention in a wide range of industrial, service and research organizations; incorporation of the most recent technological innovations in professional intervention; and development of entrepreneurial competences allowing the creation of technology-based firms.

3.4.1 Objectives

Presentation of the proposed program follows, by indicating the objectives of the curricular unit and the modular structure. The course objectives are as follows:

- understand the process of detecting and analyzing technology-based business opportunities;
- define criteria to assess the market potential of a technology and the resources necessary for its commercialization;
- know the procedures necessary for protecting the intellectual property of the technology supporting the business idea;
- design and validate value propositions and business models; and
- apply instruments of financial analysis for the purpose of assessing financing needs and forecasting the business's profitability.

Considering the distribution of the teaching load of theoretical and practical classes, for planning lasting 13 teaching weeks, the structure of the course organized by modules[3] is as follows:

Module I (MI): Introductory Concepts (T:4 h; Weight: 8.3%)

Chapter 1: Innovation and Entrepreneurship (4 h)

Module II (MII): Creative Ideas and Competitive Dimensions (T:16 h; Weight: 33.0%)

Chapter 2: Technological Ideas and Business Opportunities (4 h)

[3] A module is understood to be a unit of learning which is autonomous and with its own identity, but part of a cohesive and coherent whole supported by structuring pedagogical principles.

Chapter 3: Universities and Forms of Commercializing Technology (4 h)
Chapter 4: The Process of New Business Creation (4 h)
Chapter 5: Market, Competition and Competitive Advantage (4 h)

Module III (MIII): Business Opportunity (T:12 h; Weight: 25%)

Chapter 6: Methodologies of Analyzing Business Opportunities (4 h)
Chapter 7: Protection of Intellectual Property (4 h)
Chapter 8: Structuring the Business Model (4 h)

Module IV (MIV): Financial Planning (T:8 h; Weight: 16.7%)

Chapter 9: Financial Planning of New Businesses (4 h)
Chapter 10: Sources of Finance for New Businesses (4 h)

Module V (MV): Business Opportunity Plan (T:8 h; Weight: 16.7%)

Chapter 11: The Business Team and the Organizational Model (4 h)
Chapter 12: The Business Plan (4 h)

It is noted that students' participation and involvement (organized in teams) in the coaching sessions is considered fundamental for application of the methodology of the opportunity pentagon referred to, following a logic of design thinking as proposed in Sect. 3.2.2.

3.4.2 Results of Learning

Taking as a reference what is set out in the ECTS guide (ECTS Users' Guide, 2015)[4], the results of learning are statements about what the student supposedly knows, understands and/or is able to demonstrate on completing the learning process.

In this aspect, and following the vision of Kennedy et al. (2006), learning results can be of different natures, namely: (i) cognitive (such as knowing, understanding, identifying, applying, analyzing, summarizing and assessing); (ii) affective (i.e., presenting, receiving, responding, valuing, organizing and characterizing); and (iii) psychomotor (i.e., imitating, manipulating, being precise, articulating and mechanizing).

For Jenkins and Unwin (2001), establishing learning results means obtaining different advantages, namely: (a) clarifying for both lecturer and student that which is expected of the latter at the end of the teaching and learning process; (b) helping the lecturer to design support material and conceive more effective classroom

[4]For more information, consult: http://ec.europa.eu/dgs/education_culture/repository/education/library/publications/2015/ects-users-guide_en.pdf.

strategies and assessments; (c) helping students to understand what they will have achieved at the end of a module or subject; and (d) helping the lecturer to define assessments according to what has been taught.

Bearing in mind the aims of the subject, as well as the set of educational objectives and competences pursued, the learning results to be attained from this course aim to equip students with the following competences:

In cognitive terms:

1. **identify** different scenarios for growth (of varying speeds) of the entrepreneurial or innovative project/initiative, considering the uncertainty regarding the development and the characteristics of the technology;
2. **understand and assess** the business model to exploit the opportunity identified, through pre-validation; and
3. **analyze**, within the scenarios identified, projections related to future income and expenditure, identifying the moment from which the project/initiative will reach positive results.

In affective terms:

4. **present** strategies of target market penetration and growth, detailing customers' profile and the geographical area of the markets where the firm intends to compete in the future, as well as the value proposition, distribution channels and the means of promotion and publicizing it intends to use; and
5. **organize** scenarios for recuperating the investment in the case of leaving the market; and

In psychomotor terms:

6. **articulate** the way the project/initiative intends to remunerate investors as its growth occurs.

3.4.3 Teaching and Learning Strategies

Teaching and learning strategies are presented in Table 3.10. The lecturer team can present two case studies: (i) the first concerns the open innovation business model and is foreseen for the third week of the schedule; and (ii) the second, referring to the financial planning of new business, is foreseen for the tenth week. Considering the proposal in Sect. 3.2.2., simultaneous integration of design methodology and the methodology of the pentagon of opportunity exploitation is proposed throughout the practical classes in the subject, introducing in each of the five phases of the design thinking methodology the five tools to be used by students, namely: (1) Immersion/inspiration: Canvas model—value screen; (2) Analysis and synthesis: open innovation bridge—Tangram model; (3) Ideation: succinct plan of business opportunity; (4) Prototyping: value proposition and customer segments; and (5) Test: business plan.

Table 3.10 Learning results and teaching-learning strategies

Learning results	Teaching-learning activities	Phases of design methodology: tool	Classification
In cognitive terms:			
Identify different scenarios for the growth (of varying speeds) of the entrepreneurial or innovative project/initiative, considering the uncertainty regarding the development and characteristics of the technology	– Presentation of the initial concepts of Module I, by the lecturer team – Discussion of case 1 (lecturer and students) – Creation of teams	0. Observation of students, to create empathy	– Presentation of concepts and material, of an introductory nature – Cooperative activities – Presentation of case study 1 (or invited speaker)
Understand and assess the business model to exploit the opportunity identified, through pre-validation	– Presentation of subject matter referring to Module II, by the lecturer team – Coaching sessions – Motivating teams	1. Immersion/inspiration: Canvas model-value screen	– Cooperative activities – Exploration activities – Structuring activities – Information spreading activities
Analyze, within the scenarios identified, the projections regarding future income and expenditure, identifying the time from which the project/initiative reaches positive results	– Presentation of subject matter referring to Modules III, IV and V, by the lecturer team – Coaching sessions – Motivating teams	1. Immersion/inspiration: Canvas model-value screen 2. Analysis and synthesis: Open innovation bridge—Tangram model	– Cooperative activities – Exploration activities – Structuring activities – Information spreading activities – Discussion/critical assessment of students
In affective terms:			
Present strategies for target market penetration and growth, detailing customers' profile and the geographical area of markets where the firm intends to compete in the future, as well as the value proposition, distribution channels and the means of promotion and dissemination it intends to use	– Presentation of the subject matter referring to Modules III and IV, by the lecturer team – Coaching sessions – Motivating teams – Elaboration of the succinct plan of business opportunity	3. Ideation: succinct plan of business opportunity 4. Prototyping: value proposition and customer segments	– Cooperative activities – Exploration activities – Structuring activities – Fieldwork – Information spreading activities – Solving problem situations – Discussion/critical assessment of students

(continued)

Table 3.10 (continued)

Learning results	Teaching-learning activities	Phases of design methodology: tool	Classification
Organize scenarios for recuperating investment in the case of leaving the market	– Presentation of subject matter referring to Modules IV and V, by the lecturer team – Discussion of case 2 (lecturer and students) – Coaching sessions – Motivating teams – Elaborating the business plan	5. Test: business plan	– Presentation of advanced concepts and subject matter – Cooperative activities – Presentation of case study 2 (or invited speaker)
In psychomotor terms:			
Articulate the way the project/initiative intends to remunerate investors as its growth occurs	– Presentation of subject matter referring to Module V, by the lecturer team – Coaching sessions – Motivating teams – Elaborating the business plan	5. Test: business plan	– Cooperative activities – Structuring activities – Fieldwork – Information spreading activities – Solving problem situations – Discussion/critical assessment of students

Source: Own elaboration

Summarizing, and observing Table 3.10, it can be seen that the teaching-learning strategies cover initial presentation of the concepts and themes of an introductory nature, being followed by presentation of the first case study (or invited speaker) and creation of the work teams (two/three elements). Throughout the modular structure, various tools are introduced, these being considered essential for elaboration of a succinct plan of business opportunity, according to the design thinking approach. Here, the role attributed to tutorials is highlighted, functioning as coaching in order to motivate the teams and stimulate students' attainment of goals. The functioning proposed for the teaching-learning activities is maintained throughout the course, but the exposure to concepts and material of a more advanced nature, linked to the financial and organizational aspects of the entrepreneurial/innovative project or initiative, is reinforced by presentation of the second case study (or invited speaker). The two assignments foreseen are carried out by the work teams created at the time of the course's initial teaching activities. These assignments are: the succinct plan of business opportunity; and the business plan. The first follows the methodology of the pentagon of opportunity exploitation, following a design thinking approach

proposed for the subject. The second follows the structure proposed by the lecturer team, using a spreadsheet of the Financial Model of the Business Plan.

Besides the presentation of information by students regarding the two assignments, there is a component of critical assessment by students of the work done by their classmates.

3.5 Concluding Remarks

The growth of different concepts of entrepreneurship has emphasized the spread and popularity of an expanding area of work, which needs to take firm steps towards reconciling the multiple theoretical and empirical research efforts under the so-called Eclectic Paradigm of Entrepreneurship.

This book contributes to the ongoing discussion about the need for the academic community that devotes its attention and research efforts to entrepreneurship and innovation to place the following two tasks among its priorities: (1) revisit the complex construct of entrepreneurial and innovative opportunity, using a multilevel lens: supranational; national; regional; business; and individual; and (2) invest in the supply of innovative educational programs for qualified entrepreneurship and innovation.

Furthermore, this book also makes it clear that exploiting an entrepreneurial and innovative opportunity is not limited to the demanding exercise, with risks and uncertainty, of the entrepreneurial form of creating a new business unit. Teaching toward technology-based entrepreneurship, following a crossed approach of gamification and design thinking, is feasible both in the intrapreneurial form of nascent entrepreneurship and in that of corporate or institutional entrepreneurship, in order to include also the intellectual capital of private and public institutions.

The course in technological entrepreneurship designing proposed here, aims to enlighten students as to the specificities of the two forms of projects referred to, allowing them to study and understand how both forms allow the exploitation of technology-based business opportunities. In the initial modules about introductory concepts, creative ideas and competitive dimensions, the course has the particularity of creating a propaedeutic work basis allowing students independently, from their basic training mainly in the area of engineering and science, to progress successfully through the learning activities, which involve active participation in theoretical and practical classes and coaching sessions, leading towards the presentation and oral defense of two assignments for assessment, namely, the succinct plan of business opportunity and the business plan. In the three subsequent modules, and considering the instruments of course evaluation, greater weight is attributed to the concept of entrepreneurial and innovative opportunity, structuring the business model, financial planning and presentation of the business plan. A double pedagogical innovation is followed, by integrating a creative approach to design, based on design thinking methodology, on the process of exploiting the business opportunity, from identification of a problem (by immersion/inspiration) until presentation of the business

plan (test). Simultaneously, the use of a new methodology called pentagon of opportunity exploitation is recommended. This joins the five phases of design thinking and five tools of structuring and planning business taught in the subject, namely: (i) immersion/inspiration with the Canvas model—value screen; (ii) analysis and synthesis with the open innovation bridge—Tangram model; (iii) ideation with the succinct plan of business opportunity; (iv) prototyping with value proposition and customer segments; and (v) test with the business plan.

Since this course comes under the Treaty of Bologna, student-centred teaching methodologies are proposed, with clear definition of the results of learning, the distribution of theoretical, practical and tutorial (coaching) classes, students' autonomous work and the assessment instruments considered most appropriate to measure the attainment of goals.

Looking to the future, this course is considered to have the potential to expand, in the curricular or extra-curricular context (for example, if the activities proposed are included in a Project subject or a workshop, with a portfolio format). Therefore, it is suggested that extending the sphere of application of the methodologies proposed here can be through the creation of a Laboratory of Technological Entrepreneurship Designing & Business Modelling, including teaching and learning activities, prototyping and pre-incubation, as well as an open innovation platform that can promote interdepartmental and inter-institutional collaboration and strengthen the mechanisms of open innovation with business and institutional stakeholders from the production world and the global scientific-technological system.

References

Amabile, T., & Khaire, M. (2008). Creativity and the role of the leader. *Harvard Business Review, 86*(10), 100–109.

Audretsch, D., & Keilbach, M. (2005). Entrepreneurship capital—Determinants and impact (*CEPR Working Papers, Working Paper No. 4905*). London, UK.

Baeck, A., & Gremett, P. (2011). Design thinking. In H. Degen & X. Yuan (Eds.), *UX best practices—How to achieve more impact with user experience*. New York: McGraw-Hill Osborne Media.

Baer, M. (2012). Putting creativity to work: The implementation of creative ideas in organizations. *Academy of Management Journal, 55*(5), 1102–1119.

Barringer, B., & Ireland, R. (2006). *Entrepreneurship: Successfully launching new ventures*. New Jersey: Pearson Prentice Hall.

Baumol, W. (2002). *The free-market innovation machine: Analyzing the capitalist growth miracle*. Princeton: Princeton University Press.

Bernarda, G., Smith, A., & Papadakos, T. (2014). *Value proposition design: How to create products and services customers want*. New York: Wiley. 978-1-118-96805-5.

Brown, T. (2008). Design thinking. *Harvard Business Review, 86*(6), 84–92.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5–21.

Byers, T., Dorf, R., & Nelson, A. (2015). *Technology ventures: From idea to enterprise* (4th ed.). New York: McGraw Hill.

Chatterji, A. (2009). Spawned with a silver spoon?: Entrepreneurial performance and innovation in the medical device industry. *Strategic Management Journal, 30*, 185–206.

Drucker, P. (2002). *Managing in the Next Society*. New York, NY: St. Martin's Press.
Duarte, C., & Esperança, J. (2014). *Empreendedorismo e Planeamento Financeiro*. 2.ª Edição: edições Sílabo.
Eesley, C., & Roberts, E. (2012). Are you experienced or are you talented?: When does innate talent versus experience explain entrepreneurial performance? *Strategic Entrepreneurship Journal, 6* (3), 207–219.
Folta, T., Delmar, F., & Wennberg, K. (2010). Hybrid entrepreneurship. *Management Science, 56* (2), 253–269.
Foss, N., & Saebi, T. (2015). Business models and business model innovation: Bringing organization into the field. In N. Foss & T. Saebi (Eds.), *Business model innovation: The organizational dimension*. Oxford: Oxford University Press.
Graham, C. (2005). Insights on development from the economics of happiness. *The World Bank Research Observer, 20*(2), 201–231.
Hansen, M., & Nohria, N. (2004). How to build collaborative advantage. *Sloan Management Review, 46*(1), 22–30.
Hayton, J., & Zahra, S. (2004). Technological entrepreneurship: Key themes and emerging research directions. In *Crossroads of Entrepreneurship* (pp. 185–208). New York: Springer.
Hienerth, C., Keinz, P., & Lettl, C. (2011). Exploring the nature and implementation process of user-centric business models. *Long Range Planning, 44*(5-6), 344–374.
Hmieleski, K., & Baron, R. (2009). Entrepreneurs' optimism and new venture performance: A social cognitive perspective. *Academy of Management Journal, 52*(3), 473–488.
Ibarra, H. (2002). How to stay stuck in the wrong career. *Harvard Business Review, 80*(12), 40–48.
Jenkins, A., & Unwin, D. (2001). *How to write learning outcomes*. Accessed in December 2016 at: https://www.ubalt.edu/cas/faculty/faculty-matters/How%20to%20write%20student%20learning%20outcomes.pdf
Kelley, T., & Littman, J. (2001). *The art of innovation*. London: Profile Books Ltd.
Kennedy, D., Hyland, A., & Ryan, N. (2006). Writing and using learning outcomes: A pratical guide. In *Implementing Bologna in your institution C 3.4-1*. Accessed December 2016, from http://www.tcd.ie/teaching-learining/academic-developement/asses/pdf/Kennedy-Writing-and-Using-learning-Outcomes.pdf
Kuemmerle, W. (2002). Home base and knowledge management in international ventures. *Journal of Business Venturing, 17*, 99–122.
Landry, R., Amara, N., Cloutier, J., & Halilem, N. (2013). Technology transfer organizations: Services and business models. *Technovation, 33*, 431–449.
Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal, 27* (2), 131–150.
Leitão, J., & Gomes, D. (Coord.) (2014). *Manual para Jovens Empreendedores: Comportamentos e Competências*, Associação Coração DELTA. isbn: 978-989-20-5150-5.
Markman, G., Balkin, D., & Baron, R. (2002). Inventors and new venture formation: The effects of general self-efficacy and regretful thinking. *Entrepreneurship Theory and Practice, 27*(2), 149–165.
Osterwalder, A., & Pigneur, Y. (2009). *Business model generation: A handbook for visionaires, game changers and challengers*, Self Published.
Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*. Hoboken NJ: John Wiley & Sons.
Pedro, E., Leitão, J., & Alves, H. (2018). Intellectual capital and performance: Taxonomy of components and multidimensional analysis axes. *Journal of Intellectual Capital, 19*(2), 407–452.
Pereira, D., & Leitão, J. (2016). Absorptive capacity, coopetition and product innovation: Contrasting Italian and Portuguese manufacturing firms. *International Journal of Technology Management, 71*(1/2), 10–37.

Petroni, G., Venturini, K., & Verbano, C. (2011). Open innovation and new issues in R&D organization and personnel management. *The International Journal of Human Resource Management, 23*(1), 147–173.

Sarasvathy, S., & Venkataraman, S. (2011). Entrepreneurship as method: Open questions for an entrepreneurial future. *Entrepreneurship Theory and Practice, 35*(1), 113–135.

Schumpeter, J. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Sexton, D., & Upton, N. (1987). Evaluation of an innovative approach to teaching entrepreneurship. *Journal of Small Business Management, 25*(1), 35–43.

Siegel, R., Siegel, E., & Macmillan, I. (1993). Characteristics distinguishing high-growth ventures. *Journal of Business Venturing, 8*(2), 169–180.

Simon, H. (1969). *Sciences of the artificial*. Cambridge, MA: MIT Press.

Storbacka, K., Frow, P., Nenonen, S., & Payne, A. (2012). Designing business models for value creation. *Review of Marketing Research, 9*, 51–78.

Ulijn, J., Nagel, A., & Tan Wee, L. (2001). The impact of national, corporate and professional cultures on innovation: German and dutch firms compared. *Journal of Enterprising Culture, 9* (1), 21–51.

van de Vrande, V., Lemmens, C., & Vanhaverbeke, W. (2006). Choosing governance modes for external technology sourcing. *R&D Management, 36*(3), 347–363.

Venkataraman, S. (1997). The distinctive domain of entrepreneurship. In J. Katz (Ed.), *Advances in entrepreneurship: Firm emergence and growth* (Vol. 3, pp. 119–138). Greenwich, CT: JAI Press.

Winter, S., & Szulanski, G. (2001). Replication as strategy. *Organization Science, 12*(6), 730–743.

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

Zott, C., & Amit, R. (2008). The fit between product market strategy and business model: Implications for firm performance. *Strategic Management Journal, 29*(1), 1–26.

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning, 43*(2), 216–226.