Edited by
Moacir de Miranda Oliveira Jr.
Fernanda Ribeiro Cahen
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Startups and Innovation Ecosystems in Emerging Markets

A Brazilian Perspective

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Contents

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Acronyms

AALTOES	Aalto Entrepreneurship Society
ABES	Brazilian Association of Software Firms
ABVCAP	Brazilian Association of Private Equity and Venture Capital
AGE RIO	State Development Agency of Rio de Janeiro
ANATEL	National Telecommunications Agency
ANP	National Agency for Oil, Natural Gas and Biofuels
ANPEI	National Association of Research and Development of Innovative Companies
ANPROTEC	National Association of Entities for the Promotion of Innovative Ventures
APIs	Programming Interfaces
AUSPIN	USP Innovation Agency
BBVA	Bilbao Vizcaya Argentaria Bank
BNDES	National Bank for Economic and Social Development
CAPES	Coordination for the Improvement of Higher Education Personnel
CENPES	Leopoldo Américo Miguez de Mello Research Center
CIESP	Center of Industries of the State of São Paulo
CNA	Cultural Norte-Americano
CNPq	National Council for Scientific and Technological Development
COPPE	Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering
CVC	Corporate Venture Capital
DNS	Doppler Submarine Navigator
ES Ventures	Espírito Santo Ventures
FAPESP	Foundation for Research Support of the State of São Paulo

FAPs	Foundations for Research Support
FDI	Foreign Direct Investment
FEA USP	School of Economics, Administration and Accounting of the University of São Paulo
FIESP	Federation of Industries of the State of São Paulo
FINEP	Financing Agency for Innovation and Research
GDP	Gross Domestic Product
GNH	Gross National Happiness
HDI	Human Development Index
IB	International Business
ICT	Information and Communication Technology
IE	International Entrepreneurship
IPO	Initial Public Offering
IPT	Technological Research Institute
ISE	Business Sustainability Index
IT	Information Technology
KTT	Knowledge and Technology Transfer
MBA	Master in Business Administration
MCTIC	Ministry of Science, Technology, Innovations and Communications
MDGs	Millennium Development Goals
MG	State of Minas Gerais
MIT	Massachusetts Institute of Technology
MNE	Multinational Enterprise
NACUE	National Association of College & University Entrepreneurs
NEU	Entrepreneurship Center of the University of São Paulo
NTBFs	New Technology-Based Firms
OECD	Organisation for Economic Co-operation and Development
PDP	Product Development Process
PIPE	Innovative Research in Small Firms
PNI	National Program for Support of Technology Parks and Incubators
PNRS	National Plan for Solid Waste
POLI USP	Polytechnic School of the University of São Paulo
PRONINC	National Program of Incubators of Popular Cooperatives
R&D	Research and Development
RBV	Resource-Based View
RD&I	Research, Development and Innovation
RHAE	Education Program of Human Resources in Strategic Areas
SEBRAE	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas [Brazilian Service for Support of Micro and Small Firms]

SEED	Startups and Entrepreneurship Ecosystem Development
TBIs	Technology-Based Incubators
TECNOPUC	Science and Technology Park of the Pontifical Catholic University of Rio Grande do Sul
TTOs	Technology Transfer Offices
UFRJ	Federal University of Rio de Janeiro
Unicamp	University of Campinas
UNIFEI	Federal University of Itajubá
US	United States
USA	United States of America
USP	University of São Paulo
WCED	United Nations World Commission on Environment and Development

List of Figures

List of Tables

CHAPTER 1

Introduction

Moacir de Miranda Oliveira Jr., Fernanda Ribeiro Cahen and Felipe Mendes Borini

1.1 Introduction

Companies from developed countries have pioneered technology-driven and high-tech entrepreneurship worldwide. The most important highly intensive technology companies are headquartered in developed countries, with a heavy concentration in the United States (US). For example, companies from the US West Coast such as Apple, Google, Facebook, and Uber have created the most important center for the

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attraction of today's high-tech world. However, numerous entrepreneurial high-tech businesses have lately come out and grown in countries like China, India, Russia and Brazil. In the last two decades these prominent emerging markets, taken together, have become the largest share of global Gross Domestic Product (GDP) and enhanced their economic growth, infrastructure improvements, social development and higher education. In addition, some regions of these countries have taken on a new level of importance in promoting high-tech entrepreneurship.

There is a growing body of research related to high-tech entrepreneurship in recent years. While an accepted definition does not exist, in this book we are discussing high-tech entrepreneurship as the capacity to create and manage a high intense technology-based business venture. The most apparent way of discussing high-tech entrepreneurship is focusing on the start of new high-tech businesses, here referred to as high-tech startups. Another way is discussing how the local innovation ecosystem can promote high-tech entrepreneurship.

Innovation ecosystem is defined by complex relationships between diverse types of actors and institutional entities that enable technology development and innovation (Jackson, 2011). The actors include the human capital (entrepreneurs, investors, researchers, university faculty, industry representatives, etc.) and also material resources such as funds, equipment and facilities. The institutional entities include the universities, colleges of engineering, business schools, companies, venture capitalists (VC), research institutes, business assistance organizations, funding agencies, policy makers, etc.). The development of high-tech startups often depends on the relationships formed within their innovation ecosystems. The innovation ecosystem approach has emerged as a useful context to structure historical evidence and investigate technological development (Oh, Phillips, Park, & Lee, 2016).

High-tech startups are nascent companies in the first stage of their operations. These entrepreneurial companies are heavily concentrated in developed countries, but they are blooming in various regions of emerging markets. Beijing and Shanghai, in China, are examples, Bangalore in India, Mexico City, Moscow, in Russia, and São Paulo state in Brazil. High-tech startups are found in knowledge intensive industries such as aeronautics, pharmaceuticals, electronics, information and communications technology, optical and precision, and digital businesses, e-commerce, Internet platforms, Internet applications, digital games.

Emerging markets are not only generating high-tech startups but also unicorns (startup companies with a valuation of $1 billion or more). Examples are India's Paytm (digital transactions), and Ola Cabs (taxi service company); Argentina's Globant (software solutions), MercadoLibre (Latin America's number one e-commerce platform), Despegar (an online travel company); Brazil's Nubank (fintech company that launched a series of banking product innovations), B2W (e-commerce platform), TOTVS (software solutions). More than half of all unicorns in the world are based in the United States, and China has the highest number of unicorns outside the United States. This includes giants such as Alibaba Group (an e-commerce platform), Baidu (Internet services and products and artificial intelligence), Didi Chuxing (taxi service company), Tencent (Internet-related services, entertainment, artificial intelligence and owner of WeChat, which is the largest messaging, social media and mobile payment app in China) (Cahen & Oliveira, 2018).

Besides of all these unicorn examples, scholars and practitioners have often overlooked high-tech companies from emerging markets, particularly from those countries that have not yet gained worldwide recognition for high-tech sophisticated products and services. Generally, the discussion on entrepreneurship in emerging markets focuses on low-tech sectors such as agribusiness, food, natural resources and mining. High-tech entrepreneurship, which is much more representative for the degree of technology development in emerging countries, has been discussed insufficiently, and concentrated in examples from China. Rich in natural resources, one of the most prominent emerging markets, Brazil has established itself in the international markets as a commodity exporter. However, high-tech startups are consistently growing in the domestic market, and some Brazilian startups are increasingly influencing the international marketplace. The rise of high-tech entrepreneurship and the growing movement of high-tech startups in certain regions of the country is the result of the establishment of a business-friendly environment with scientific base, investors and a financial sector interested in making investments in high-risk projects for this type of business (Cahen & Oliveira, 2017).

As high-tech entrepreneurship in emerging markets has been growing and developing, we cannot assume that it will follow the same patterns as entrepreneurship in developed economies. GDP in emerging countries is growing faster, compared to traditional developed

economies. The business and institutional environment setting are significantly different. Important drivers of high-tech entrepreneurship, such as investors, technology parks, and research-based universities in emerging countries are far more constrained than in developed economies. Moreover, high-tech startups may face economic and political instabilities in their home countries, which can mean barriers for potential investors (Siqueira & Bruton, 2010). For example, Brazil just faced its worst corruption scandal and deepest economic slowdown in decades.

In the context of emerging markets, this book examines the behavior of high-tech startups and important aspects of innovation ecosystems in Brazil. More specifically, the book contains a complete discussion on the experience of Brazilian high-tech startups with regard to innovation, sustainability, funding, background of the entrepreneur, and their efforts for entering international markets. The book is also dedicated to innovation ecosystems and explains the role of business incubators, acceleration programs and university entrepreneurship in the country. It discusses how these local innovation ecosystems boost startups and high-tech entrepreneurship in Brazil, leading to the most successful implementation of technology parks and incubation movements in Latin America.

This is the first book that goes beyond anecdotes and case studies, and looks at the successful development of high-tech startups and innovation ecosystems in Brazil. This book is part of a wider research agenda on high-tech entrepreneurship financed by the National Council for Scientific and Technological Development (CNPq). We rely on extensive results of research, accomplished at the School of Business Administration of the University of São Paulo by Full Professors, in Master and Ph.D. research projects. Our data present several successful experiences, but they also allow us to discuss some persistent challenges that Brazil must overcome, before reaching the current levels of high-tech entrepreneurship of the world's most developed countries.

1.2 The Rise of High-Tech Startups and Innovation Ecosystems in Brazil

Brazil has the most mature innovation ecosystem in Latin America. The country has a long history in its industrialization of import substitution policies (between 1930s and late 1980s), and policies to support local technological capabilities in state-owned companies. However,

entrepreneurship in more intensive sectors started in the 1970s, with the creation of the Brazilian Service for Support of Micro and Small Firms (SEBRAE) in 1972. This private non-profit organization was created to promote entrepreneurship, competitiveness and the development of nascent businesses. It has been very active since its inception, and is similar to the Small Business Administration in the United States (Cahen & Oliveira, 2017).

The first specific public policy initiative for high-tech entrepreneurship was launched in the 1980s. The National Program of Technology Parks was established in 1984, and in the same year ParqTec—the São Carlos Technology Park—was created. ParqTec was the first technology park and the first high-tech business incubator in Latin America. The National Association of Entities for Promotion of Innovative Ventures (ANPROTEC) was established in 1987 and started to stimulate business incubators, technology parks, educational and research institutions, and public agencies, and to articulate other stakeholders linked to high-tech entrepreneurship and innovation activities. It has been very active since its foundation.

By the mid-1990s, institutional changes and pro-market reforms had taken place through policies aiming at the development of technological and innovative capabilities in Brazil. Programs were also implemented to stimulate partnerships between universities, research centers and companies. After the pro-market reforms, collaboration between government and stakeholders such as private companies, banks and sectorial associations also increased, for the benefit of entrepreneurship in high-tech sectors. For example, the number of technology parks and incubators which support high-tech entrepreneurship has risen significantly.

According to ANPROTEC, in 2017, there were 94 technology parks in Brazil (29 in operation, 32 being built and 32 at the project stage). Among the technology parks in operation, there were approximately 400 incubators for startups and approximately 4800 companies linked to technology parks and incubators in the country. Non-government and hybrid initiatives are also common. The government (federal and state) has played an essential role in creating and supporting innovation ecosystems, such as incubators and technology parks, but there are also non-government initiatives. For example, the Federation of Industries of the State of São Paulo (FIESP) operates a dozen incubators, and Brazil Central Bank has created an innovation

pool, with both state-owned and private banks partnering with technology leaders such as Microsoft to develop fintechs in the country (BCG, 2018). The Southern and South Eastern states concentrate 84% of technology parks in the country. The other regions account for 16% of tech-parks.

According to ANPROTEC, funding sources for technology parks are 36% private, 22% from the federal government and 42% from state and city governments. Financial support for incubators comes from government programs such as the National Program for Support of Technology Parks and Incubators (PNI), which is designed to assist the creation of new incubators and the expansion of existing ones. Other private stakeholders, such as ANPROTEC, are also instrumental in this process.

High-tech entrepreneurship, innovation habitats and, most importantly, universities are mainly concentrated in the Southeastern and Southern states of Brazil. These are the most industrialized and wealthiest regions of the country, responsible for approximately 75% of Brazilian GDP. São Paulo is by far the most developed state in the country. As the richest Brazilian state and a major industrial complex, São Paulo state alone is responsible for 34% of the Brazilian GDP, which is one of the world's 9th largest GDP. The state is the financial hub of Latin America and is the largest exporting state, with more than 30% of Brazilian exports. In the ranking of the 100 best cities to do business in Brazil, the state of São Paulo has the largest number, 37. Additionally, the region around the city of São Paulo, the state capital, is considered the sixth largest urban agglomeration in the world, consisting of nearly 20 million habitants. In São Paulo city, the startup culture is an emerging movement. The city is the largest technological hub in Latin America and ranks number 12 among the most attractive startup ecosystems in the world, according to the 2015 Startup Ecosystem Ranking Report, by Compass. In the same ranking Bangalore in India is ranked number 15. It has the most prestigious research universities in Latin America, being University of São Paulo (USP) and University of Campinas (Unicamp) internationally ranked. Regarding this concentration, most of data collection and case studies for this book were carried out in the Southern and Southeastern states of Brazil.

São Paulo state is among the largest 15 tech ecosystems in the world, but economic recession and political turmoil between 2015 and 2018 have challenged the Brazilian ecosystems, but also new competitors from China made it lose ground in the global comparison. In the same Startup Ecosystem Ranking, São Paulo city fell from 12th to out

of the top 20. The ecosystem has the potential to reverse this trend. The City of São Paulo just approved a program to reduce the time required to start a new business. There are new government efforts such as InovAtiva, an online mentoring program. The country also counts on organizations such as the government Financing Agency for Innovation and Research (FINEP), which launched its largest start-up support project in Latin America, PRIME, in 2010; and international organizations such as Endeavor (non-profit organization that mentors and accelerates entrepreneurs that operates in Brazil since 2000); new accelerators, such as Dínamo and Startup Farm. Global technology companies such as Google, Facebook and others have made São Paulo city their Latin American headquarters. Google established a first batch of residents' startups in 2017 (Global Startup Ecosystem Report, 2017).

1.3 Book Structure and Framework

The book is structured in two parts. The first part discusses Brazilian high-tech startups (Chapters 2–5), specifically the capacities to operate a successful startup in Brazil. The second part is devoted to the study of Brazilian innovation ecosystems (Chapters 6–11).

The first part starts with Chapter 2, on startups and technology transfer from universities and research centers. The chapter discusses the association between the launch of new products by startups residing in the technology-based incubators (TBIs), which have a relationship with universities and research centers. The results call attention to the relational resources of startups and TBIs. Formal agreements with research centers have a positive relationship with the launch of new products by the incubated startups. Here it is important to consider that the majority of the investigated TBIs have formal agreements with universities. However, the effectiveness in launching new products go beyond this first relationship. There is a major effect on the creation of new products when there are formal agreements with universities and research centers. This means that the relationship with formal institutions of science and technology in Brazil is a capacity that startups need for their performance in launching new products.

Chapter 3 "Internationalization of Brazilian High-Tech Startups" discusses how high-tech startups, as nascent businesses with limited resources, succeed in international markets. Results indicate that the advantages of startups from emerging markets in experiencing accelerated internationalization rely on the capabilities of the entrepreneur. Startups which have an entrepreneur, or a group of executives with

international management skills, are more prone to an early and accelerated internationalization. However, it is not enough entrepreneurial capabilities. Innovation and marketing capabilities are essential to the internationalization of startups. The results also show that the internationalization of startups integrated into global production chains is faster. The chapter also discusses some digital startups, which seem to develop digital capabilities required to enter international markets, such as cross-cultural programming skills, global virtual networks, cross-border digital monetizing adaptability and international business model reconfiguration.

Chapter 4 outlines the profile of entrepreneurs from 95 high-tech startups in business incubators from the state of São Paulo. The chapter analyzes the relationship between the profile of the entrepreneur (education and experience) and the product innovation of the business. The results indicate that high-tech incubated startups whose entrepreneurs have technical academic education closer to the exact sciences promote more product innovation, regardless the size of the company. In smaller startups, the entrepreneur's experience indicated more positive association with product innovation.

Chapter 5 presents the main funding sources used by Brazilian startups. The chapter explains the funding sources, the investment processes and discusses the challenges that Brazilian startups have to overcome to access different financing sources. Additionally, the chapter describes case studies of Brazilian startups that used different types of funding to develop their business. The chapter brings mainly practical contributions to entrepreneurs. Knowing the differences among the sources of funding is extremely important for entrepreneurs to make decisions about which source is more adequate for the startup. Besides, the entrepreneur gets to know the process of investment of each one of the funding sources.

Chapter 5 draws attention to the issue of funding for startups. The interesting aspect of the chapter is to show the dynamism regarding the abilities to obtain financing. Funding changes in the six different stages of the startup life cycle. It is important to note that these life cycle stages in startups are often short and fast. This requires special attention to the financial capacity in startups—specifically, the relationship ability of the financial area. The funding partners change from stage to stage: university, equity, angel investor, venture capital and private equity funds.

The knowledge accumulated in these four chapters gives us the opportunity to propose a general framework of pre-requisites in terms of capacities to operate a successful startup in Brazil. The framework is presented in Fig. 1.1. We can see the central role of entrepreneurial orientation capacity for development of high-tech startups in Brazil. This entrepreneurial orientation capacity depends on the educational and professional experience of the entrepreneur. Educational experience is associated with the degree of education focused on science and technology areas, and professional experience comes from the years of operation in industry and experience with entrepreneurial projects.

On the other hand, only the entrepreneurial orientation capacity is not enough. It is the central ability to develop other three main capacities to achieve the strategic objectives, like the sustainable growth of the firm by the launch of new products and development of new markets (national or international markets). The book suggests that the performance of Brazilians high tech-startups is built by marketing, innovation and relationship capacities. They are linked to the development of new products and new markets. However, each one focuses more on one or other aspect. Marketing and innovation capacities are essential to conquering new markets in the country or abroad. Meanwhile, relationship capacity is strongly associated with new products. This last could be analyzed under three dimensions: relationship with universities and research

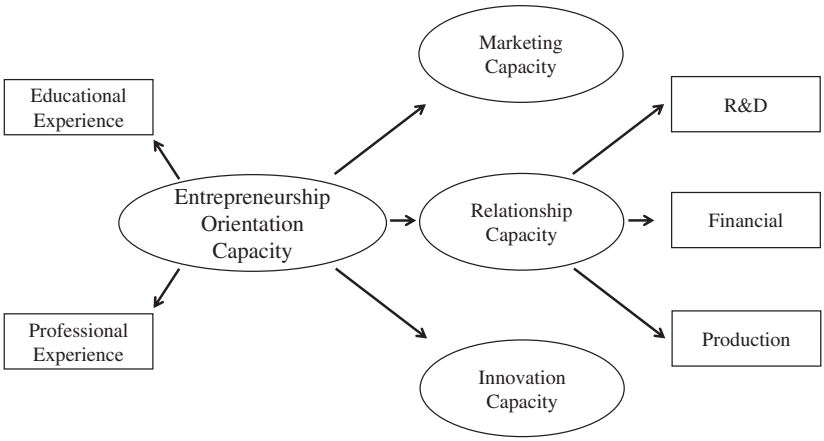

Fig. 1.1 Startups' capacities

institutions and funding agents, centered in three functional areas of production, research and development, and financial. Production and research and development relationship capacities are essential for start-ups to develop their growth into new markets, after the first product and market. This means the capacities of integration into global value chains (production) and alliances with research institutions and universities (research and development). In its turn, financial relationship capacity needs to be dynamic to reach the different funding partners that change in each stage of the startup life cycle.

Part II of the book is devoted to the study of Brazilian innovation ecosystems and includes five chapters that follow.

Chapter 6 returns to the question discussed in the first part of the book. In this chapter we look at how the actors in a technology park contribute to the product development of high-tech startups. Typically, high-tech startups choose to stay in technology parks as a way to overcome the inherent limitations of small and young companies, such as financial constraints and the lack of skilled human resources. The focus of this chapter is on the managers of incubators and technological parks and in the main policies for ecosystem building. The research is based on three case studies of startups settled in technology parks located in the South and Southeast regions of Brazil. The results indicate the importance of cooperation with universities for product development and the financial resources provided by government agencies that foster research. Collaboration with the private sector is also essential and must be stimulated, from small-sized companies to large multinationals.

In line with managerial premises for incubators and technological parks, Chapter 7 focuses on managerial aspects, as well as some important initiatives for Technology-Based Business Incubators (TBI) management. Business incubators are defined in the chapter as places oriented to the installation and use of shared services, related to infrastructure and technology, which compose business networks and market opportunities that, reinforced by a dedicated administrative structure, stimulate and support startup companies in their process of business consolidation. Besides mapping the main incubators in the state of São Paulo, one of the main objectives of the chapter is to identify aspects of TBI management, particularly the strategies adopted in its governance. The results reveal an ongoing movement, particularly with regard to actions used to achieve the financial sustainability of incubators and incubated companies. Regarding governance, there is not an active role of several

municipal agents. Local management handles the daily strategic operation of incubators. There is a weak network management with public agents. In general, TBI managers have several ideas in progress, especially regarding financial sustainability, but, currently, only a few are implemented.

Chapter 8 discusses practices and indicators related to social and environmental management of business incubators in the State of São Paulo. The results show that despite being aware of the importance of adopting sustainability practices and indicators, incubators are far from being sustainable. None of them has social responsibility certifications, and all managerial planning is still based on financial issues. Hence, there is a great potential to be explored regarding the social and environmental management in business incubators.

The focus of Chapter 9 is to indicate how a Brazilian government startup accelerator works to create indicators in order to monitor the acceleration process. Although there is a great incentive of both government and entrepreneurs to implement strategies for supporting new entrepreneurs, such as accelerators, it is still unclear what is the role and effectiveness of these programs. The results show three central indicators for startup accelerators, more specifically those promoted by the government. Startup accelerators have to focus on networking promotion, to offer activities for the development of incubated startups, and to offer business solutions to the local or regional ecosystem.

Chapter 10 focuses on entrepreneurship in Brazilian universities. Student-led movements supporting entrepreneurship in universities have become a well-recognized phenomenon in some European countries, such as the United Kingdom and Finland, and are known as grassroots movements due to their bottom-up nature. More specifically, the chapter discusses the grassroots phenomenon of entrepreneurship in Brazilian universities. The results indicate that grassroots operate as new gears in university entrepreneurship ecosystems, and their impact indicates a transformation in the culture of the institutions where they operate. Universities need to be open and offer a proper structure for grassroots movements. First, it is important that the university be only the place and the trigger for the movement, because grassroots are a non-institutional and fully autonomous movement. The role of the university is to instigate the entrepreneurial orientation of students and to promote grassroots movement by connecting entrepreneurship agents—students,

startups and promoters—and by creating dynamic cultural practices and allowing the intensive undergraduate students' participation. In this way, the role of universities is to inspire and incentive students for entrepreneurship. Additionally, they offer oriented and strong training and education on entrepreneurship.

Finally, Chapter 11 inquires what are the factors that influence the success of Brazilian spin-off firms. Universities can encourage the emergence of planned spin-offs by (i) creating regulations that address the form of action and support to companies, (ii) establishing clear policies and support programs for academic entrepreneurship, (iii) providing Technology Transfer Offices (TTOs) with the appropriate structure, processes and professionals, (iv) having procedures and standardized legal documents for TTOs, support foundations and academic institutions, and (v) strengthening in TTOs the idea that protecting the creation is a necessary step for exploitation. The message in this chapter is that the university should foster and support the strengthening of innovation environments, such as incubators and science parks.

Figure 1.2 completes the framework proposed in Fig. 1.1. In Fig. 1.2 we can see the role of actors of the innovation ecosystem, more specifically TBIs, incubators, universities, firms and government. The framework highlights the roles of the ecosystem actors. TBI and incubators are players in the first level of relationship with high-tech startups,

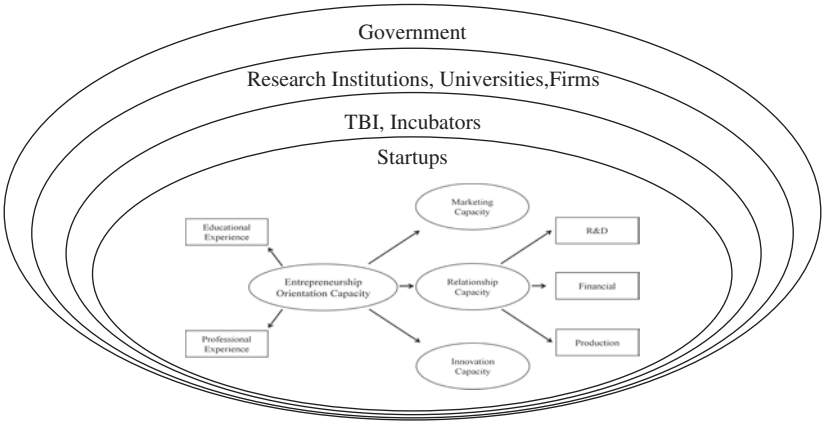

Fig. 1.2 Ecosystem's startups

and universities, institutions and other firms form the second level. Government is the third level. TBI and incubators are responsible for strengthening relationships between startups and universities, research institutions, financial agents, small and large national firms and multinational companies.

Research institutions and universities are responsible for training the specialized human resources and encouraging the entrepreneurial orientation in the innovation ecosystem. Universities could stimulate in a deliberate way, by structuring strategic plans of spin-offs, and also offering local conditions to grassroots entrepreneurial movements. Firms of different sizes and origins are important to demand products and services, not only as clients but as business partners.

The government performs the role of nurturing the ecosystem by using public policies to develop universities and research institutions focused on the development of basic and applied research that could benefit the startups. It is a government role (especially for state and municipal government) to develop a close and active relationship with TBIs and incubators, to align the strategic plans and promote financial, environmental and social indicators of management and performance for these entities.

The framework in Fig. 1.2 consolidates the results presented in the chapters. We illustrate its applicability by presenting some of the most illustrative examples of high-tech startups and innovation ecosystems in Brazil.

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PART I

High-Tech Startups

CHAPTER 2

Startups and Technology Transfer from Universities and Research Centers—An Analysis of the Impact on Launching New Products

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2.1 Introduction

There is a growing understanding that the collaboration between universities and research centers and industry can play an important role in economic development, especially in knowledge-intensive new ventures. Universities and research centers are a privileged place for the creation of new knowledge and, when transfer of knowledge to society occurs, the opportunity to implement a virtuous cycle is created: (i) transfer of knowledge from universities and research centers can stimulate the creation of new knowledge-intensive startups; (ii) these new businesses create wealth by developing products based on innovation; (iii) these innovation-based new businesses demand skilled labor

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with better wages; and (iv) these new startups require more innovation, through the establishment of relationships with universities and research centers. It is expected that this cycle will contribute to the economic development of countries or regions in the so-called global knowledge economy. Because of this virtuous cycle, governments are actively promoting the creation and development of relationships between universities and research centers, stimulating the establishment of new businesses (Perkmann et al., 2013).

In this chapter, we seek to understand the role of knowledge and technology transfer (KTT) from universities and research centers to startups residing in Technology-Based Incubators (TBIs), and their impact on the launch of new products. We chose to focus our analysis on scientific knowledge assets, which are acquired by means of partnerships with universities and research centers. The reasons that led us to delimit our analysis are that, among the strategic assets, intangible assets seem to be the more relevant, as they are harder to be imitated by competitors. We use the Resource-Based View (RBV) approach (Barney, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984), which suggests that organizations are comprised of a set of tangible and intangible assets. It is up to organizations—in this case, TBIs—to identify the most relevant strategic assets in order to encourage technological innovation, which might lead to the launch of new products by incubated startups. The relational view (Dyer & Singh, 1998; Lavie, 2006) extends RBV and focuses on the relationships and networks of firms as the unit of analysis, in order to explain the superior performance of an individual firm within that relationship/network.

The research involved a mix-method approach. First, qualitative data collection was accomplished by a semi-structured questionnaire that was forwarded to 44 incubators; the sample was reduced to 34

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after each incubator was classified (or not) as a TBI. Only 31 of the 34 TBIs participated in the subsequent stages of the research, which included personal interviews with managers and visits to companies. Second, we also mailed a survey to all 461 incubated firms located in TBIs in the state of São Paulo, which resulted in a sample of 100 respondents. The survey was divided into three dimensions: (a) qualification; (b) perception; and (c) results. In the first dimension, our purpose was to identify the company, its field of business and general characteristics, such as: profile of the partners; revenue; and business segment. In the second dimension, we got the opinion of the companies, regarding the activities of the incubator, i.e., an evaluation of the services provided and infrastructure available. In the last dimension, we identified the results already reached by the company during the period of incubation, that is jobs, innovation, patents, market share, revenue, etc.

In this chapter we made a strategic analysis of the contribution of TBIs for incubated startups based on RBV, a strategic approach that offers a different perspective from that of industrial organization (Porter, 1980). While the industrial-based view proposes that the company must analyze the external environment to formulate strategies, RBV emphasizes the need for organizations to analyze their inner workings to identify resources and capabilities that can foster a competitive advantage (Peteraf, 1993; Wernerfelt, 1984). We also argue that an increasingly important unit of analysis for understanding competitive advantage is the relationship between firms (Dyer & Singh, 1998; Lavie, 2006); therefore, the strategic resources studied herein are scientific knowledge, which comes from partnerships with universities and research centers.

2.2 Theoretical Framework

The role played by startups and innovation habitats are prominent research topics, whose relevance is widely acknowledged. A startup is a nascent business or organization designed to search for a repeatable and scalable business model (Blank, 2013). Through startups, new ideas are brought to the market and changed into economically sustainable enterprises. However, due to their small size, startups face a structural lack of tangible and intangible assets. The lack of financial and human resources hampers the development of innovation processes. In this

sense, several studies have analyzed the impact of relational resources on the performance of companies (Bandera & Thomas, 2018; Dyer & Singh, 1998; Stam, Arzlanian, & Elfring, 2014).

On the other hand, innovation habitats support the startups during their process of development by helping them to build support networks (Tötterman & Sten, 2005). An innovation habitat is defined by the complex relationships formed among the players, whose purpose is to enable technological development and innovation, boosting the economy and creating new jobs (Jackson, 2011). A common characteristic of an innovation habitat is the availability of relational resources and the geographic proximity between the elements of the innovation ecosystem.

The inter-organizational cooperation promoted by these innovation habitats is the quickest way for startups to obtain essential intangible resources in knowledge-intensive environments. This is especially true for two reasons. First, the cooperation is important to explain how companies create a structure that can be used to deal with the environmental instability (Pemartín & Rodríguez-Escudero, 2017; Story, Hart, & O'Malley, 2009). Second, the risk inherent to innovation in startups is high because the internal resources of companies are hardly enough and adequate for the development of innovation, which indicates that companies need to obtain external resources, combining them with several other resources and capacities, in a continuous way (Chesbrough, 2003; Pemartín & Rodríguez-Escudero, 2017; Story et al., 2009).

Therefore, the insertion of startups in innovation environments promotes the access to valuable knowledge in the development of new products, which can generate benefits for the organizations involved, such as: (i) acceleration of the product development process, (ii) reduction of development costs, (iii) promotion of technological improvements, (iv) improvement in product quality, and (v) increase of the ability to find innovative opportunities that might come up in the confluence of different knowledges (Pemartín & Rodríguez-Escudero, 2017).

2.2.1 Resource-Based View

Resource endowment has a long tradition in economics; an important research on this field was done by Penrose (1959), which understood firms as a broad set of resources. This research is rooted in Wernerfelt's (1984) study, which presents resources as anything that could be

thought of as a strength or weakness of the firm, or as the (tangible and intangible) assets that are semi-permanently tied to the firm. The author gives some examples of resources: brand names, technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital, etc. Wernerfelt's (1984) approach was quite insightful, presenting a way of using resources as the main source of competitive advantage, through the development of what the author called "resource position". Resource position is the possibility of using resources to develop a competitive position more difficult for others to catch up. In this way, "firms need to find those resources which can sustain a resource position barrier, but in which no one currently has one, and where they have a good chance of being among the few who succeed in building one. They have to look at resources which combine well with what they already have, and in which they are likely to face only a few competitive acquirers" (Wernerfelt, 1984, p. 175).

Peteraf (1993) presents another important contribution. According to her point of view about the strategic role of the resources, "a major contribution of the resource-based model is that it explains long-lived differences in firm profitability that cannot be attributed to differences in industry conditions. (…) So long as the assets are imperfectly mobile; inimitable and non-substitutable, other firms will not be able to mimic its strategy" (Peteraf, 1993, p. 186). Indeed, the conditions outlined above are reinforced by Barney's (1991) assertion that "firms cannot expect 'purchase' sustained competitive advantages on open markets (…). Rather, such advantages must be found in the rare, imperfectly imitable, and non-substitutable resources already controlled by a firm".

The need for a resource difficult to imitate, transfer, buy, sell or substitute, and that must have a systemic integration with other resources is, therefore, the main contribution of RBV to the development of sustainable competitive strategy. In a more comprehensive way, Schoemaker and Amit (1997) present the distinctive characteristics of strategic assets, including: (i) Difficult to trade or imitate; (ii) Scarce, durable and not easily substituted; (iii) Complementary to one another (that is, one asset's value increases as another asset's value increases); (iv) Specialized to the firm (hard to transfer); (v) In line with the future strategic industry factors; and (vi) Creator of value for the firm's shareholders (appropriable). In this research, we propose that, among the intangible

and tacit assets, knowledge is the most important resource that can provide a competitive advantage to a firm.

2.2.2 Transfer of Knowledge in Networks

The network approach involves interrelated groups working in the constant exchange of resources, focusing on information and knowledge, which are the so-called intangibles assets. The objective of the network strategy is to improve the performance of a set of organizations searching for strategic alliances and other forms of partnership and, consequently, getting access to new knowledge and other resources, thus leveraging new sustainable competitive advantages.

In the case of tacit and ambiguous knowledge, it is very difficult to transfer it from its source of creation to other parts of the organization or even to other organizations, like in the case of universities and research centers transferring knowledge to incubated startups. The relative difficulty in the absorption and transfer of knowledge depends on the type of knowledge involved. The more explicit knowledge may be included in procedures or represented in documents or databases, and transferred with reasonable accuracy. The transfer of tacit knowledge generally requires intense personal contact and work relationships. Such relationships tend to involve the transfer of various types of knowledge, from explicit to tacit. Not all of the communicated knowledge is complex and intuitive, but it is the tacit knowledge that cannot be readily transferred by any other way.

There are several potential benefits to gain from networks, especially with regard to the attributes of flexibility and adaptability in a competitive environment. Companies in networks can generate relational incomes (profit generated together) by means of specific assets in the relationship, such as knowledge sharing, complementary resources and effective governance (Arya & Lin, 2007; Dyer & Singh, 1998).

Collaboration networks that have profitable and non-profitable goals are very similar in their provision of greater flexibility and organizational adaptability to participants. In profit-driven relationships, collaboration networks allow quick access to the resources of specialized partners, such as complementary competencies, new technologies or new markets (Gulati, 1998); non-profit collaboration networks can link partners with services and distinct knowledge in different local markets, while strengthening firms' ability to better meet the multiple needs

of customers (Selden, Sowa, & Sandfort, 2006). Networks that have non-profitable goals are usually proposed by the government, which provides significant resources, proper regulations and public articulations for solving economic and social problems (Arya & Lin, 2007).

Taking into consideration the importance of partnerships to generate knowledge and develop new technologies, the network theory presents an important perspective that complements RBV, in terms of organizational competitive advantage. Complex business networks, universities and government laboratories are critical players in several industries, especially in areas with rapid technological turnover such as computer science, semiconductors, pharmaceuticals and biotechnology (Powell & Grodal, 2006).

2.2.3 Startups and the Contribution of Technology-Based Incubators (TBIs)

An international literature review on the typology of TBIs presents several categories that can be used to understand the Brazilian reality and, more specifically, technology-based business incubators located in the state of São Paulo. Grimaldi and Grandi (2005), based on the Italian experience, mapped and classified business incubators in four categories, according to their contributions for incubated companies:

> Centers of Innovation in Business: These are public incubators whose origin in Europe dates back to 1984, when these Centers were created due to an initiative of the European Commission. The incubation activity in this category consists of offering several basic services to "tenant" companies, which include the provision of space, infrastructure, communication channels, information about external funding possibilities and visibility.
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> University Business Incubators: This is another example of public incubators. Public policy makers see science as a vehicle to boost regional and national economies and, frequently, request universities to direct resources, time and faculty skills toward economic development. Despite their focus on education, universities can provide substantial contributions for the local economy through leadership in research, which fosters patentable inventions and transfer of technology. This is very relevant in new technology-based enterprises.
>
> Independent Private Incubators: They are normally organized by individuals or groups of individuals. They invest their capital on new

companies in exchange of equity stake. Sometimes they are also called "accelerators", because they usually do not invest during the process of business conception, but only after the company has already been launched and needs specific injections of capital or expertise.

Corporate Private Incubators: They are created and owned by large corporations in order to support the emergence of new units of independent businesses. These new independent business units (corporate spin-offs) usually originate from spillovers of research projects, and are the result of diversification strategies.

Partnership between the university and the TBI also brings relevant information. Partnership with universities provides a proximity to university laboratories and research centers, which can offer companies residing in TBIs and science parks an easier access to scientific knowledge and academic findings, facilitating the transformation of university research into commercial applications. Such argument is based on evidences from the United States of America (USA), where the relationship established with universities have favored the innovative activity of local companies (Colombo & Delmastro, 2002).

In order to test the effect of these partnerships, Colombo and Delmastro (2002) made a comparison between a sample composed of 45 Italian startups that, in the beginning of the 2000s, were residents in a TBI or science park, and another sample composed of 45 similar startups (in terms of company age, sector of activity and geographic location), located outside TBIs or science parks.

The empirical outcomes indicate that the inputs and outputs of the innovative activity are marginally different between companies located in and outside TBIs. However, it was also possible to show that Italian TBIs and science parks managed to attract executives with higher human capital, which was measured by the educational background and previous work experience. In addition, companies located in TBIs presented higher growth rates than those outside incubators. The results also indicate that companies that reside in TBIs are better in terms of adopting advanced technologies, participating in international research and development (R&D) programs, and establishing collaborative arrangements with universities. The authors concluded that companies that reside in TBIs have easier access to public subsidies (Colombo & Delmastro, 2002).

The incubation movement attracted more attention as a startup facilitation model. For example, venture capitalists see business incubators

as a way to diversify their investment portfolio, and entrepreneur candidates as individuals that seek support for their entrepreneurial initiatives. Incubators face the challenge of managing the investment and entrepreneurial risks. New types of incubators are currently emerging. These incubators pursue different strategic objectives, make use of different skills and competencies, and serve different markets. Consequently, they developed a new understanding of their sources of advantage and competitive business models. Based on 41 interviews conducted with incubators and R&D managers, Zedtwitz (2003) proposed five archetypes of incubators (see Table 2.1).

Support activities are most relevant because, without them, the name "hotel" would be a better description than the term incubator; however, the use of shared facilities is also an important advantage—besides sharing a common space, it also provides opportunities for transfer and share of knowledge among incubated companies (Bergek & Norrman, 2008).

All these types of business incubators show the diversity of contributions that incubators in general, and TBIs in particular, can offer to incubated companies. Firms can choose an approach that provides stronger emphasis on the offer of tangible assets, or on assets related to knowledge, technology and relationship with key-stakeholders, such as funding sources.

In the Brazilian context, Medeiros (1998) observes that the incubator, in its original sense, is an interinstitutional arrangement with appropriate facilities and infrastructure to encourage and facilitate: the bond between the company and the university (and other academic institutions); the strengthening of companies and the growth of their connection; and the increase of the association between the productive sector and support institutions (besides research institutions, municipalities, private and public funding agencies, services that support micro and small-sized companies, among others).

As for the beginning of the incubation movement in Brazil, there was an emphasis on tangible assets and a lack of concern regarding intangible assets. Medeiros & Atas (1995) provide a critical analysis of the beginning of the incubation movement in the country. They claim that in almost half of the cases the real estate share was overrated. In almost 60% of the enterprises, there was no specialized assistance, as in marketing areas.

Table 2.1 Types of incubators

Types of incubators	*Main characteristics*
Independent commercial incubators	They emerge as result of prospective activities developed by entrepreneurs or companies related to venture capital. They enjoy greater freedom to develop their own business models. As profit-driven companies, these incubators are strongly based on their internal competencies, and focus on a specific technology, industry, or region
Regional incubators	Usually established by local governments or organizations with similar regional economic and political interests, in order to promote logistic support for beginners of a specific community. Their objective is to align their results to public policies: job creation, improvement of the local industry, and enhancement of the region's public image
University incubators	Universities can be considered the cradle of new inventions/innovation and cutting-edge technology. These incubators can be associated with science parks, and function as laboratories designed to improve and strengthen the collaboration between academia and industry
Intra-entrepreneurial incubators	Associated with corporate R&D activities, the main purpose of this incubator is to deal with technological discontinuity, improve the communication between technical and corporate areas, minimize the inflexibility of organizational and managerial structures, and improve the ability to align the long-term commitment of the corporation with short-term needs
Virtual incubator	Unlike traditional incubators, virtual incubators do not provide physical area or logistic support. They seek to build and strengthen platforms and access to entrepreneurs, investors and consultants. This type of incubator is considered more adequate for businesses in early stages and, preferably, those related to information technology

Note Author's interpretation based on Zedtwitz (2003)

2.3 Results

2.3.1 Perception of the Startup Regarding TBIs

Most of the startups investigated are located in TBIs at universities. Among the reasons that led the startup to choose an incubator, it is important to emphasize that location and network opportunities were the most quoted reasons—67% of the respondents considered these items very important; infrastructure was considered very important by 60% of the respondents; costs by 59%; label by 58%, and professionalism and management competencies by 52.5% of them. The item "access to laboratories" was considered by 34% as very important, but 27% considered it of little importance. Other factors mentioned were: access to faculty, personal help, business clusters, exposure, interface with institutions within the university, access to the ecosystem, access to USP's database ISI Web of Knowledge, guidance on how to manage a company, how to entry a market, how to get customers, how to apply to the Foundation for Research Support of the State of São Paulo (FAPESP) program Innovative Research in Small Firms (PIPE), access to information on funding and financial resources, information on public calls, interaction, internationalization of companies, success rate of incubated companies, partnership between government institutions and the company, and market visibility.

Startups say that incubators are associated with: Brazilian Service for Support of Micro and Small Firms (SEBRAE) (75%), Entrepreneurial associations (66%), Universities (65%), Local government (58%), and State government (43%). These startups also affirm (63%) that the relationship between the incubator and external players can bring benefits to the company, which strengthen its role as articulator and the insertion of companies in business networks.

Regarding the benefits expected from an incubator, respondents had to rate the following statement: "Managers of incubators are concerned about the economic sustainability of the incubated companies". 42% of the respondents partially agreed to this statement, and 36% totally agreed, which shows the incubators' concern about the financing of incubated companies by funding agencies and external institutions.

On the other hand, when rating the statement "The relationship between the incubator and external players brings benefits to the company", 24% of the respondents partially agreed, and 63% of them totally

Table 2.2 Number of products and services launched from 2010 to 2012

	2012	*2011*	*2010*
Products	78 (41 companies)	48 (27 companies)	38 (29 companies)
Services	122 (43 companies)	66 (30 companies)	53 (26 companies)

agreed, which indicates the importance of such a relationship for incubated companies.

2.3.2 Innovative Performance of the Startup

Regarding the launch of new products and services, we emphasize that (Table 2.2):

- 41% of the respondents launched at least one new product in 2012, and 43% launched at least one new service.
- The number of companies that launched new products and services increased between 2010 and 2012: from 41 to 65%, respectively.
- The number of new products and services launched by the respondents in 2012[1] was, respectively, 78 and 122.

Investments in R&D made by companies that already had revenues is shown in Table 2.3.

It was not possible to estimate the investment in R&D of companies that still had no revenue when we conducted this research. From the 39 companies, only four informed the real investment in R&D in the previous year (in absolute values). As the number of respondents was not representative, no assumptions could be made.

2.3.3 Profile of the Managers of Startups

The profile of the managers of incubated startups in the TBIs researched is the following:

[1] One of the companies launched 276 new products between 2010 and 2012. Another company launched 58 new services between 2011 and 2012. Both were excluded from the table above.

Table 2.3 Investments in R&D from 2010 to 2012

Investments in R&D/Revenue	*2012*	*2011*	*2010*
R&D/Revenues above 100%	9	7	9
Between 75 and 99%	3	7	3
Between 50 and 74%	9	6	3
Between 25 and 49%	8	6	4
Between 10 and 24%	13	11	12
Between 1 and 9%	5	3	4
No investment in R&D	14	21	26
Average investment (%)	49.3	48.2	43.8
Maximum investment (%)	400	1000	1000

Note Number of respondents: 61

From 100 respondents, 93 are partners of the startups and 7 are employees.

It is common that partners of newborn companies operate in diverse areas, which was proven in our research: from all respondents, 78.5% operate in R&D areas; 65.6% in planning, and 68.8% in administrative areas.

Regarding the educational background of the respondents, 89.3% of partner entrepreneurs have a university degree; 22.6% are doctors or postdocs. In other words, incubated startups in TBIs have highly qualified personnel in charge of the business.

The fields of knowledge of the respondents are exact sciences (27.7%) and engineering (39.8%).

Regarding their professional experience, it is worth mentioning that 67.1% have more than 10 years of experience.

The companies are new: 42% were founded from 2011 onwards; 52% joined the incubator between 2011 and 2013.

2.3.4 Relationship with Universities and Research Centers

Considering that potential strategic assets of incubators can contribute for the launch of new products by startups, the relationship with universities is a reality according to 65% of the respondents. It means that universities are relevant for incubators and, as a consequence, for startups, since more than half state to have a relationship with the university. They are also potentially important for the networking of startups, due to the diversified relationships with other universities and research centers,

which are also potential sources of knowledge for innovation through the launching of new products (Table 2.4).

Another important asset for startups is the relationship between incubators and research centers. According to Table 2.5, 42% of the respondents mentioned a relationship with such entities.

The number of formal agreements between research centers and universities can also be a resource for these startups. Data show that 23% of the companies have no formal agreements with research centers; 40% have up to three agreements; the other 37% have more than three and up to 10 agreements. There was one outlier, which had 276 agreements with research centers, as seen in Table 2.6.

The number of agreements with universities is lower: 75% of the sample mentioned no such agreements; 25% claimed that they had up to 5 (Table 2.7).

Our data indicate that the number of relationships with universities is higher than the number of relationships with research centers; however, formal agreements with research centers are higher than with universities. Therefore, it is possible to infer that research centers, considering the alignment with applied research, have more structured processes and the habit of formalizing such agreements.

Table 2.4 Relationship between startups and universities

Relationship with universities	*Frequency*	*Valid percentage (%)*
No	35	35
Yes	65	65
Total	100	100

Table 2.5 Relationship between startups and research centers

Relationship with research centers	*Frequency*	*Valid percentage (%)*
No	58	58
Yes	42	42
Total	100	100

Table 2.6 Number of agreements with research centers

Number of agreements with research centers	*Frequency*	*Valid percentage (%)*
0	23	23
1	9	9
2	19	19
3	12	12
4	7	7
5	2	2
6	4	4
8	2	2
9	5	5
10	5	5
11	1	1
12	1	1
13	1	1
14	1	1
15	1	1
16	1	1
19	1	1
24	1	1
30	1	1
37	1	1
58	1	1
276	1	1
Total	100	100

Table 2.7 Number of agreements with universities

Number of agreements with universities	*Frequency*	*Valid percentage (%)*
0	75	75
1	14	14
2	4	4
3	6	6
5	1	1
Total	100	100

On average, incubators that have a relationship with universities also have a relationship with research centers, which emphasizes that having a link with such organizations is a relevant resource for incubators. To keep a relationship with these institutions is beneficial, considering that they provide academic and technical knowledge, besides helping to develop networking of these incubators.

Our results indicate that companies with a higher number of agreements with research centers are also the ones that have the National Bank for Economic and Social Development (BNDES) as the main funding source, which emphasizes the assumption that BNDES funds projects in more advanced stages, i.e. projects that are no longer at the basic research stage, but at the applied research phase. However, even knowing that the higher number of companies funded by BNDES are those that have agreements with research centers, the companies that have only a relationship […]. Startups that have agreements with universities have a greater ability to obtain BNDES funds compared to those that do not have such agreements.

2.4 Conclusions

Our results indicate that the relationship with universities and research centers do not ensure the launch of new products in incubated startups. One possible conclusion is that the relationship with the university, given that the incubated startup is usually located inside its campus or that the university takes part in its governance, is not sufficient to support the transformation of new scientific or technological knowledge generated by university research groups into new products for the market. The barriers of the relationship between university and industry seem to support this result.

The research indicated that formal agreements with research centers present a positive relationship with the launch of new products by the incubated startups. However, formal agreements with universities are not that effective. An explanation for this result is also related to the barriers concerning the relationship between companies and universities, which seem to be poor or nonexistent in research centers. Unlike the university, the main purpose of a research center is not education and teaching and, therefore, there seems to be less barriers when bringing the research results to the market.

This study contributes to the existing literature and knowledge on startups and TBIs in Brazil in four ways:

First, this is an extensive study that covers 31 TBIs mapped in the state of São Paulo, which allowed us to obtain results that can be considered more representative and conclusive.

The second important point is that, besides the qualitative and quantitative data collected within the 31 TBIs, a survey was also conducted— we analyzed 100 valid answers from the managers of incubated startups. With data obtained from the incubated startups, it was possible to establish correlations with data provided by the researched TBIs.

The third relevant point relates to RBV, a traditional Strategic Management approach that we used regarding entrepreneurship, innovation and TBIs in particular. Hence, this chapter creates the possibility of enhancing the strategic role played by TBIs and their respective incubated startups.

The fourth and last point regards stakeholders. For all TBI managers, there is an increasing challenge to emphasize their efforts toward intangible and high added-value assets for incubated startups. For the incubated startups' managers, it is important to decide what they should seek before deciding to allocate their activities in a TBI. For the government, the outcomes of this chapter help to design incentive policies to stimulate the creation of TBIs. For investors, the results may help them to define where to look for the most innovative startups.

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CHAPTER 3

Internationalization of Brazilian High-Tech Startups

Fernanda Ribeiro Cahen

3.1 Introduction

High-tech startup companies are young ventures, frequently small, which have been described as important sources of knowledge-intensive engagement and promoters of innovation in different countries (Autio, Sapienza, & Almeida, 2000). High-tech startups are nascent companies found in knowledge-intensive services, such as digital businesses, and in industries such as aeronautics, pharmaceuticals, electronics, information and telecommunications, optical and precision, and their internationalization is typically discussed as a natural path of their strategy. These companies are described as global startups, born globals, or international new ventures, because most of them typically start their business abroad, sometimes with no experience in the domestic market or shortly after domestic operations are established.

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Despite the number of studies, International Entrepreneurship (IE) literature is fragmented, and lacks elements on the internationalization of product-based and digital startups. Two decades after the pioneering study by Oviatt and McDougall (1994), there are no general explanations "of how and why these firms develop and implement their internationalization strategies, and what makes them successful remains incomplete" (Zander, McDougall-Covin, & Rose, 2015, p. 27).

Reporting on the internationalization of high-tech startups, the most referenced studies have been conducted using samples of product-based exporting companies (Knight & Kim, 2009; Oviatt & McDougall, 1994). Therefore, the models that have emerged so far to explain the international engagements of startups are based on the experience of physical, product-based startups, and limited attention has been paid to digital startups' internationalization. There are some startups that operate solely through an online presence. Internet applications, digital games, digital animation and Internet platforms are the types of businesses with which these high-tech startups typically operate internationally. Digital startups can be considered as a subset of companies in IE research. Accepted definitions of the IE field and of international new ventures, such as those by Oviatt and McDougall (1994, p. 49)[1], are compatible with startups that produce digital products.

International markets are no longer just for large and mature multinational enterprises (MNEs). High-tech startups worldwide are joining the biggest platforms and e-commerce marketplaces, in order to reach international markets and connect with users, customers and suppliers around the world.

In this chapter we answer this question: how high-tech startups, as nascent businesses with limited resources, succeed in international markets? We used a mixed method approach combining a quantitative survey and a multiple-case study methodology.

First, we applied a survey to 800 Brazilian high-tech startups in 2012, in which we analyzed 129 valid questionnaires of product-based and digital startups. We compared high-tech startups with accelerated internationalization (the company does business in at least one international market within three years after its creation) with high-tech startups

[1] "We define an international new venture as a business organization that, from inception, seeks to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries" (Oviatt & McDougall, 1994, p. 49).

that followed a slower-paced internationalization process (the startup initiates international operations more than three years after its foundation) to understand what are the drivers of the internationalization process of these companies.

Second, in 2017, using a multiple-case study methodology, we collected qualitative data of eight case studies of Brazilian digital startups. We selected the cases that were active in any type of international operation (online international expansion, which means having digital sales or users in foreign markets; international partnerships with other companies; or any type of outward "physical" assets characterized by their corporate offices, employees working in shared offices, data center hubs, in at least one foreign market outside Brazil).

The growth of high-tech industries in the country has been stimulated in the past ten years by the increased participation of large Brazilian companies and substantial investments by multinationals. The internationalization strategies of Brazilian high-tech is observed in industries such as information technology (IT), aeronautics, biotechnology and digital businesses. Brazil's high-tech startups mostly operate within the Latin America region, and there is modest integration into global supply chains, but the trend is increasing. High-tech startups in IT, aeronautics, biotechnology and digital businesses are improving their technological sophistication and attempting to internationalize.

3.2 Literature Review

3.2.1 The International Entrepreneurship Field

IE has appeared as an important field of investigation for scholars in both international business (IB) and entrepreneurship (McDougall & Oviatt, 2000). Starting in the mid-1990s with the pioneer study of Oviatt and McDougall (1994), the first studies tried to explain issues such as: why new ventures export or not, comparison of domestic and international new ventures, and why traditional IB theories failed to explain early and fast internationalization of startups. By the late 2000s, there was a growing number of empirical studies on IE, especially focusing on the export behavior of international new ventures, mostly in high-tech industries, and explaining general factors of their early internationalization (Cavusgil & Knight, 2015; Knight & Cavusgil, 2004; Knight & Kim, 2009).

Basically, IE studies have overlooked digital startups, focusing on ventures that export physical products. Critical reviews have described IE as phenomenally based, fragmented and lacking in theory (Keupp & Gassmann, 2009; Kiss, Danis, & Cavusgil, 2012). This theoretical flaw can be seen in the shortage of studies addressing digital startups; IE literature still knows little about these type of startups.

Digital startups are based only on digital products, and product-based startups are based on physical products; when their internationalization processes are compared, certain differences stand out.

IE studies have pointed out that product-based startups usually start their internationalization by exporting products (Cavusgil & Knight, 2015). When these startups go overseas, they must handle the transaction costs of their product and the location of their physical operations (Dunning, 2001). To export, for example, physical product-based startups must handle distributors in the foreign market and deal with the trade-off between continuing to export and opening a manufacturing subsidiary, for example (Dunning, 2001). All this means taking on the risks that come with foreign direct investment (FDI), such as opening a manufacturing operation. Dealing with and making alliances with foreign companies in manufacturing or research and development (R&D) in the new country is also a challenge. In the internationalization of product-based startups, there is a correlation between (large) foreign assets and (high) foreign sales.

Digital startups' international engagement in virtual marketplaces has allowed them to break the nexus from the established correlation between foreign assets and foreign sales. In turn, their physical presence through FDI is less necessary, resulting in new ways to access international markets. Their digital presence reduces cross-border information asymmetries and allows these companies to re-draw organizational boundaries (Autio & Zander, 2016), in order to access users and virtual consumers around the world. Digital startups can be pure digital companies and mixed players. Pure digital startups derive all of their revenue from transactions conducted in virtual marketplaces. Mixed players are e-commerce companies and other businesses with high levels of digitalization, with mixed business models that combine a prominent digital dimension with the delivery of a physical product or service.

Pure digital startups show the highest gap between (small) foreign assets and (high) foreign sales. Mixed players also exhibit a lighter FDI footprint compared to traditional MNEs, but to manage their

physical dimension they have more FDI and foreign assets than digital companies (UNCTAD—United Nations Conference on Trade and Development, 2017). The international engagement of digital startups, however, does not involve the FDI that is comparable to product-based startups. These are high-tech companies with an intense digital business strategy and high internationalization commitment. However, their internationalization with tangible outward assets is characterized by non-equity entry modes, such as corporate offices (typically rented places), employees working in shared offices, data center hubs and international partnerships (UNCTAD, 2017, p. 164). This process has been mentioned as "lean internationalization" (Autio & Zander, 2016).

3.2.2 Drivers of High-Tech Startup Internationalization

How do high-tech startups (product-based and digital) succeed in international markets? There is no consensus about the drivers that explain startup internationalization, but some factors related to the capabilities of the entrepreneur or of the entrepreneurial team, organizational capabilities, and external factors, such as the innovation ecosystems of the home country, are cited as positively associated with the internationalization of high-tech startups. While organizational and entrepreneurial factors are frequently mentioned in studies on startup internationalization, the analysis of the external environment is less common.

The entrepreneur or the entrepreneurial team may be able to articulate resources and capabilities, enabling startups to outperform their more established competitors through new products, innovative business models and fast internationalization[2] (Cavusgil & Knight, 2015; Onetti, Zucchella, Jones, & McDougall-Covin, 2012). Typically, an entrepreneur who runs an international startup has a higher tolerance for risk,

[2]The literature is controversial to define early and rapid internationalization strategies. The most recurrent criteria the beginning of international activities after the foundation (varies from 2 to 15 years), the percentage of revenues arising from foreign operations (ranging from 5 to 75% for companies with small domestic markets), and the range of markets (one or few international markets, in the same or in different regions around the world). Observation of these variables suggests that the adoption of a definition is contingent upon the company's home country and the characteristics of its business environment (Dib, da Rocha, & da Silva, 2010).

has developed a global mindset and often has professional experience and relationships to facilitate businesses in different countries.

Organizational factors, such as innovation capability, international marketing skills combined with brand awareness, market and product knowledge, and the orientation to meet international customers' needs, are positively associated with internationalization.

Other organizational drivers, such as the use or adoption of digital capabilities, are highlighted as a tool that enables the internationalization of exporting entrepreneurial firms (Gabrielsson & Gabrielsson, 2011; Mostafa, Wheeler, & Jones, 2005; Samiee, 1998). In this perspective, IB literature also presents an analysis of large traditional multinationals that adopt Internet technologies to expand their international sales' strategies and to reorganize production across national borders (Chen & Kamal, 2016). There is a second perspective that views the Internet as a core capability, not just a tool (Loane, McNaughton, & Bell, 2004, p. 82). From this perspective, authors such as Loane et al. (2004) highlight the Internet's core competence, but do not explain its composition or how companies build that core competence.

External factors such as the innovation ecosystems of the home country and the size of the domestic market also appear to be influential. Other

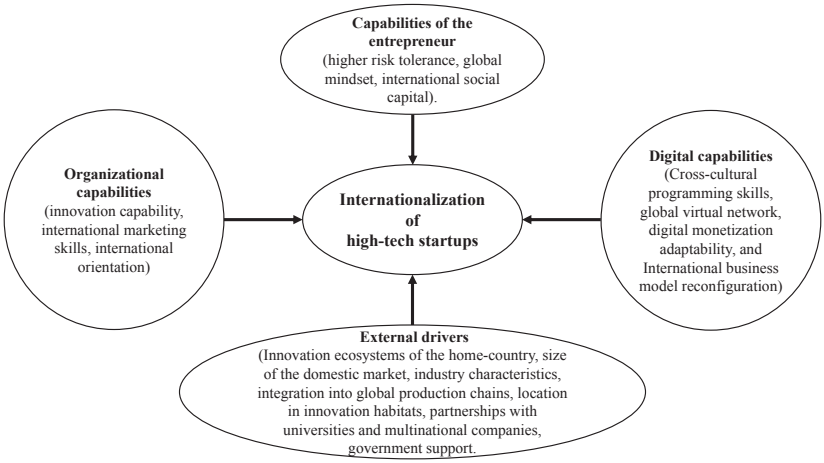

Fig. 3.1 Drivers of the internationalization of high-tech startups

elements, such as industry characteristics and strategic alliances and networking, may influence the likelihood of the internationalization of high-tech startups. Additional external factors, such as integration into global production chains, location in innovation habitats, partnerships with universities, research institutes and multinational companies, and government policies that support internationalization in the home country also seem to be positively associated with startup internationalization (Fig. 3.1).

3.3 Results

In a survey-based study applied to 800 Brazilian high-tech startups, we analyzed the drivers that influenced the internationalization of Brazilian high-tech startups. We considered the organizational drivers and those related to the entrepreneur, because they seem to have more explanatory power for companies from emerging markets (Kiss et al., 2012). We also examined some of the external drivers, such as integration into global production chains, location in innovation habitats, partnerships with universities, research institutes and multinational companies, and government policies that support internationalization. Other external drivers are also important, but they do not hold much explanatory power in this case. Fernhaber, McDougall, and Oviatt (2007) conducted a study in the United States and identified more than 20 industry structure variables and other external drivers that may influence the likelihood of a startup internationalization. The complexity and variety of external drivers prevented us from analyzing their effects herein. In the case studies, we examined the drivers related to digital capabilities.

The results of the survey provide empirical support for the entrepreneur's capabilities. In the case of Brazilian high-tech startups, those with an entrepreneur or a team of entrepreneurs with international management skills and international experience are most likely to experience accelerated internationalization.

The entrepreneur or a team of entrepreneurs who run a high-tech startup have some characteristics that may lead the firm to accelerated internationalization (Oviatt & McDougall, 1994; Zander et al., 2015), such as their technical and management background, their experience accumulated over their professional and academic career, language knowledge, higher tolerance to risk, global mindset and often international social capital. Based on the characteristics related to an entrepreneur's profile, we have built the concept of international management

skills of a born global's entrepreneur (Holtbrugge & Wessely, 2009). The international management skills enable entrepreneurs to create specific strategies to reach international markets (Knight & Kim, 2009) and to deal with global competitors, such as market positioning, forming international partnerships and choosing where to locate the company's activities more effectively.

This result is consistent with the findings of the literature on born globals, which suggest that entrepreneur's capabilities are essential for the rapid entry in international markets. It also supports the results of other studies in emerging market contexts, indicating that the accelerated internationalization of high-tech startups from emerging markets depends on the international management skills of the entrepreneur.

IE studies have suggested that startups from emerging markets rely heavily on the entrepreneur's skills and vision for internationalization (Cahen, Lahiri, & Borini, 2016; Cahen, Oliveira, & Borini, 2017) and on the social capital of entrepreneurs (Prashantham & Dhanaraj, 2010) to compensate for the resource and capability constraints typical of the business environment in their home countries. The emerging market context might enhance the role of entrepreneurs in entering international markets.

In startups from developed countries, the accelerated internationalization is mainly driven by organizational capabilities, such as international orientation, international marketing skills and innovation capabilities. In contrast to the results reported in the literature, our findings suggest that Brazilian startups seem to require more time to build organizational capabilities to enable their internationalization. Moreover, Brazilian startups with more experience in the domestic market (more than five years) rely more on their innovation capabilities and international marketing skills during the internationalization process. Younger startups in the Brazilian context typically do not rely on organizational capabilities for their early and accelerated internationalization.

Regarding external drivers, our results suggest that startups integrated into a global production chain tend to follow an accelerated internationalization process. Startups that either become suppliers of a large multinational company or enter highly global sectors tend to have an early and accelerated internationalization. These startups operate in sectors where global supply chains are already configured, such as aeronautics, biotechnology or software and IT industries. The startups appear to be "pulled" quickly by the international market due to the supply needs of their foreign customers.

Other external drivers, such as location in innovation habitats, partnerships with universities, research institutes and multinational companies, and government policies that support internationalization, are more important for startups with more experience in the domestic market. The more experience the startup has in the local market, the more it can benefit from certain external drivers in the internationalization process. Startups with more practice in the domestic market have long-standing business relationships and experience in the local business environment, making it easier to use these contextual resources to enter the international market.

Digital startups might share some of the drivers with product-based ventures, such as innovation or marketing capabilities. However, the digital dimension of these companies might create new drivers or even new forms of internationalization through significant digital sales and users overseas, with no FDI. This implies the possibility of other drivers that are different from those of product-based ventures. If we compare the internationalization of digital startups with product-based startups (startup that sell a physical product), the following distinctions can be drawn (Cahen & Borini, 2018).

First, product-based startups are especially motivated to seek new markets; as a result, they develop organizational capabilities to export or to invest in physical operations overseas (Knight & Kim, 2009). On the other hand, digital startups' internationalization does not necessarily involve transferring operations to a foreign market. Digital startups mainly seek to increase digital sales and their virtual users' base. As a result, they typically develop digital capabilities to capture and manage users over the Internet.

Second, for digital startups, networking strategies often involve complex and dynamic coordination across multiple companies in global virtual marketplaces—virtual networking—rather than establishing a set of physical connections between companies (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). Virtual networking can take on a variety of forms, such as electronic data interchange, shared virtual sales, pooled virtual-based user support and other electronic links.

Third, rather than obtaining financial returns from physical sales, digital startups' monetization sources are centered around the consumption of virtual services, such as the payment for access to virtual experiences (Clemons, 2009). In addition, the monetization model must be adapted for each new market the company intends to reach.

Finally, the life cycles of virtual products are particularly short. The combination of digitalization, connectivity and abundance of data demands that digital startups quickly adapt their business models (Amit & Zott, 2001; Blank, 2013).

The eight case studies accomplished in this study revealed particular types of capabilities that appear to be prominent drivers in the internationalization of digital startups. All of the companies studied herein have international digital sales and a growing number of users in foreign markets.

The digital nature of their products exposes these companies to virtual marketplaces internationally, although, in some cases, the company does not have a clear internationalization strategy. Grounded in the eight cases' results, we highlighted the most prominent digital capabilities that digital startups develop to expand worldwide over the Internet (online international expansion). First, evidence from all cases suggests:

1. Sophisticated cross-cultural programming skills. It refers to the startup's ability to adapt the user interface, to create value for users from different cultures, participate in shared digital systems that involve multiple international companies on links through the application of programming interfaces (APIs) and web services, and the ability to plug and play in standardized virtual products accessible to users anywhere in the world (Bharadwaj et al., 2013; Morse, Fowler, & Lawrence, 2007).
2. Global virtual networks. Establishing virtual ties with users and organizational connections through the use of digital technology is particularly important for online international expansion. This capability represents a step towards online international expansion. It is critical to managing the networks of digital users and also inter-organizational connections, which often involve dynamic coordination across multiple companies in virtual marketplaces (Bharadwaj et al., 2013).
3. Digital monetization adaptability. Entrepreneurs also emphasized the importance of adapting the monetization of their virtual products to adjust and respond to the payment needs of local users in each of the countries where they operate virtually. The monetization model needs to be adapted to each of the countries the digital company intends to reach, as well as to the users' needs, banking systems, payments methods or government agencies.
4. IB model reconfiguration. The cases indicated that the success of virtual products often requires a rapid change in the way they do

business (Chesbrough, 2010), essentially going abroad through virtual marketplaces. It is about the ability to switch the business model in a fast and effective way, at the correct time. Changes in the business model vary by company and by activity, according to the shifts in the international context where the company competes.

However, engaging in non-equity investments, such as renting or sharing an office, depends mainly on the international orientation of entrepreneurs. Our results suggest that outward assets of digital startups are moderated by the entrepreneur's international orientation. Those with an international orientation explore aggressively and actively new business opportunities in international markets, by creating value for customers in several foreign markets (Knight & Kim, 2009) (Table 3.1).

Table 3.1 Differences in internationalization: product-based and digital startups

Physical product-based—high-tech startups	*Digital startups*
Most of the internationalization starts with exports of goods/services, and then the firm internationalizes through FDI	No FDI-compared to traditional business—non-equity entry modes, such as corporate offices (typically rented places), employees working in shared offices, data center hubs and international partnerships
International market orientation and international marketing capabilities to export or to encourage FDI overseas	High capabilities in Internet technologies—sophisticated programming skills related to online international expansion
Physical Networking: Networking capabilities for market access, referrals and distribution channels	Networking capabilities—network of digital users—complex and dynamic coordination across multiple companies in virtual marketplaces
Monetization—from selling real things through physical sales or e-commerce—Marketing skills and International market orientation	Digital Monetization models: monetization adaptability in different countries to meet different users' needs, banking systems, etc.
Innovation capabilities through R&D—New processes and new products	Business model reconfiguration: Fast engagement in changing opportunities of digital technology innovations, and flexibility to rapidly abandon losing initiatives in virtual marketplaces

3.4 Conclusions

We examined the drivers that influence the internationalization of startups, comprised by organizational drivers, drivers related to the entrepreneur, and external drivers, through a survey applied to Brazilian startups. Additionally, based on eight case studies, we analyzed the drivers related to digital capabilities.

The survey findings indicate that startups, which have an entrepreneur or group of executives with international management skills, have more opportunity of an early and accelerated internationalization. In contrast to previous research in the field, results demonstrate that startups that take more than three years to enter the international market are actually developing or improving their competencies and capabilities related to innovation and international marketing, for an upcoming internationalization process.

Our results indicate that the advantages of startups from emerging markets to experience accelerated internationalization rely on the capabilities of the entrepreneur. In startups from developed countries, the early and accelerated internationalization is mainly driven by organizational capabilities such as international orientation, international marketing skills and existing technological competencies (Cavusgil & Knight, 2015; Knight & Kim, 2009). Different from the main born global studies, our results suggest that in order to establish operations in an international market, startups from emerging countries seem to require more time to build organizational capabilities such as international marketing skills and innovation skills. This explains our result that startups which take at least three years to internationalize, with a little more experience in the domestic market, rely more on their innovation capability and international marketing skills during the traditional internationalization processes. The distinct trend of startups from emerging markets may be partly explained by the difference in business environment between developed and emerging countries (Kiss et al., 2012).

Among the drivers related to the external environment that affect the startup internationalization is the integration into a global production chain. In general, these startups operate in sectors where global supply chains are set up, such as the aviation or software industry. Startups in these industries typically need to develop an internationalization strategy quickly, due to the demands of their customers. They are rapidly "pulled" toward the international market because of the conditions and supply needs of their foreign customers.

Most of the drivers of internationalization in developed countries (Knight & Kim, 2009; Oviatt & McDougall, 1994) have also been reported in studies for developing countries (Dib et al., 2010), especially drivers related to entrepreneur's competencies. Other organizational and external drivers are still controversial, and research on startups from emerging economies that focuses on these drivers is still limited (Kiss et al., 2012).

Regarding digital capabilities as a driver to internationalization, we bring digital startups to the IE literature. Our findings suggest that digital startups develop critical digital capabilities that enable them to engage in foreign markets without FDI, or with limited outward assets characterized by non-equity entry modes. Cross-cultural programming skills, global virtual networks, cross-border digital monetizing adaptability and IB model reconfiguration comprise a collection of digital capabilities that helps entrepreneurs to think beyond the traditional capabilities required to export and to encourage FDI overseas. The internationalization of digital companies does not necessarily involve the transfer of goods to a target market.

Our cases show that online international expansion is not optional for digital startups; all entrepreneurs reported that they must handle, to some extent, foreign online sales, international users and shared virtual assets with foreign partners. However, not all cases have tangible assets overseas. Six of our cases have an internationalization commitment with outward assets, including corporate offices, employees working in shared offices and partnerships with local companies in a foreign market. In our study, there are digital startups with a clear internationalization strategy, but other cases also revealed companies more passive towards physical operations in international markets. Thus, our results suggest that online international expansion is a pre-requisite for the physical internationalization of digital startups. However, the online international expansion is not sufficient to motivate the venture to actually enter foreign markets. The cases suggest that physically entering foreign markets depends mainly on the international orientation of the entrepreneurs. The emerging market context of our case studies might enhance the role of entrepreneurs in entering international markets.

Over the past five years, digital startups have expanded in number at an unprecedented rate in different parts of the world. The development of Internet technology has removed some of the barriers to enter international markets and considerably reduced the minimum

size and scale required for a small digital company to do business outside its original markets (McKinsey Global Institute, 2016; UNCTAD, 2017).

Managerially speaking, our results reveal a set of drivers that enable internationalization, through more traditional ways in product-based startups, such as exporting and FDI, and through international online expansion and non-equity investments, more typical in digital startups. Currently, entrepreneurs from anywhere have access throughout the Internet to the same information, digital channels and users as their competitors from Silicon Valley, for example. Additionally, for typical drivers, such as innovation capabilities and international market skills, the digital capabilities identified in our case studies help entrepreneurs of digital and product-based startups to develop a more assertive behavior in the search for internationalization. By managing digital capabilities, entrepreneurs of digital startups are able to engage in virtual marketplaces internationally and to invest in non-equity entry modes. Conceptualizing internationalization under digital conditions raises questions about how the digital dimension of new ventures or digitalization is changing companies' internationalization strategies. Digital startups or any internationalizing ventures that engage in digitalization have a significant international engagement by reaching users and digital sales overseas, and can enter foreign markets with fewer outward assets.

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CHAPTER 4

The Background of the Entrepreneur in High-Tech Incubated Startups

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4.1 Introduction

This chapter presents the profile of entrepreneurs from technology-based startups located in business incubators in the state of São Paulo.

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The entrepreneur's background has been analyzed based on performance indicators, such as the company's performance, discovery of new entrepreneurial opportunities (Shane, 2000), creation of new enterprises, performance in new enterprises, previous performance, among others. However, the analysis of the relationship between his/her background and product innovation is little explored and can be better understood when considering the importance of knowledge and previous experience of the entrepreneur in the field of innovation, with a focus on product innovation. Understanding the profile of entrepreneurs ensures that interested parties can submit proposals for the selection processes of companies for incubation in technology-based incubators, by checking the adequacy of their profile, considering that this is one of the criteria for selection in such processes.

Indeed, knowing the attributes of the entrepreneur's background contributes to a better selection process carried out by business incubators, in the same way that a well-done selection adds to the effective allocation of resources in organizations (Bergek & Norrman, 2008). Together with the effectiveness of resource allocation in incubators, product innovation is also a central issue in high-tech incubated startups, as these incubators are innovation-driven and the products launched by them are innovative, generating a financial and economic impact from their commercialization.

This research had a quantitative approach through a survey. It was conducted in 2013, and the starting point was the identification of technology-based business incubators in the state of São Paulo. For data collection, we sent an electronic questionnaire to 461 startups, which were connected to 34 incubators throughout the state, of which 112 answered. From these answered questionnaires, 17 had to be deleted from the databank due to inadequacies regarding the scope of the research; therefore, we analyzed 95 incubated startups.

4.2 Product Innovation

Product innovation is defined as the introduction of new or significantly improved goods and/or services in the market (OECD—Organisation for Economic Co-operation and Development, 1997). This concept comprises significant improvements in technical specifications, components and materials, incorporated software, user-friendliness or other functional characteristics. This concept enables ranking product

innovation as radical or incremental, in which completely new products and services are classified as radical innovation; significant improvements are, on the other hand, classified as incremental innovation. Although the concept of product innovation encompasses goods and services (OECD, 1997), we considered herein only goods, according to Freeman and Soete (2008).

Product innovation is not the only type of innovation; there are other sorts, such as process, marketing and organizational innovation (OECD, 1997). Process innovation refers to production or delivery methods, new or significantly improved. Comparatively, while product innovation is related to changes in the characteristics or functionalities of goods, process innovation is related to changes in the way goods are produced and delivered. Marketing innovation refers to changes in product conception or packaging, product placement, product promotion or pricing; in other words, innovation is not related to the characteristics and use of the goods, but to the way they are presented in the market. Last, but certainly not least, organizational innovation refers to changes in the organizational methods used by companies, whether in business practices or in internal and external relations.

Given these distinctions between the different types of innovation, in order to develop product innovation it is necessary to add significant changes to the characteristics and functionalities of goods and services. Changes in the conception of the product, for instance, that do not imply significant changes in its attributes and functionalities, cannot be considered product innovation (OECD, 1997).

4.3 Background of the Entrepreneur

The background of the entrepreneur is considered here as the characteristics related to education and experience acquired over time. There are some studies that discuss the attributes of entrepreneurs, which began with the research by McClelland (1961) to identify psychological features inherent to them and not identified in non-entrepreneurs. These studies addressed some characteristics such as the need for achievement (McClelland, 1961), propensity to take risks (Brockhaus & Horwitz, 1986), internal locus of control and tolerance to ambiguity (Begley & Boyd, 1987), among others.

Although these are psychology-related issues, other features were also examined, such as those related to education and experience. The

concept that supports the association between education and experience, herein understood as the background of the entrepreneur, and product innovation is mainly the asymmetry of information.

4.3.1 Education of the Entrepreneur

Entrepreneur's education is an essential variable for the discovery of entrepreneurial opportunities (Shane & Venkataraman, 2000). The growth of organizations' complexity and the intensity of information that moves around companies demand more and more highly skilled entrepreneurs in order to make better decisions and promote stronger interactions in the business environment (Lee & Tsang, 2001).

With that in mind, some studies have analyzed the relationship between the levels of education of the entrepreneur compared to non-entrepreneurs. Considering samples obtained in Canada and in the United States, some of these studies identified that entrepreneurs present a level of education significantly higher than non-entrepreneurs (the general population). Moreover, entrepreneurs also present higher levels of education compared to their employees, which are in turn associated with income from work and autonomous/entrepreneurial initiatives.

Besides the importance of entrepreneurs' level of education as a differential element between entrepreneurs and non-entrepreneurs, there is evidence that their level of education is associated with the performance of companies and entrepreneurial initiatives in times of crisis. In recession times, the probability of emergence of entrepreneurial initiatives is lower for highly skilled entrepreneurs, and higher in periods of economic growth, as seen through the Finnish economic situation in two different periods (Kangasharju & Pekkala, 2002).

Besides the level of education, another important element when considering the educational background of the entrepreneur is the area of study. The analysis of the area of study is underpinned by the concept of asymmetry of information. This concept indicates that people have different or incomplete information, which makes the relationship between agents uneven (Spence, 1973). Therefore, people do not perceive entrepreneurial opportunities equally (Shane & Venkataraman, 2000).

Bearing in mind that people have different or incomplete information, transactions in the market are based on what the people

involved know about what is being negotiated. This can lead to errors that distribute resources inappropriately (Shane & Venkataraman, 2000), enabling more efficient allocations or combinations that can generate superior profits over costs, which constitutes an entrepreneurial opportunity.

Such asymmetry of information occurs mainly because of the different educational qualification between individuals, which shows the differences between the chosen areas of study. With different types of knowledge, people can find out entrepreneurial opportunities more related to the knowledge they possess (Shane & Venkataraman, 2000).

4.3.2 Experience of the Entrepreneur

Experience is another aspect of the entrepreneur's background. It provides access to distinct information acquired throughout the functions and enterprises developed by the entrepreneur, which also emphasizes the asymmetry of information. Lee and Tsang (2001) affirm that the experience of the entrepreneur consists of three main components: entrepreneurial, industrial and managerial experience. Entrepreneurial experience consists of the previous involvement of the entrepreneur in creating new enterprises; industrial experience is related to his/her experience in the industry where the business operates; and managerial experience is the result of the involvement of the individual with managerial functions in a specific industrial sector.

The study by Lee and Tsang (2001), which encompassed 168 Chinese entrepreneurs in small and medium-sized companies of Singapore, identified a positive relationship between the experience of the entrepreneur and business growth. In addition, the authors observed the negative side of the entrepreneur's experience, where previous experience can act as a barrier or, at least, hinder significant strategic changes when necessary. This happens because, based on previous experiences, the entrepreneur is unable to see other ways different than the ones he/she already learned and used over time. Experience acquired also represents asymmetries of information between individuals (Shane & Venkataraman, 2000). Therefore, previous managerial functions of the entrepreneur and the knowledge acquired help him/her discover new entrepreneurial opportunities.

4.4 Characteristics of Entrepreneurs from Technology-Based Incubated Startups

The state of São Paulo presents a structure of business incubators that aims, as part of science and technology policies, to stimulate technology-based companies, and also non-technological firms, to innovate and undertake, thus promoting economic development. In this context, the profile of entrepreneurs of high-tech startups allows an understanding of the parties involved in the process and their characteristics in the development of such important task, that is, to boost entrepreneurship and innovation.

In our study, we analyzed entrepreneurs from 95 technology-based incubated companies distributed across the state of São Paulo. Considering product innovation, it was possible to identify that 52.6% of the companies had innovated in their products for three consecutive years (2010, 2011 and 2012). These companies have, on average, 5.74 employees; 88.4% of the entrepreneurs have above a bachelor degree; 57.9% have an educational background in exact sciences; 90.5% work in areas related to R&D and production; they have, on average, 5.74 years of experience in the company and 18.82 years of overall experience.

Table 4.1 presents the characteristics of entrepreneurs as well as of technology-based startups. Starting with innovation, we investigated how innovative companies were in terms of products and, for this purpose, checked if they had launched new or significantly improved products in the market over the period 2010–2012.

According to Table 4.1, 47.4% of the technology-based incubated companies analyzed do not develop product innovation, while 52.6% do. This indicates that mostly high-tech incubated startups launched products over the three years covered by the research. The essence of the incubatoni process is the need to boost innovation in companies. It is worth mentioning, however, that companies may not have developed

Table 4.1 Product innovators

	Frequency	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
No	45	47.4	47.4	47.4
Yes	50	52.6	52.6	100.0
Total	95	100.0	100.0	

Table 4.2 Level of education of the entrepreneur

	Frequency	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
High school (Secondary education)	6	6.3	6.3	6.3
Vocational school	5	5.3	5.3	11.6
Higher education (Tertiary education)	29	30.5	30.5	42.1
Master in Business Administration(MBA)/*Lato sensu* specialization	22	23.2	23.2	65.3
Master's degree	12	12.6	12.6	77.9
Doctor's degree	8	8.4	8.4	86.3
Postdoc	13	13.7	13.7	100.0
Total	95	100.0	100.0	

product innovation during that period, but, instead, service innovation or any other sort of innovation, which should be further examined in a subsequent research—that is a limitation of this study.

Considering specifically the variables related to the entrepreneur's background, Table 4.2 presents the level of education of the entrepreneurs of technology-based incubated startups.

Only 11.6% of the entrepreneurs interviewed do not have an educational level compatible with higher education or other upper levels. Of the other ones, 30% have higher education and 57.9% have a higher education degree (master and PhD levels, including postdoc). Such findings indicate the high skilled workforce employed in such companies, assuming that, as startup companies, partners tend to take over important functions within the organization. Besides, in these startups, most of the products developed stem from the research carried out by partners during their master, doctorate and postdoc programs. The location of incubators—most of them reside in universities or have strong bonds with universities—also induces students and newly graduated professionals to put effort into entrepreneurial activities in high-tech incubated startups.

Considering the area of study, we analyzed entrepreneurs involved in the fields of exact sciences in comparison with entrepreneurs with a background in human sciences. Results are presented in Table 4.3.

Table 4.3 Entrepreneurs with a background in exact sciences

	Frequency	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
No	40	42.1	42.1	42.1
Yes	55	57.9	57.9	100.0
Total	95	100.0	100.0	

Table 4.4 Experience of the entrepreneur in the company

	Frequency (%)	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
2	10	10.5	10.5	10.5
3	16	16.8	16.8	27.4
4	16	16.8	16.8	44.2
5	8	8.4	8.4	52.6
6	13	13.7	13.7	66.3
7	13	13.7	13.7	80.0
8	6	6.3	6.3	86.3
9	5	5.3	10.5	91.6
10	1	1.1	1.1	92.6
12	1	1.1	1.1	93.7
13	1	1.1	1.1	94.7
15	1	1.1	1.1	95.8
16	1	1.1	1.1	96.8
18	1	1.1	1.1	97.9
22	1	1.1	1.1	98.9
24	1	1.1	1.1	100.0
Total	95	100.0	100.0	

As presented above, 42.1% of the entrepreneurs have an educational background in the field of human sciences, while 57.9% have a background in exact sciences. For the exact sciences, we considered engineering and courses related to mathematics and exact aspects of science. Such finding distinguishes entrepreneurs in terms of asymmetry of information and mindset. The asymmetry of information indicates that entrepreneurs with an educational background in the field of exact sciences tend to venture more in the creation of technology-based startups, considering the reality of business incubators in the state of São Paulo.

The experience of the entrepreneur in the company was also measured in years, in absolute terms. As mentioned above, experience can be

Table 4.5 Total experience of the entrepreneur in the industry

	Frequency (%)	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
1	1	1.1	1.1	1.1
2	1	1.1	1.1	2.1
3	1	1.1	1.1	3.2
4	2	2.1	2.1	5.3
5	3	3.2	3.2	8.4
6	4	4.2	4.2	12.6
7	4	4.2	4.2	16.8
8	7	7.4	7.4	24.2
9	3	3.2	3.2	27.4
10	5	5.3	5.3	32.6
11	1	1.1	1.1	33.7
12	3	3.2	3.2	36.8
13	4	4.2	4.2	41.1
14	1	1.1	1.1	42.1
15	8	8.4	8.4	50.5
16	2	2.1	2.1	52.6
17	2	2.1	2.1	54.7
18	2	2.1	2.1	56.8
19	1	1.1	1.1	57.9
20	3	3.2	3.2	61.1
21	1	1.1	1.1	62.1
22	1	1.1	1.1	63.2
23	3	3.2	3.2	66.3
24	1	1.1	1.1	67.4
25	6	6.3	6.3	73.7
27	4	4.2	4.2	77.9
29	2	2.1	2.1	80.0
30	4	4.2	4.2	84.2
34	2	2.1	2.1	86.3
35	2	2.1	2.1	88.4
38	3	3.2	3.2	91.6
40	3	3.2	3.2	94.7
41	2	2.1	2.1	96.8
42	1	1.1	1.1	97.9
45	1	1.1	1.1	98.9
47	1	1.1	1.1	100.0
Total	95	100.0	100.0	

Table 4.6 R&D and production working areas

	Frequency	*Percentage (%)*	*Valid percentage (%)*	*Cumulative percentage (%)*
No	09	9.5	9.5	9.5
Yes	86	90.5	90.5	100.0
Total	95	100.0	100.0	

classified in three different types: experience in the company; experience in the industry; and managerial experience. We considered the experience by measuring the number of years that the entrepreneur was active in the company. Results are presented in Table 4.4.

Besides the experience in the company, our research also measured the experience achieved by the entrepreneurs over the years they were active in the industry; frequencies are presented in Table 4.5.

Besides measuring the quantitative aspect of the entrepreneur's experience, we also took into account his/her working area. In order to measure such variable, we considered entrepreneurs active in the areas of research and development and production, compared to those working in distinct areas. The frequency of the operating area of the entrepreneur is presented in Table 4.6.

When considering the working area of the entrepreneurs, we identified that most part are active in areas related to research and development and production, which indicates that the experience achieved enables them to develop and manufacture the products launched by their companies. Such accumulated experience, in many cases, stems from research developed in projects during their master, doctorate and postdoc programs, or conducted by the R&D department of large companies. Hence, at a certain moment of their career, entrepreneurs decided to undertake through the creation and establishment of startups, most of them inserted in technology-based business incubators.

4.5 Conclusion

The purpose of this chapter was to present a description of the profile of entrepreneurs of technology-based incubated startups located in the state of São Paulo. To do this, we analyzed entrepreneurs from 95 startups that reside in business incubators. These startups were approached

through a questionnaire answered by the entrepreneurs that created or managed these companies.

As result, it was possible to identify a highly skilled profile of the entrepreneurs in the startups analyzed. In fact, 88.4% of the interviewees have a university degree; 57.9% of them have an educational background in the area of exact sciences, while 42.1% have a background in different areas. The area of study is essential to understand the asymmetry of information that exists between entrepreneurs, which enables some of them to effectively innovate.

When considering the working area of the entrepreneur, 90.5% of the respondents operate in areas related to research and development and production. Their previous experience is essential, especially with regard to the development of innovation within the company. These entrepreneurs, besides providing knowledge in the areas above mentioned, have a total average experience of 18.82 years in industry and 5.74 years within the company. Table 4.7 summarizes these findings.

Mapping the profile of the entrepreneurs from incubated startups leads to a few important practical contributions.

First, results provide managers of business incubators with information that can be used in the selection process of incubated companies. Among the companies analyzed herein, for instance, results indicate that 52.6% developed product innovation, while 47.4% did not develop this sort of innovation. It is possible that these companies that did not develop product innovation were involved with different types of innovation, such as services and business model innovation. Still, considering that most part of them developed product innovation (52.6%), the characteristics of the entrepreneur's background helped to understand the profile more prone to product innovation in these companies.

In fact, the concept of information asymmetry helps to understand the results. High-tech companies demand a higher level of knowledge from entrepreneurs, and mainly, specialized technical knowledge. For that reason, findings show that 88.4% of the entrepreneurs in this research have a higher level of education, above high and vocational schools. Besides, 57.9% have a professional background more related to exact sciences, which indicates technical knowledge. The higher the amount and diversification of information an entrepreneur has, the higher the possibility to reallocate resources that have been used inefficiently so far; such reallocation may lead to new entrepreneurial opportunities, many of them related to product innovation.

Table 4.7 Profile of the entrepreneurs from technology-based incubated companies in the state of São Paulo

Characteristic	Description
Product innovation	– 52.6% innovated – 47.4% did not innovate
Average number of employees	– 5.74 employees/companies
Educational background of the entrepreneur	– 88.4% above higher education – 11.6% below higher education
Area of study of the entrepreneur	– 57.9% with a background in the area of exact sciences – 42.1% with a background other than exact sciences
Working area of the entrepreneur	– 90.5% operate in areas related to R&D and production – 9.5% operate in areas other than R&D and production
Total professional experience of the entrepreneur	– Entrepreneurs have an average experience of 18.82 years
Professional experience of the entrepreneur within the company	– Entrepreneurs have an average experience of 5.74 years within the company

Besides giving relevance to the level of education and area of study, the results also show that 90.5% of the entrepreneurs work in areas related to R&D and production, which strengthens the need for technical knowledge in these companies, which enables the development and launch of new products. In addition, these entrepreneurs had previous experience in industry for an average of 18.82 years, which provided them with important information and tacit knowledge to operate in high-tech and innovative companies.

Business incubators, when conducting processes for the selection of companies for incubation, need to pay attention to two crucial aspects: the market potential of the proposed idea and the entrepreneur/team that submitted the idea. Regarding the first, it is necessary to perform a market analysis in order to accept or not the idea for incubation. On the other hand, when considering the entrepreneur/team that submitted the idea, it is necessary to develop parameters that enable managers to identify an entrepreneur capable of promoting innovation within the company. Our findings are useful to managers of business incubators when selecting candidates. Entrepreneurs with a higher educational

background related to technical areas, with experience in R&D and production, and experience in industry (considering the average number of working years), bring information that enables them to allocate resources—that were so far badly used—and promote innovation in the companies where they work.

Additionally, considering public policies for entrepreneurship and innovation, the results lead to some insights. The most evident is that to promote innovation, public policy makers can attempt to adapt university programs in order to emphasize entrepreneurship. Courses related to technical or exact sciences areas need, in addition to the usual content, to increase the availability of subjects related to entrepreneurship, which would provide students, since the early stages of their academic life, with the necessary techniques to undertake and put in practice innovations that can serve as basis for startups.

Therefore, by understanding the profile of entrepreneurs from high-tech startup companies, it is possible to stimulate and support profiles prone to innovation, which is an essential step to promote economic development, especially in emerging economies.

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CHAPTER 5

The Financing of the Startup Life Cycle

Liliam Sanchez Carrete and Aline Mariane de Faria

5.1 Introduction

This chapter presents the main funding sources used by Brazilian startups, by addressing definitions, investment processes and challenges that need to be overcome in order to stimulate innovation and entrepreneurship in Brazil. In addition, we describe some case studies involving Brazilian startups that used financing provided by venture capital investors in order to expand their activities of creating disruptive innovation and affecting society.

This chapter brings practical contributions for entrepreneurs and researchers. To know the differences among funding sources is extremely important for entrepreneurs to make decisions about which type of capital is the best option to finance each stage of the startup life cycle. Additionally, the entrepreneur gets to know the process of investment of each of the funding sources.

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In this chapter, the funding sources are organized in two groups: venture capital and government financing. Venture capital consists of angel investment, venture capital, private equity and corporate venture capital; whereas government financing refers to any capital offered directly by federal, state, municipal government or any governmental agency. These sources of funding are complementary, because each one addresses a different stage of the life cycle of startups, which comprises six stages. The first stage consists of the creation of a startup, which usually originates from results achieved by basic or applied research developed at the university. This type of research is usually funded either by the university, by public financing agencies or by companies as a sunk cost.

Once some kind of knowledge with high potential to become a product or service for the market is identified, there is the need for capital to carry out tests, define the product, i.e. steps that will enable the development of an innovative product from the academic results. After product definition, the entrepreneur implements the third stage, which consists of testing the product in the market, where the necessary adjustments are made and a prototype is built, in order to achieve the most adequate product for meeting a specific market demand.

The second and third stages, which consist of the development of a viable product and prototype tests, respectively, are usually financed either by insider financing or bootstrapping. The insider financing option refers to financial resources used by the entrepreneur, such as his/her own capital, capital from friends or family, personal credit card financing and personal bank loans. Bootstrapping refers to techniques used by entrepreneurs that reduce the need for capital, such as the acquisition of used equipment instead of a new one, to borrow equipment for a short period of time, to employ relatives and friends with no market wages, or to run the business from home, among others. Winborg and Landström (2001) analyzed the behavior of entrepreneurs of small-sized companies that used capital to support internal operations; they identified more than thirty alternatives.

The fourth stage of the life cycle of a startup regards the attraction of the first customers and the beginning of revenue generation. In this particular stage, venture capitalists provide resources for startups by enabling their growth, taking part in the results in the long-term perspective of the business. The necessary capital to fulfill stages three and four

is, usually, provided by angel investors. Angel investors are described in detail in Sect. 5.2 of this chapter.

The fifth stage of the life cycle of a startup consists of investments in marketing and infrastructure, to provide the company the capacity to increase its production scale in order to meet a higher demand boosted by the investment in marketing. This stage demands a greater amount of capital, which is provided by other venture capitalists. Section 5.3 describes how the process of venture capital works. Another potential investor in the fifth stage is the corporate venture capitalist, which is an extension of the concept of venture capital. Section 5.5 describes this sort of investment.

The sixth stage of a startup consists of the expansion of its market at the national and international levels. To that end, the startup needs a larger amount of long-term capital that can be provided by a private equity company. The private equity investment is described in Sect. 5.4.

Therefore, it is possible to represent the funding sources according to each stage of the life cycle of startups, as presented in Fig. 5.1. The horizontal axis refers to the period of time starting on startup foundation. The vertical upper axis refers to the generation of revenue in the company, which occurs with the emergence of the first customers. From this

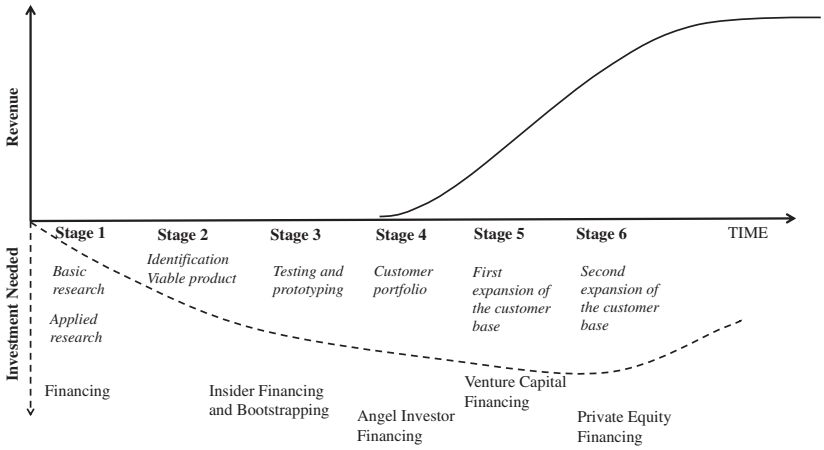

Fig. 5.1 Representation of the funding sources according to phases of the life cycle of startups

moment on, the company starts to attract attention of investors due to its ability to meet market demands. On the other hand, the need for capital occurs way before the first sale and it is represented by vertical lower axis.

5.2 Angel Investment

5.2.1 Definition

The pioneering research on the use of the term "angel investment" was the seminal paper published in 1983, "Angels and Informal Risk Capital", by William Wetzel. Angel investment is defined as "informal venture capital-equity investments and non-collateral forms of lending made by private individuals, using their own money, directly in unquoted companies in which they have no family connection" (Mason & Harrison, 2000). This definition excludes the investment made by friends and family of the entrepreneur, which are based on considerations and criteria different from those used by external investors (Mason & Harrison, 2000). That is, the angel investor is the one who has a high amount of capital and decides to invest a part of its assets in high-risk ventures with high potential returns.

Angel investors are usually professionals, executives or experienced entrepreneurs with a relevant network of relationships. Besides the financial investment, angel investors also invest their own knowledge into the new business by guiding new entrepreneurs and sharing their network of relationships to boost the growth of the company.

Considering that high-tech startups present high rates of mortality during their first years of operation, it is possible to realize that the risk associated to the investment in new technology companies is high and, for that reason, investors decide to invest only a small part of their assets in this sort of investment. The amount of capital invested can vary significantly, between R$ 50 thousand and R$ 500 thousand. In Brazil, the average amount of capital invested in companies is R$ 97.5 thousand (Hashimoto, 2014). In order to minimize the risk and increase the investment capacity, investors can organize themselves in groups or investment clubs to invest together, through participation in several companies. This diversifies risk by reducing investor portfolio risk, while developing culture and market infrastructure, thus stimulating angel investment.

Angel investors have several motivations; among them, it is worth mentioning the expressive potential financial return on the investment. In addition, angel investors have personal reasons that vary from one person to the other, such as: (i) to help the development of other enterprises through their personal experience, (ii) to be close to innovative businesses, and (iii) to interact with newborn businesses that present a synergy in their field of operation.

The investment accomplished by angel investors is also known as seed capital, because it is made in a stage where the company develops only one product, and has a small number of customers.

5.2.2 Investment Process

The investment process of an angel investor in the startup can be represented by five steps: the first step consists of the selection of startups of interest to the investor. Second, the investor identifies the company whose entrepreneur and business model fit his requirements, and sends the initial terms with the conditions for the investment, known as term sheet. Once the entrepreneur accepts these terms, the investor carries out a more complete evaluation of the business, considering technology, market potential, production process and buyers' decision process, an analysis known as due diligence. The fourth step consists of the negotiation of the contract that regulates the investment, regarding the investor's participation in the decision-making process of the company. The last step refers to the transfer of resources to the startup. The formalization of the investment can be done through convertible debt. In Brazil, angel investors take precedence over the formalization of the investment through convertible debt due to the risks that they are willing to assume, whereas the shareholder takes the risk of all decisions made by the entrepreneur in the startup company, including those prior to the capital injection by angel investors, such as tax and labor contingent liabilities.

5.2.3 Opportunities

The opportunities for angel investors in Brazil are related to (i) the cycle of the Brazilian market, (ii) high potential returns in this sort of investment, (iii) the unknown number of individuals that possess significant sums of capital, and (iv) the relevance of startups routine.

First, the Brazilian market is currently growing, which is a different situation from European countries that present mature but paralyzed economies. Thus, several venture capital funds, including angel investment, seek larger profits, especially by investing in emerging countries (Hashimoto, 2014).

The investment in early-stage businesses presents a high potential of return due to high risk. The uncertainties related to the investment involve the ability of the offered product to meet the demands of the market, the size of the potential market, the power to increase business scale, and the entrepreneur's ability to dedicate himself/herself to the business by improving the production cycle, sales and product delivery.

Additionally, even though there are more than 6300 angel investors with a potential investment of over R$ 500 million in Brazil, around 160,000 people in the country, with personal assets that are worth more than R$ 1 million, still do not consider this type of investment (Hashimoto, 2014). This fact can be a large opportunity for the growth of this sector in the near future.

Finally, although there are other types of risk investment, such as stock exchange, angel investment is the only kind that enables a direct participation in the business, which can expand the investor's networking while enabling a relevant daily routine in the new and fascinating universe of startups.

5.2.4 Challenges

On the other hand, the challenges associated with angel investment in Brazil can be enormous. Some of them are: (i) risk aversion by investors, (ii) lack of knowledge and specialization by entrepreneurs and investors, (iii) poor regulation, (iv) high taxation, (v) lack of public incentive, and (vi) bureaucratic complexity of the processes.

Initially, excess of precaution from the investor can hinder the development of the activity. Even though it is called risk investment, high risks are usually not well accepted by investors. Such apparent incoherence is due to the lack of investor's maturity in understanding the meaning of "taking risks", when analyzing a specific opportunity (Hashimoto, 2014).

Another challenge is the lack of experience of the entrepreneur, who does not know how to behave and present the project, does not know how to negotiate, does not show the necessary skills to manage the business, or does not have an entrepreneur profile. Therefore, the investor has no conditions to assess the real potential of the business and ends up by not making the investment. In addition to the lack of experience of the entrepreneur in the elaboration of proposals, both entrepreneur and investor are not aware of the legal restrictions related to this sort of investment.

Despite the relevance of the theme, only in 2016 Brazil created the first regulation for angel investment (LC 155/16), by including articles 61-A and 61-D in the Complementary Law No. 123/2006; and recently, the Federal Revenue Service launched the Normative Instruction No. 1719/2017, which established tax treatment.

Before the Complementary Law No. 155/16, the investor had an additional potential risk. Besides losing all the investment, he had to deal with the company's additional liabilities, even if he/she had no involvement in the company's management. With the current regulation, the resources provided by angel investors through the establishment of a contract do not make this investor a partner of the company where in which the resources were invested. Hence, the angel investor has neither voting right or management power in the business, nor is responsible for debts, including eventual receivership. Therefore, the regulation meets the wishes of investors that needed a distinct investment mechanism, without becoming partners.

The participation contract is hybrid, that is, it cannot be considered a simple loan, because there is the possibility of converting the investment into stocks, but the angel investor does not become a partner.

Although the Complementary Law represented an important advance for the sector, in July 2017 the Federal Revenue Service issued the Normative Instruction No. 1719/2017, which regards the taxation of operations related to angel investment, which caused an increase of investors' concern. According to such regulation, income from the investment is subject to taxation, calculated through the application of regressive tax rates, according to the period of validity of the participation contract:

i. 22.5% for participation contracts with a term up to 180 days;
ii. 20% for participation contracts with a term between 181 and 360 days;
iii. 17.5% for participation contracts with a term between 361 and 720 days; and
iv. 15% for participation contracts with a term above 720 days.

The regulation of angel investors in Brazil is very recent and has been much criticized, either because of excessive efforts to regulate the investment, or the lack of a beneficial tax treatment that effectively stimulates innovation. According to a decision from the Federal Revenue Service, angel investments are taxed equal to fixed investments.

It is very important that Brazil adopts policies that protect and stimulate angel investors. In several countries, such as the United State of America (USA), England, France and Portugal, there are policies related to the provision of tax incentives for angel investors, because governments understand that the higher the number of investments, the higher the creation of jobs and future tax payment.

5.2.5 Case Study: Buscapé

The case of the company Buscapé, founded by four newly graduated students from the University of São Paulo in 1999, with the support of an angel investor, is a successful example. The product developed by the company is a website that presents a portfolio of several companies, where the user can compare the price of a specific product at different online shops.

One year after its launch, Buscapé received some important investments. There were basically two contributions: US$ 500 thousand and US$ 6 million. With this money, the operation became profitable and an expansion process was carried out, which led to the opening of offices in Mexico, Argentina, Chile and Colombia. In 2005, the first angel investor of Buscapé sold his equity stake to a North-American fund, which later purchased BondFaro—a competitor of Buscapé—and merged the operations. With that, Buscapé became the largest price comparison online service in Latin America.

In 2009, the South African media conglomerate Naspers Limited, through its digital media channel (MIH Holdings), acquired 91% of

Buscapé for US$ 342 million. Naspers' portfolio relies on telecommunications companies, internet and entertainment in Africa, China, India, Eastern Europe and other parts of the world, besides a 30% stake of Editora Abril (Buscapecompany, 2018). In June 2018, Naspers hired the investment bank Citigroup to sell its Buscapé shares.

5.3 Venture Capital

5.3.1 Definition

Venture Capital consists of investing in companies that need capital to expand their client base and their products and services portfolio. It is used to finance capital expenditures to increase production capacity, marketing campaigns to promote its products and services, and working capital needs due to assets expansion. In this life cycle stage of a startup, entrepreneurs can no longer access government and corporate funding sources for research and development, and they have no business history, revenue stability and customers' portfolio to access bank credit lines or capital markets. These venture capital investors fill the gap of cash availability for startups to finance the creation of a customers' portfolio.

Venture capital investments are characterized by the acquisition of equity stake in the startup. Together with a Shareholder's Agreement, investors obtain the voting right in the company's management decisions, which ensures the transfer of managerial skills to the startup, while initiating the process of value creation. The managerial capacity of the investment fund is the result of its investment experience in other companies of the same industry, and its suppliers and customers' networks, which are worth more than the simple capital injection.

5.3.2 Investment Process

The investment process of venture capital in a startup starts with the constitution of the investment vehicle, which is usually an investment fund created exclusively to receive resources from investors and allocate them in startups through sharehold interesting or loan agreement. The initiative to create the investment fund is taken by an asset manager (asset management), who identifies a market opportunity in a specific market segment of a geographic region. Venture capital funds

define the market niche in which they want to invest. The asset management company is known as general partner of the investment fund, and is responsible for decision-making with regard to capital allocation; the investors are known as limited partners and are responsible for the provision of resources for the acquisition of corporate interest in startups. The investment process can be described in six stages (Fig. 5.2).

The first stage refers to the constitution of the investment vehicle by the general partners; the second involves the formalization of the investment commitment by the investor. The third stage consists of the selection of the startups that will receive the resources. The fourth refers to the transfer of resources to the startups. Usually, the investment fund manages a startup portfolio, which generates a synergy between the startups and contributes to the process of value creation, which refers to the fifth stage. In this stage, the general partner selects one executive with experience in the startup's area of operation in order to driver the company's management along with the entrepreneur, i.e. the founding partner of the startup. This is when value creation occurs, turning the startup into a company with a market value of millions or billions of dollars. Finally, the last stage refers to the investment redemption, by selling its equity stake and transferring financial resources to investors, also known as limited partners. In the situation where the process of value creation is successful, the sale of the fund's participation in the startup is enough to compensate the investor,

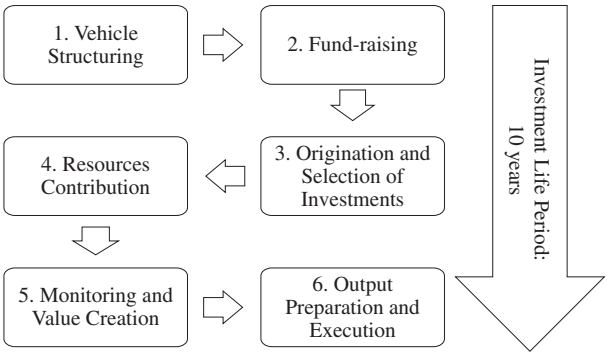

Fig. 5.2 Stages of the venture capital investment process

given the investment risk, and still repay the general partner with a stake of the investment performance. Besides the remuneration by performance, the general partner charges a management fee for selecting startups that receive capital contribution.

The six stages described are accomplished in approximately 10 years; during the first 2–3 years, the investment fund selects the invested companies; over five to seven years after the disbursement, the process of value creation is started in order to enable the investment redemption and ensure the investor cost of opportunity.

5.3.3 Opportunities and Challenges

Venture capital investments offer an opportunity to value the capital invested at higher rates of return than the average rates of the capital market. On the other hand, the risk of such investment is higher, since technological innovation already presents a risk, as well as entering new markets. Due to the higher risk, investors also require higher returns. The return rates demanded are between 40 and 60% per year, depending on the business segment, and the investment framework varies from 5 to 10 years (Titman & Martin, 2010). The main performance measure of venture capital funds is the multiple of exit obtained by the division of the redemption value and investment value of the investment.

$$Exit\ Multiple = \frac{Redemption\ Value}{Investment\ Value}$$

Considering the required rate of return of 40% per year and the investment period of 7 years, the expected multiple of exit should be 10 times as much as the capital invested. It is a huge challenge to achieve this rate of return, because it depends on potential market, capacity of strategy implementation, which depends on the entrepreneurs team, expertise of venture capital executives, and the period of time that the startup innovation represents a competitive advantage in the market.

Some studies aim to investigate the returns obtained by venture capital funds, whose returns are totally related to how the investment recovery is accomplished. For unsuccessful investments, redemption is done through the firm's liquidation, a case in which the venture capital fund can lose all the invested capital. For economically viable companies, however, which did not meet the goals defined by the manager during the

period of value creation, they can be sold to founding partners or other investors. In that case, the venture capital fund can recover the capital invested. For companies that met the goals and operate in business segments of interest to more mature companies, redemption can be carried out by selling shareholding participation to another company, an option known as strategic sales. Here, there is the possibility of return on capital at much higher rates. Finally, for companies that have a strong growth potential after the period of value creation, redemption is accomplished through the public listing of the invested company, which is known as Initial Public Offering (IPO). In this case, the returns obtained can be even higher when compared to strategic sales.

Das, Jagannathan, and Sarin (2003) used a sample of high risk investment funds of the North-American market, from 1980 to 2000, and identified that the average Exit Multiple of investment funds, which were focused on investing in companies in their first stage, was 10 times in the case of investments whose redemption were made by strategic sales. On the other side, in the case of redemptions made by the public listing of the invested company, the IPO, the Exit Multiple was 20 times.

In the Brazilian market, Minardi, Bortoluzo, and Moreira (2015) investigated the multiple of exit based on a sample obtained for the period between 1994 and 2012, and identified that the average Exit Multiple of venture capital funds was 2 times.

5.3.4 Case Study: Neon Bank

The investment fund Propel Venture Partners was created in 2017 with an investment of US$ 250 million from the Spanish bank Banco Bilbao Vizcaya Argentaria (BBVA), besides funds raised from other investors, and is located in San Francisco. The focus of the fund is on startups that operate with technology and finance. In 2018, Neon Bank, a fintech that delivers financial services, received a capital contribution of US$ 22 million. This investment enabled the bank to expand its technology team in order to launch new products. Neon Bank was founded in 2016 in the Cubo Itau's innovation hub with a business model that has no maintenance fees for checking accounts and all financial transactions are accomplished by cell phone, including for opening an account, which takes only five minutes. When using an iPhone, the user can transfer money via Siri by requesting the app to transfer the money to a beneficiary, who also has

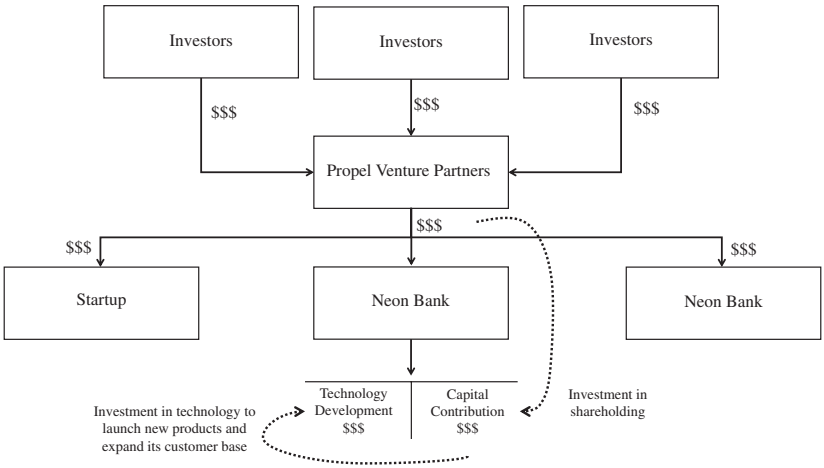

Fig. 5.3 Investment made by Propel Venture Partners

an account at Neon, through facial recognition, without the need to use pin codes. The investment made by Propel Venture Partners can be represented by Fig. 5.3.

5.4 Private Equity

5.4.1 Definiton

Private equity consists of investments in private companies that do not have access to capital market. Private equity means equity of privately held companies. It refers to the financing source for companies that have no access to investors because they are not listed on any stock exchange, but need capital due to its huge opportunities of growth.

Private equity is characterized by the acquisition of corporate interest in the invested company, assuming decision-making power. Therefore, the private equity investor believes that it will be possible to add value, depending on his/her management capacity, in order to extend client portfolio by offering commercial access to the other companies of the investment portfolio, and to expand the access to revenue sources due to the proximity with financial institutions. Hence, the invested company gets, in addition

to capital, non-financial resources that, together with the experience of the company's current managers, enable the accomplishment of growth objectives, increase of market share and launch of new products, for instance.

5.4.2 Investment Process

The private equity investment process in a privately held company starts with the establishment of the investment vehicle, which is usually an investment fund created exclusively to receive contributions from investors, and the allocation of these resources in the acquisition of equity stake in that company. The asset management company responsible for the creation of the fund designates a fund administrator, which is known as general partner of the investment fund. The administrator is responsible for decisions related to the allocation of capital, and investors are called limited partners, who provide resources for the acquisition of corporate interest in companies.

The process of private equity investment can be described through the following stages:

i. identification of an investment opportunity in a business segment, in a specific geographic region;
ii. establishment of an investment vehicle;
iii. fundraising from investors;
iv. investment selection: analysis of business models, business plans and identification of the potential market of the company that will receive the investment;
v. establishment of preliminary conditions for the investment in the selected company;
vi. accomplishment of preliminary due diligence;
vii. accomplishment of formal due diligence;
viii. negotiation of the documentation;
ix. agreement between the private equity fund and the company;
x. allocation of resources through the acquisition of equity stake;
xi. value creation process;
xii. redemption of investment.

These stages occur within approximately 5 years, which is a shorter time when compared to venture capital. This is due to the fact that the investment is made in relatively mature companies, which is different from early-stage companies funded by venture capital.

5.4.3 *Opportunities and Challenges*

Private equity investment funds are remunerated by the management fee to compensate for portfolio selection and monitoring costs. The average percentage charged by managers is 2% of the investment (Zeisberger, Prahl, & White, 2017). The private equity fund also charges a performance fee, called carried interest, which is based on the profits of an investment. The standard interest allocation is 20%, on average, of the net remuneration of the investment portfolio. The net result achieved by the final investor is, therefore, 80% of the general remuneration (Zeisberger et al., 2017).

There are several empirical studies on the returns demanded by private equity funds. In the American market, for instance, Gompers and Lerner (1998) identified that the rates of return amount to around 20 to 25% per year. This rate is lower than the interest demanded by venture capital due to a lower risk, considering that the investment is made in more mature and larger companies, which are institutions that present lower risks.

Ljungqvist & Richardson (2003) analyzed the returns obtained from 1980 and 1993 by 2199 private equity funds in the United States and the weighted average returns were 18% per year (return weighted by the volume of investment). Kaplan and Schoar (2005) identified that the average internal rates of return by 746 private equity funds, between 1980 and 2001, was 121% of the average rate of return of the capital market, which is measured by the S&P500 index. Harris, Jenkinson, and Kaplan (2014) used a sample of 598 private equity funds, and obtained the average internal rate of return, over the 1980s and 1990s, of approximately 18% per year, which validates the results found by other researchers. During the first decade of the 2000s, the average internal rate of return was 11% per year. This return shows an average rate over the capital market index of 3% per year, which indicates the remuneration for additional risk taken by private equity funds plus 3% per year.

5.4.4 *Case Study: Cruzeiro Do Sul Educacional*

Cruzeiro do Sul Educacional, founded in 1965, sold its equity stake to the private equity fund managed by the Brittish company Actis in 2012, receiving the amount of R$ 180 million for 37% of its capital. The capital was used to expand the group activities through acquisitions; in the year of the acquisition, the institution had 36,000

students, and in 2015 it had over 130,000 students. Besides financial resources, Actis transferred some knowledge in the area of educational management, due to some previous investments in this sector: acquisition of shares in the language school Cultural Norte Americano (CNA), and participation in the Chinese Educational Groups EIC and Ambow.

Actis sold its shares to GIC, the sovereign Singaporean fund, in 2017. Besides the 37% shares of Actis' participation, GIC acquired other 3% from other stockholders, and presently owns 40% of the group Cruzeiro do Sul for R$ 500 million.

5.5 Corporate Venture Capital

5.5.1 Definition

Corporate Venture Capital (CVC) are investment vehicles created by established companies to invest in startup firms to develop innovation in new businesses. This differs from research and development (R&D) investments made by established companies, since startup companies in their portfolio are not subject to investment policies and established procedures. The investment vehicle can be an investment fund or a company whose only purpose is to acquire equity stake in startups. The main purpose of the investing company is not only financial, as it happens with the venture capital investor, but strategic, because there is an interest in promoting innovation in the company's market of operation.

The interest of the investing company is either to access a new technology, enter a new market niche, or create entry barriers for potential competitors.

5.5.2 Investment Process

The investment process consists of the creation of the investment vehicle that, in Brazil, is an investment fund whose main purpose is to invest in startups that develop solutions in the company's same sector of activity. The goal of the investment fund is to manage a startup portfolio in order to create value, such as a venture capital or private equity fund. The difference is that capital redemption can be achieved through the sale of its shareholding participation to the investment vehicle's owner company, which is the corporate venture fund investor. Benson and Ziedonis

(2010) carried out a study in which they analyzed, between 1987 and 2003, a sample of 530 startup acquisitions; 89 startups were purchased by the corporate venture fund investor company.

5.5.3 Opportunities and Challenges

Corporate venture capital is an opportunity to develop innovation for large companies, because innovation is developed outside the company. In addition to the necessary capital for development and expansion, companies provide startups with the access to distribution channels, suppliers, technology, infrastructure for scale production, and customer services; it all depends on the complementarity between the startup and CVC parent company.

On the other hand, conflicts of interest between venture capital investments and startups go beyond the usual conflicts between investor and startup. In the case of corporate venture capital, there is the risk of competition between the startup and the company; potential acquisition of the startup by other competitors; the startup can compete for capital with other business units of CVC parent company; risk of technology expropriation by CVC parent company; access restrictions to funds held by competitors of CVC parent company.

According to such risks, one may doubt the feasibility of CVCs. Empirical studies investigated if the benefits overcome the CVCs risks and conflicts of interest. Gompers and Lerner (1998) analyzed 32,364 investments made between 1983 and 1994. Less than 5% were CVC investments, and the main results, considering that IPO is the most profitable exit option for venture capital investors, indicated that 30.6% of the investments in venture capital underwrote IPO, while 35.1% of the CVC investments underwrote IPO, which shows the superiority of CVCs. By selecting only CVCs with a strong strategic alignment with CVC parent company, it was possible to check that 39.1% of the investments underwrote IPO. On the other hand, write-off is the exit that results in the worst performance for the venture capital investor: 18.7% of the independent venture capital fund investments were liquidated, against 14.6% of the corporate venture capital investments. By selecting only CVCs with a strong strategic alignment with CVC parent company, they found that 14.3% were terminated.

Dushnitsky and Lenox (2006) used a sample of 1173 US public companies, from 1990 to 1999, and identified that 171 held a CVC investment vehicle. The authors analyzed the relationship between investment in CVC and the dependent Tobin's Q variable, which refers to a value creation measurement: the higher the ratio, the higher the value of the company perceived by investors. The independent variable is the amount of investment in CVC (besides the control variables). The result of the analysis confirms the positive and statistically significant relationship between the variable "investment in CVC" and Tobin's Q. It indicates that companies that invest in CVC are more valuable than companies that do not.

Finally, literature mentions CVCs' successful factors. Park & Steensma (2012), Siegel, Siegel, and MacMillan (1988), and Sykes (1990) identified that value creation is associated with the synergy between the startup and the CVC parent company. When there is synergy, the strategic value of the startup for CVC parent company occurs through:

i. new business opportunities;
ii. new business partners;
iii. new acquisition opportunities;
iv. change in the corporate culture.

The investment vehicle must be structured taking into account the autonomy of the investing company in decision-making processes. For instance:

i. The startup must have access to capital, regardless of the budget of the business units of CVC parent company.
ii. CVC must be an entity independent from CVC parent company, with its own remuneration policies and independent investments.
iii. CVC must be managed by a professional of the venture capital industry, with participation of managers of CVC parent company, in order to identify and benefit from synergies. For this purpose, it is necessary to establish a communication flow between CVC parent company and the startup, regarding issues of mutual interest.

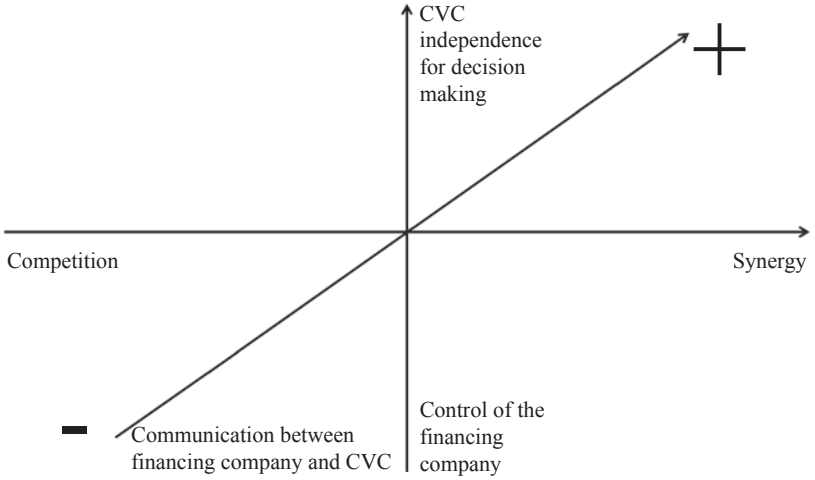

Fig. 5.4 Performance of the CVC fund according to the degree of competition or complementarity of the startups' businesses

Based on these studies Fig. 5.4 shows the performance of the CVC fund, according to the degree of competition or complementarity of the startups' businesses, the degree of independence and the degree of communication between the startup and CVC parent company.

5.5.4 Case Study of Corporate Venture Capital in Brazil

M12, formerly Microsoft Venture, is a corporate venture capital subsidiary of Microsoft, and launched the investment fund BR Startups in 2013. This multicorporate investment fund, which received investments from Qualcomm, Monsanto Group, Banco do Brasil Security, Algar, Votorantim Bank, ES Ventures (Espírito Santo Ventures) and State Development Agency of Rio de Janeiro (AGE RIO), in order to invest in newborn companies, is managed by MSW Capital, which was founded in 1999 by Professor Moises Swirski, PhD in Finance by Stern School of Business.

The areas of interest of BR Startups are: cloud systems, agritech, fintech, insurtech, edtech, digital health, telecom, information and communication technology (ICT), tourism, renewable energy, urban mobility, smart cities, productivity, internet of things and public security.

In December 2017, BR Startups made an investment of R$ 1 million on the startup QueroQuitar, an online fintech for debt settlement and financial education that already helped around 280 thousand people to handle their financial situation. Since 2015, QueroQuitar works as a marketplace platform that operates as a real online negotiation table between debtors and creditors, which aims at preserving a good relationship between the company and its customers. Today there are more than 3 million debtors registered in the database, and also financial credit institutions, such as Santander, Bradesco, Porto Seguro, Caixa Econômica Federal, Tribanco, MRV Engenharia, Sofisa, FortBrasil, Riachuelo, Alphaville e Credz.

5.6 Government Financing

5.6.1 Definition

As mentioned before, venture capital is the main source of the financial market for funding innovation. However, such source requires the existence of a stable capital market for the consolidation of the investment process. In Brazil, the lack of private venture capital funds made public institutions vital elements for the promotion of technology-based companies (Cherobim, Mendonça, Woehl, & Nascimento, 2011).

In this perspective, since the end of the 1990s, Brazil has promoted deep political reforms to support technological innovation and micro and small-sized companies. Several programs for financial support have been implemented by public technology funding agencies. Today, the legislation that supports science, technology and innovation is composed mainly by sectorial funds of science and technology and by the Innovation Law, followed by other legal mechanisms (Morais, 2008).

The sectorial funds were created in 1999 thanks to a solid work developed by the currently named Ministry of Science, Technology, Innovations and Communications (MCTIC) (Salerno & Kubota, 2008). There are 16 sectorial funds, from which 14 regard specific sectors and 2 are cross-sectional: one stimulates the interaction between universities

and companies (Green-Yellow Fund, FVA in Portuguese), and the other is directed to the improvement of science, technology and innovation structure (Luna, Moreira, & Gonçalves, 2008). The financial resources of sectorial funds are managed by the Financing Agency for Innovation and Research (FINEP), which is the executive office of the funds, and the National Council for the Development of Science and Technology (CNPq). The main objectives of the sectorial funds are: (i) to ensure the expansion and stability of financial resources for R&D; (ii) to boost private investments in research and innovation; (iii) to foster partnerships between universities, research institutions and the production sector; and (iv) to guarantee the continuity of R&D investment in the private sector (Morais, 2008).

The Innovation Law (Law No. 10973/2004) was the milestone that created the framework for financial support through direct economic grants to companies, in order to develop innovative products or processes (Maçaneiro & Cherobim, 2011).

5.6.2 Investment Process

With the emergence of the Innovation Law and sectorial funds, several government programs were created in order to boost the development of innovation in the country. These programs comprise five large promotion strategies: (i) subsidized resources (non-refundable); (ii) traditional funding investments with special terms and fees, which are lower than those found in the financial market (refundable resources); (iii) government support for using venture capital and private equity; (iv) tax incentives; and (v) technological and managerial support.

The financial resources of the first three items are provided by institutions of the federal and state governments, and are managed by funding agencies, which handle the process (Maçaneiro & Cherobim, 2011). Companies compete for these resources in order to develop their technological projects (Salerno & Kubota, 2008).

At the country level, FINEP is the main institution that funds R&D projects in companies. At the state level, Foundations for Research Support (FAPs) sometimes play the same role in specific niches, many times through a partnership with FINEP (Salerno & Kubota, 2008).

It is important to mention that a defined percentage of the budgetary resources of the federal government for subsidy is directed to micro and small-sized companies. In order to ensure that these

resources reach these companies, the Innovation Law defined that FINEP should establish agreements and to accredit regional, state and local funding agencies, besides defining simplified procedures for the submission of projects by micro and small-sized companies (Morais, 2008).

We present the main public institutions that elaborate public notices for innovative companies to submit projects in search for financial support:

i. National Council for Scientific and Technological Development (CNPq). The main purpose of CNPq, which was founded in 1951, is to promote scientific and technological research and improve the educational background of Brazilian researchers in all knowledge areas. Today, the main entrepreneurial support of the institution is the Education Program of Human Resources in Strategic Areas (RHAE), created in 1987, to boost the insertion of researchers (masters and doctors) in micro, small and medium-sized companies (CNPq, 2015). This is an essential support, especially for confronting one of the main risk factors of funding innovation: the high investment in skilled labor for the development of new products and technological processes (Hall, 2002).
ii. Foundations for Research Support (FAPs). These are agencies that promote science and technology at the state level. They are associated with MCTIC and work as mediators between research institutions and universities and public and private companies in technical cooperation activities and service rendering, besides providing resources through government programs (ANPEI, 2009).
iii. Financing Agency for Innnovation and Research (FINEP). It is also a federal agency that supports innovation and technological development, founded in 1967. Its main objective is to encourage the development of technological research in domestic companies (Maçaneiro & Cherobim, 2011) in several ways, such as: (i) non-refundable resources (economic subsidy), (ii) refundable loans with different terms of payment, and (iii) venture capital, in which it participates as partner of the firm. Depending on the type of company, the technological relevance of the project and the level of innovation and risk, credit alternatives offered to companies can be combined through different programs. Such combination of funding instruments is much appropriate for micro and

small-sized companies. Therefore, by combining refundable and non-refundable resources, FINEP can foster essential activities for the increase of competitiveness in the Brazilian corporate sector (FINEP, 2015).

iv. Brazilian Service for Support of Micro and Small Firms (SEBRAE). Created in 1972, it is an institution that prepares micro and small companies to achieve the necessary conditions to compete and grow (SEBRAE, 2014). It has developed the program Startup SP, to increase the opportunities for innovation in startup companies. The program for the development of digital startups in the state of São Paulo focuses on startups that need to validate the main assumptions of their business models. The program lasts 4 months and offers training, business monitoring and mentoring with partners from the market and from the startup ecosystem. It happens twice a year, and the first event took place during the first semester of 2017. In 2018, SEBRAE intended to invest around R$ 45 million in startups through investment funds; such initiative was called "Capitalizing innovative companies". The main purpose of this project is to facilitate access to business capital through application in investment funds; the support is directed to small innovative firms with high growth potential (SEBRAE, 2018).

v. National Bank for Economic and Social Development (BNDES). It is an institution associated with the new Ministry of Economy, and is the main agency for long-term funding in every segment, and offers special conditions for micro, small and medium-sized companies (BNDES, 2018). It supports companies through the provision of funding and investments, subscription of securities, provision of collateral, and non-refundable resources. The bank provides products, programs and funds, according to the modality and characteristic of the operations. Some specific examples of funding programs for innovation are: (i) BNDES Finem, (ii) BNDES Funtec, (iii) Fundo Clima (Climate Fund), (iv) Inova Mineral, and (v) Plano Inova Empresa. Still, the strongest focus of BNDES is on refundable financing. The bank has some difficulty—which is a characteristic of the banking system—to fund innovation projects in newborn companies, since these projects present higher risks and only a few real securities.

5.6.3 Opportunities and Challenges

The Brazilian government funding mechanisms for innovation present several obstacles to overcome. Some of these challenges are related to the budget available for research and development of projects, which also includes the qualification of skilled researchers in order to accomplish innovation. Since 2014, the public budget for research has decreased, due to the political crisis that the country has faced lately, together with the increase of the public debt.

In addition, first-time entrepreneurs often do not know about these alternative sources of funding, neither have the expertise to develop projects for submitting to financing agencies.

5.7 Conclusion

One of the greatest challenges for the entrepreneur to deal with is capital restriction while he/she identifies investment opportunities of high return. This chapter presents several options of venture capital, since the access to this sort of funding implies the sale of equity stake and giving up decision power over the business. If the entrepreneur is not willing to waive equity stake, he/she has access to funding capital, bootstrapping and insider financing, which meet the need for resources. However, as the business expands and the demand for capital increases, the entrepreneur will have to deal with this conflict—access to capital and sharing decision-making. The purpose of this chapter was to present and discuss the main funding sources used by startups, investment processes and challenges that need to be overcome in the Brazilian context. Thus, entrepreneurs can identify the best funding source according to the startup's level of maturity, and understand the different contracting processes, depending on the investor.

The chapter also presents contributions for practitioners, i.e. managers of incubators and science parks, which will help them guide entrepreneurs in decision-making processes related to getting capital. The private sector, which consists of large corporations, can take the lead and encourage companies in a specific stage of their life cycle to get new technology partners.

Finally, the challenges of each source of capital can lead government officials to develop public policies in order to optimize the use of such sources. Therefore, it will be possible to leverage the development of

innovative companies, either by increasing life expectancy of startups or promoting the growth of mature companies in the market. As a result, such actions can bring positive externalities to the country, through the creation of high quality jobs and the increase of innovation indicators.

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PART II

Innovation Ecosystems

CHAPTER 6

The Contribution of Technology Parks to High-Tech Startups

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6.1 Introduction

The aim of this research was to understand the Product Development Process (PDP) in high-tech startups located in technology parks, where it is assumed that the inputs and actors involved can facilitate product-planning activities, Research and Development (R&D), engineering, equipment tests, certifications, and product launch, among other necessary activities for the development of an innovative product. In this chapter, we answered the following research question: how do actors associated with technology parks contribute to the PDP of high-tech startups?

Fierce competition and technology innovation race fostered the emergence of new technology intensive industries, such as biotechnology, biomedicine, nanotechnology, microelectronics, robotics, among others. Such sectors make use of advanced technologies because they develop

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processes, products or services whose technology is considered new or innovative.

Such corporate areas have shown an increasing relevance in the world economy, especially regarding high-tech startups. The most important characteristic of these companies is the high level of technical knowledge embedded in products and services. For this reason, high-tech startups usually have human resources with high technical knowledge levels, which is hardly found in traditional companies.

For high-tech startups to launch products with good marketing feedback, they need to have a competitive PDP. This process begins with the identification of an opportunity by the company staff and ends with the commercialization and technical support of the product. The PDP is a complex and essential activity for the company to survive and to compete in the market; it is a process inherent to every firm involved in product development. Product development consists of a range of activities through which it is possible to develop and commercialize the product. But, to do this, the firm must take into account the particular needs of the market and technology possibilities and limitations, and both competitive and product strategies of the company (Rozenfeld et al., 2006).

Considering that the PDP of high-tech startups defines products and services with high-value added, employs qualified human resources, and replaces foreign imports with domestic production, creating employment opportunities and income, many governments have encouraged and supported initiatives for the establishment and development of such companies. Since the creation of these companies is strongly related to research and educational institutions, government initiatives have tried to establish a relationship between companies, governments and universities. In this perspective, technology parks are one of the main ways to encourage the creation and development of high-tech startups along with the strengthening of research and educational institutions.

Technology parks are environments that stimulate cooperation between companies and universities in order to promote innovation and scientific and technological research. The common features of technology parks is the geographical proximity of several actors belonging to the private sector, research and educational institutions, and governments. Of all the actors involved in a technology park, we emphasize the importance of companies, universities, laboratories, research institutes, innovation agencies, business incubators, institutions that support small-sized

companies, venture capitalists, and government funding agencies. Technology parks, therefore, play an important role in promoting innovation, technology-based entrepreneurship and the economic development of their regions.

High-tech startups find a very particular environment in a technology park because of the proximity of other companies and of research and educational institutions, which allows companies to develop business networks and thus benefit from such network when developing new products. The initiatives of technology parks are based on the idea that an environment built in a special area promotes the development of high-tech companies. The advantage for high-tech startups located in such parks is the easy access to a great variety of actors, which the company would not be able to reach, except in a technology park. Due to highly qualified resources and the development of specialized products and services, the proximity and cooperation with universities and research institutes can leverage the survival and development of these companies.

We present here a qualitative research. We used the multiple case study method by selecting some high-tech startups established in technology parks. The multiple case study method was based on literal replication by selecting companies that presented similar characteristics. The criteria for selection of the companies were: (1) development of products that incorporate intensive knowledge and cutting-edge technology; (2) localization of headquarters in a technology park for at least one year; and (3) accomplishment of PDP within its facilities in the technology park.

6.2 Product Development Process

To develop a product means to materialize an idea into a physical asset or a service. Thus, PDP is composed of planned, coordinated, and controlled activities that aim at accomplishing the creation of a new product (Machado & Toledo, 2008). PDP is strategically important for companies because it stands right between the company and the market; PDP has to identify market needs and come up with more advantageous and quicker solutions than competitors. In an attempt to understand PDP, literature presents several conceptual models, each with its own characteristics. All models offer a sequence of steps that basically originate from an idea and go all the way until product launch (Machado & Toledo, 2008). A model is the abstract representation of reality, which is created,

checked, analyzed and manipulated, in order to increase the understanding of this reality.

The theoretical models of PDP present different stages and activities, but they also share some common features. Considering the differences and similarities, PDP can be ranked in three phases (pre-development, development and post-development), according to the model proposed by Rozenfeld et al. (2006).

6.3 Technology Parks

Technology parks are environments that promote innovation through the establishment of networks between companies, and also between these and research and educational institutions. The concept of technology park is diverse, due to the different experiences reported by such institutions throughout the world; therefore, it is nearly impossible to adopt a single definition that encompasses all models. Technology parks have specific objectives regarding their relationship with companies and their impact on the geographic region; the outcomes of their activity may not attain similar results; thus, definitions may vary.

The definition of these environments can also differ according to the region or country where they are located. In the United States, it is common to find the term "Research Parks"; in Europe, it is more common to find the concept of "Science Park"; in Asia, the term "Technology Park" (Link & Scott, 2007). In Brazil, most of the studies, as well as managers of parks and associations, call such environments "technology parks", but we can also find the expression "Science Parks".

Some technology parks, although classified as such, developed no association with universities or research centers, and operate as "company hotels" (Fukugawa, 2006). Since the interaction between universities and companies is one of the strongest benefits provided by technology parks (Siegel, Westhead, & Wright, 2003), such incorrect definition is a contradiction as to the real meaning of technology parks.

6.3.1 The Ecosystem of Technology Parks

In a technology park environment, it is possible to find several sorts of actors, such as research institutions, universities, entrepreneurs, investors, and government funding agencies, among others. These actors can vary substantially due to the distinct development of technology parks.

The administrative organization of the parks coordinates the interests of several actors—universities, companies, etc.—and, in addition to managing science and technology, they can also provide property management (Figlioli & Porto, 2012). In order to transfer technology from innovation suppliers (university researchers) to those that can potentially commercialize such innovations, university works as a mediator. These mediation structures provided by universities are known as Innovation Agencies or Technology Transfers Offices, and are essential for commercializing university research.

A common characteristic of technology parks is the presence of technology business incubators, R&D centers, laboratories, technology-based companies—which can be related to one specific sector or to several sectors—and several other institutions that support and serve, like bank branches, post office, restaurants, etc. (Figlioli & Porto, 2012). The actors of a technology park can be defined as stakeholders (Vedovello, Judice, & Maculan, 2007). According to these scholars, there is a diverse set of agents committed to such initiatives, like research centers, entrepreneurs and scholars, financial agents and venture capitalists, and development agencies and authorities from national, regional and local governments.

Business incubators are relevant actors in the environment of a technology park because they stimulate the creation of innovative enterprises, offering several sorts of supporting mechanisms, such as infrastructure, consulting, networking, etc. Business incubator is an organization created to support entrepreneurs in technological areas, offering a variety of support services during the initial stage of the company.

There are other actors who are not physically established in the park, but can be associated to this environment: business consulting and agencies that support small-sized firms. Consulting services can help companies with managerial issues, considering that management is a subject that technology entrepreneurs usually do not master (Zhang, 2008). These services can be useful to support exports and imports documentations and request investments from venture capitalists or other funds.

Government funding agencies are also part of the ecosystem of a technology park, even not being physically present, because they have a strong relationship with companies, research institutions and universities. R&D agencies allocate financial resources, through specific

Table 6.1 Main actors of a technology park

Actors	*Characteristics*
Actors based in the technology park	
University	Education of qualified human resources and execution of research activities
Research Institutes or Foundations	Accomplishment of own research activities or in partnership with universities and companies
Park's management team	Ensures financial feasibility of the park and meets the demands of participants
Resident and associate companies	Search for profitability, and partnerships with or support from actors of the park
Technology-based incubators	Promotion of technology-based companies
Innovation agencies	Support technology transfer from universities and research centers to companies
Not-based actors, but present in the innovation system of a technology park	
Government funding and development agencies	Support the development of technology-based companies
Venture capital companies, risk capital and angel investors	Search for investment opportunities through funding of technology-based companies
Consulting and supporting agencies for small-sized business	Support in management services, finance, marketing, and sales

programs, to support cooperation activities between companies and universities, to encourage technology innovation in firms (Zouain & Plonski, 2006).

Literature review addressed the several actors that are present in technology parks, whose functions are relevant for this environment. Table 6.1 shows the main actors of a technology park.

6.4 Analysis of the Selected Companies

6.4.1 Company A

Company A is based in the Science and Technology Park of the Pontifical Catholic University of Rio Grande do Sul (TECNOPUC). We interviewed the firm manager. He is not a company's partner, but has extensive knowledge of engineering-related activities and of the relationship between the company and other actors in the technology park.

Company A operates in the field of R&D of medical and hospital equipment, developing products for hospital use. In addition to R&D, it sells this technology for manufacturing companies and supports the insertion of its products in the production line of customer companies. The firm was founded in 2008 and was located in one of the university colleges next to the park. In 2011, it moved to a new building inside the technology park. At the time we carried out the interview, the company had 15 staff members, including partners, employees, interns and consultants.

The first product developed by the company was a multi-parameter monitor and the second, most recently, was a defibrillator. According to the manager, the monitor was so far the most innovative and relevant equipment developed by the company, and for that reason we chose it as the product and process to examine. When it was developed, in 2008, there was no similar equipment in the local market. Besides its multiple functionalities, it has different screens, which facilitates monitoring by physicians and paramedics.

The product was developed in one year. The resources for its development were provided by founders and investment partners of another company. These financial resources were used to hire employees—especially engineers—and to buy equipment, supplies and contract some mechanical projects, which were necessary for product development.

6.4.1.1 Contributions of Actors Associated with the Technology Park for the Product Development Process of Company A

The interviewee said that the university is a very important player for developing new products. The university hospital contributed significantly to develop the monitor, since the company carried out several tests within the hospital and kept an important exchange of information with physicians and paramedics during the incorporation and improvement of new parameters. The geographic proximity between the hospital and the technology park enabled the company's staff to be in touch with the medical staff and other employees. About such contributions, the interviewee stated that:

> We have partnerships with the university, we have already developed projects with them and the hospital is our testing area. Hence, for us it is

> really good to be geographically close, because there is always somebody from our developing team monitoring, testing, and measuring the monitor performance in real-life conditions. These tests, carried out during people's treatments, are only allowed after the certification and in the presence of the medical staff.

Another contribution was the free access to all university databases, which enabled the consultation of specialized bibliography and outcomes of medical research published in the country and abroad. This was essential to track the advances of methodologies and parameters used in this type of monitor, as well as in other medical equipment that the firm has developed. Soon after, the interviewee mentioned that the access to university's engineering alumni was another great contribution to the company's PDP.

6.4.2 Company B

Company B is located in a technology park in the southeast region of Brazil and belongs to a famous Brazilian public university. We interviewed three people from this company: the entrepreneur, the financial manager and a project engineer. Company B operates in the offshore market and offers products and services for processing and analyzing meteo-oceanographic data, including bathymetric mapping.

The company was founded in 2006 by researchers that were former graduate students of Ocean Engineering at the university, which is a member of the technology park. By the end of 2007, the company joined the university's technology-based incubator, residing inside the technology park, right beside the incubator. The company operates in the field of oceanographic instrumentation, analysis of oceanographic data and mapping of submarine terrain and bathymetry.

The first product developed by the company was "ondaleta". After that, it developed a buoy, and by the time we conducted the interview, it was developing a third product, the Doppler Submarine Navigator (DSN), an acoustic instrument used in navigation equipment or diving systems. This case study focuses on the PDP of the "ondaleta", because the entrepreneur considered this equipment the most consolidated

product of the company and, due to its engineering, it was a significant technology challenge for the company.

The opportunity to work on the "ondaleta" PDP emerged because of services that Company B had provided for the research center of another company (Company Y), which is located at the university. At that time, Company B was incubated and the development of products was not one of its purposes. But, after forging closer ties with Company Y's research center, they asked Company B to contribute with their research team to develop an equipment to monitor waves, which was still a prototype. Thus, Company B helped to develop this product, together with the center researchers, and became acquainted with this sort of equipment and technology.

6.4.2.1 Contributions of Actors Associated with the Technology Park for the Product Development Process of Company B

The actors of the technology park contributed in different degrees to the "ondaleta" PDP. The university also contributed, by providing easy access to skilled labor, to scientific databases, and cooperation with faculty and research institutes. It is worth mentioning that the contribution made by faculty and researchers from the Institute of Oceanography and Engineering was essential for developing the product. Such cooperation was not established through formal projects, but during informal sessions between the staff of Company B and university's faculty and researchers. For that matter, the entrepreneur commented on the relationship with the research center:

> Sometimes we had a few doubts, when something didn't work properly. The first problem was to assemble the equipment, how they had described it and how it should be commercialized. Sometimes we would assemble the equipment and it wouldn't work. Then, we had to call the center, and they would say "maybe you should check this or that".

The university also contributed to the accomplishment of tests on the "ondaleta". First, the equipment was tested in a tank at the laboratory of Ocean Engineering, which simulates the waves and tides. Then, the company tested the equipment and solutions related to the collection service, processing, analysis, data storage and transmission of the environmental monitoring system, at the docks of the

technology park. These tests were very important for the development of the "ondaleta".

6.4.3 Company C

Company C is located in a technology park that is associated with a known public university, in the Southeast region of Brazil. This company manufactures selective membranes for the process of water and effluent treatment, and is considered as pioneer in this sort of activity in Latin America. We interviewed one of the company's entrepreneurs, currently the director, and one of the key employees in the company management. Company C was created in June 2005 and soon was chosen to be part of the incubator of the engineering department of the same university, where it resided until 2006. After graduating from the incubator, the company settled in the university technology park.

According to the entrepreneur, PDP started from the idea of developing and manufacturing membranes, whose technology had been developed by other researchers 18 years before, at the university's research laboratory for membrane separation. In that occasion, the entrepreneur said that, by being in contact with other laboratory researchers, while getting his doctor's degree, he became aware of that technology and realized that there was a market potential for water and industrial effluent filtering equipment.

Regarding the development of the necessary technology to manufacture microfiltration membranes, the entrepreneur observed that there was no need to develop R&D activities, since these studies had been done 18 years before. Besides, he realized that the company needed a filtration technology complement, which was achieved by developing some additional modules to enable manufacturing the filtration equipment.

6.4.3.1 Contributions of Actors Associated with the Technology Park for the Product Development Process of Company C

The entrepreneur mentioned that there was a strong relationship with the actors of the technology park while he was getting his doctor's degree in chemical engineering, especially with laboratory researchers involved in the processes of filtration membranes associated with the university technology-oriented research projects. He emphasized that the contribution he got from lab researchers was technology and

infrastructure support, in order to carry out experimental tests of prototypes of products and filtration systems, based on the use of membranes.

The transfer of knowledge from the university also contributed to PDP because the company used it to patent the filtration process. Thus, the company ensured the technology property rights not only for the company but also for the laboratory that developed such membranes, guaranteeing that part of the revenues from sales would go to the membrane lab. In the following excerpt, the entrepreneur emphasizes the importance of ensuring part of the property rights to the laboratory:

> The microfiltration membrane had been developed about 18 years before our study, and you need six months to patent something; after a 20-year period, the patent falls into public domain. Hence, we could have simply launched it in the market, without worrying about the university, but we opted for a technology transfer contract.

Regarding venture capitalists and angel investors, the company never received any kind of resources for the development of new projects. However, the entrepreneur mentioned that he was in touch with two investment funds to provide capital for the company, but no decision had been made so far. As for consulting companies and agencies that support small-sized companies, Company C never got any sort of funding to develop its research projects.

6.4.4 Data Analysis and Discussion

In terms of contributions received by companies A, B, and C, data collected in the multiple case studies were described in the cross-matrix analysis, where it is possible to state that the university was a relevant player in the PDP of the companies analyzed. The contributions involve ease access to university units, such as university hospitals and research labs, to accomplish shared technology development and experimental tests of prototypes. Table 6.2 presents the cross-matrix analysis of each of the actors.

Universities contributed by allowing companies to get easier access to qualified student workforce; these students were interns and were also developing their final undergraduate work within the companies, as well as scientific research projects. Most part of highly qualified collaborators, such as masters and PhDs, had some sort of connection with the university.

Table 6.2 Synthesis of actors' contribution to PDP

Technology park actors	*Company A*	*Company B*	*Company C*	*Similarities*	*Singularities*
University	1. Access to the university hospital to carry out experimental tests of the monitor, alongside the company and the medical staff 2. During the development of the defibrillator, the company got help from the laboratory and the hospital to carry out tests 3. Easy access to student workforce	1. Help from researchers of the oceanography engineering lab 2. It allowed the company to carry out tests of the prototype in the tank of the oceanography engineering lab 3. Easy access to student workforce (undergraduate and graduate students)	1. It allowed access to the membrane lab of the university to carry out experimental tests of the prototype alongside the company and the lab team 2. Easy access to student workforce (undergraduate and graduate students)	1. In PDP, all three companies used lab resources from research units of the university, for the experimental development of the product 2. Professional teams and researchers from the university helped the three companies to test their prototypes	1. Company C was the only company where a technology previously developed by the university lab was used to manufacture and sell its product
Incubator	When founded, the company did not reside in the incubator and got no contribution during PDP		The company was incubated during the development of the filtration system, and had lower rental charges compared to companies located outside incubators		Company A was the only one that was not incubated. Right after its foundation, it settled in the technology park

(continued)

Table 6.2 (continued)

Technology park actors	*Company A*	*Company B*	*Company C*	*Similarities*	*Singularities*
Resident companies	There were no partnerships with other resident companies	There were no partnerships with other resident companies	There was no contribution to company's PDP of the filtration system	In all three cases, companies got no sort of contribution; in other words, there was no support from other resident companies	The business type of each of the companies (A, B, and C) is very specific and, therefore, not related to the activities developed by other resident companies
Park's management	Support from the management team to promote and spread technology in events and fairs	Support from the management team to promote and spread information about the company, and informal consulting on the product	Support from the management team to promote the company for other resident companies	In the three cases, the management team was considered an important promoter of their businesses, getting attention from other actors and society for the companies	

(continued)

Table 6.2 (continued)

Technology park actors	*Company A*	*Company B*	*Company C*	*Similarities*	*Singularities*
Innovation agency	There was no contribution from the agency for patent deposit	There was no contribution from the agency for patent deposit	The company used the innovation agency to apply for a patent, which was registered by the firm and the university		The division of technology property in equal shares, 50% for the company and 50% for the university, was a singularity observed in the case of Company C
Government funding agencies	The company got more funding from public agencies after the launch of the first product, the monitor	The company got financial resources for research from a federal agency	Public funding agencies contributed by providing resources for the development of technology	In all cases, government agencies provided resources for PDP	Company A received no funding from any agency for the development of the monitor. However, it received investment from Customer X
Venture capital company, risk capital and angel investors	Entrepreneurs received a few offers from investors, but there was no deal	Entrepreneurs received a few offers from investors, but there was no interest on the part of the company	The company never got any resources from venture capitalists, but is still examining some investment fund possibilities	Despite interacting with investors, no company got venture capital	

(continued)

Table 6.2 (continued)

Technology park actors	*Company A*	*Company B*	*Company C*	*Similarities*	*Singularities*
Consulting firms and support service for small-sized companies	The company's team received managerial and technological training from a Consulting agency associated with the park	In order to develop patents, the company was supported by organizations that help small-sized firms. The company received training courses for internationalization	The company received no relevant support from consulting agencies or organizations that help small-sized companies		

The university also made an important contribution to Companies B and C, by identifying the business opportunity; because of the university, these companies got the technology that would be further developed in their products. Company B developed the "ondaleta" due to a public bidding from a private company's research center located at the university. In the case of Company C, a technology developed in the membrane laboratory was the beginning of product development and the creation of the company. A technology that had been previously developed by the laboratory was used by the researcher and the entrepreneur to develop the filtration system.

The interviewees from the three companies said that they got contributions from institutes, foundations, research laboratories and hospitals, from organizations associated with the parks, and from universities, especially for carrying out the experimental tests of the products. It was possible to observe in the three cases that the R&D structure of companies did not have all the necessary equipment nor expertise to conduct complex tests and trials; therefore, they had to seek help from these organizations to develop their technology.

This situation could be noticed in Companies A and B. Company A used regularly the facilities of the university hospital to carry out tests in their equipment, besides relying on the feedback from the medical staff, who monitored these devices. Company B made use of the oceanography tank of the university to carry out tests in similar conditions as in the ocean, and later used the docks at the technology park to test the complete solution of the "ondaleta" service.

Matrix analysis indicates that resident firms did not contribute to the three companies' PDPs. Their contribution was probably reduced because the three companies operate in distinct areas, with highly specialized activities. Another element for such lack of interaction can be the low level of maturity of the parks, which still did not reach a consolidated stage, with a large number of companies that look for the establishment of relationships between them.

According to the matrix, interviewees mentioned some contributions made by the management team of the park, especially regarding the promotion and disclosure of the companies, their products and services. These actions attracted the attention of other actors associated with the park. At the same time, the management team organized technical events to attract venture capitalists and support from government funding agencies. The interviewed entrepreneurs believe that being located

at the park provides a certain credibility for high-tech startups and their product development projects. Such credibility, although not identified in the theoretical framework of this study, is a relevant aspect for companies and deserves further examination.

The contribution of the innovation agency was very small. Only Company C used the agency to apply for the patent of the developed product. Regarding the contribution of government funding agencies, data from the matrix indicates that all companies had some sort of financial support during one or more phases of PDP. Company A did not receive resources from funding agencies to develop the monitor, but received them when developing the defibrillator.

The resources obtained by the companies were essential for the development of the products, since it would be very difficult to carry out R&D activities by relying only on the company's own capital. In this sense, it is worth mentioning that all interviewees emphasized the importance of these resources for the development of projects. We could see that when companies are located in technology parks, they get credibility from funding agencies, thus increasing the possibility of project funding.

Regarding private investments from venture capitalists and angel investors, although these actors got in touch with the companies, none of them was successful at the time of the interviews. The consulting activities offered by organizations that focus on small-sized companies were observed in every case. The type of contribution is basically managerial training, preparation for quality process and technology training consulting.

6.5 Conclusion

Based on this study, it is possible to draw some important conclusions for managers of innovation environments (technology parks and incubators) and for high-tech startups managers. Regarding the former, especially technology parks, we observed the urge to create environments that have a closer relationship with research institutions, and to foster entrepreneurship in partnership with those institutions. In many cases there are technologies that could be commercially exploited, but without an implementation initiative and a little support from the ecosystem players, these technologies end up by failing. This was almost the situation observed in Company C, whose technology for filtration systems took years until commercial use, although the technology was developed long ago.

It is also necessary to emphasize that the development of technology parks must go hand in hand with long-term public policies that foster and strengthen research and educational institutions, because they are the ones that qualify specialized human resources so needed for the development of technology-based products. The implementation of such public policies is important to invigorate technology parks, ensuring that they have the basic resources for their implementation and operation. Collaboration with the private sector is also essential and must be stimulated, from small-sized companies to large multinationals. One of the weaknesses seen in the multiple case study is the small participation of venture capital companies, which are critical for the development of new businesses. This context illustrates a relevant and little developed area of high-tech entrepreneurship in Brazil, especially when compared to countries like the United States or China.

In terms of implications for high-tech startups, we noticed the importance of cooperation with universities in product development, since high-tech startups have financial and human resource restrictions; the collaboration with faculty, students and researchers can be determinant for companies' success. In this sense, one of the recommendations to overcome the internal restrictions and difficulties imposed by the market is to look for cooperation networks to support R&D investments (Gronum, Verreynne, & Kastelle, 2012).

In terms of managerial teams, it is important that companies bring together managers with a generalist profile and those with a technological profile; in many cases there are teams and founders with a strong technical profile, but little commercial or managerial experience, which can lead to difficulties for developing a new business. Besides developing partnerships with universities and research centers, high-tech startups must be aware of the opportunities to get financial resources from funding agencies, such as the Foundation for Research Support of the State of São Paulo (FAPESP) and the National Council for Scientific and Technological Development (CNPq), for instance. Such resources were essential for product development in the presented cases.

Companies should also be open to investments from venture capital companies; although these companies were not addressed, such investments can boost the development of businesses, not only by injecting financial resources into companies but also by bringing experience in marketing and management, which can be a determining factor for business growth. In addition, it is important that companies look for

mentors to support their business strategies, according to the requirements of park management. A community with a strong social capital can offer mentors, usually angel investors that were successful in commercializing innovation, who can serve both as mentors for new entrepreneurs and as initial investors in their ideas (Auerswald & Branscomb, 2003).

Finally, we noticed that companies located in consolidated and known technology parks are more acknowledged by the market, which increases their chances to obtain resources from government agencies that support technology research, while improving company's image for potential customers and partners. For future studies, we suggest further research on the relationship between high-tech startups and universities and research institutes, for a second and/or third product development, and to check the possibility of finding a pattern of collaboration on product portfolio over time.

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CHAPTER 7

Evaluation and Challenges in Managing Business Incubators

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7.1 Introduction

Public agenda concerning economic development has faced several challenges, such as how to convert research and scientific knowledge into technological innovation. This is the reason why many countries—developed and emerging—invest in government programs to speed up and promote this sort of innovation. One of the options to foster such behavior is to encourage entrepreneurial activities in civil society and in private sectors. In this sense, this chapter is the result of a research conducted with

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technology-based incubators (TBIs) in the state of São Paulo. The goal is to map the key players and identify specific aspects of their management, in particular the strategies adopted for their governance. The results allow to observe the main models and initiatives used for promoting the creation of TBIs. We emphasize the challenges that might hinder the development of entrepreneurship and technological innovation in the state.

Within this context, business incubators became a central issue, since they are considered a viable strategy for promoting entrepreneurship in local economies (Bergek & Norrman, 2008). Therefore, initiatives regarding business incubators tend to develop driving factors for creating new businesses and (partly) replicate the conditions of the organizational environment provided by specific business centers or successful economic cooperation systems, with emphasis on technology-based firms (Santos, Dutra, & Sbragia, 2008).

In fact, national governments choose public policies that aim at spreading and implementing business incubators in their economies, notably technology-based incubators. Such preference was inspired by Schumpeter studies, which consider that entrepreneurship is a critical factor for economic development. For him, entrepreneurship is a sort of action through which economic activities get started, organized and conducted, whose results and positive externalities have consequences for innovation, technical progress and productivity.

Regarding entrepreneurship as a chain of events of value creation and innovation, based on a behavior geared to attitudes and decisions expressed over time, the development of a strategy for its promotion, incentive and introduction in national economy through business incubators offers an essential dimension of success, especially the technology-based ones. Not by chance, researchers have reflected on this issue in order to identify what are the options and bases chosen by governments

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for stimulating technological entrepreneurship through business incubators, while trying to evaluate their results and effectiveness.

In Brazil, this is an outstanding issue, given the growing number of business incubators created over the past years. Their annual growth rate in the 2000s showed an increase of more than 25% (CERNE—Reference Center for Support of New Ventures, 2011)—in a trend headed by the expansion of companies that supported the creation of more technology-based incubators. The National Association of Entities for the Promotion of Innovative Ventures (ANPROTEC) registered the existence of 369 business incubators in the country, which gather around 2310 incubated companies and 2815 graduated companies (ANPROTEC, 2016). Furthermore, this is not a quantitative process evaluated by the number of existing incubators, but a trend based on normative changes, such as the institutionalization of government programs to support and promote business incubators. An example of such initiative is the Decree 56424/10, issued by the state government of São Paulo, which indicates and suggests the role of governments on this issue in Brazil.

Considering the positive understanding shared in public and private spheres regarding the merits of incubators and the institutional advances observed in the field, relevant challenges exist for this type of enterprise—and management is one of the most important. Although the goals of a technology-based incubator are known and accepted, considering the funds raised by the state, the means for execution need further studies. This is a relevant topic, since the type of management in an incubator determines the support and especially the environment favorable for growth and business sustainability (Santos et al., 2008). In other words, it is not possible to evaluate a business incubator without considering and analyzing how it is managed. Potential flaws in this regard may affect and damage the accomplishment of its goals.

In order to carry out our study, we opted for a multi-method research. Such approach is based on the combination of quantitative and qualitative data collection strategies and data analysis. With regard to the quantitative approach, we prepared a questionnaire that was sent to entrepreneurs and leaders of companies and startups that received direct support from incubators. This questionnaire was available on an online survey tool, and invitations were sent to potential respondents; the purpose was to map (identify) and characterize the enterprises. Thirty-four active incubators were mapped, and we conducted personal interviews

with 28 managers. In addition, we collected data from 100 incubated companies through electronic survey. The results reveal an ongoing movement, particularly related to actions for achieving financial sustainability of incubators and incubated companies.

7.2 Literature Review

There are several definitions of business incubators. The most generic, as proposed by Bergek and Norrman (2008) and Chan and Lau (2005), defines them as organizations that form or create supporting environments for the development of new companies. Phan, Siegel, and Wright (2005), from this generic definition, include another fundamental features: business incubators are organizations that constitute administrative centers focused on speeding up businesses through shared knowledge and resources. In Brazil, the most used definition is the one given by (ANPROTEC—National Association of Entities for the Promotion of Innovative Ventures, 2012), that incubators must be understood as a place designed specifically to protect and shelter companies, with a structure dedicated to stimulate, streamline and offer knowledge transfer to entrepreneurial activities.

In this chapter, business incubators are defined as places for the establishment and use of shared services, especially those related to infrastructure and technology. They enable business networks and market opportunities, and strengthened by a dedicated administrative structure, stimulate and support startup companies in their process of business consolidation, including raising funds from third parties. Therefore, this definition covers the key points of an incubator, and explains its bond with economic development. These sites provide proper conditions for entrepreneurs to protect themselves from uncertainty periods that affect startup companies.

A technology-based incubator is oriented for the generation and intensive use of technology, which demands a solid relationship with knowledge creation centers, such as universities and research institutes. Consequently, an incubator's administrative structure must have a strong governance and portfolios of planned services, in order to promote a high potential incubation, through connections with external strategic agents, such as venture capitalists.

The role played by incubators in economic development is relevant, especially in emerging economies. According to Al-Mubaraki and Busler (2013), the economic development of a country is perceived as both process and practice; as far as challenges are overcome, new ones emerge in an ongoing process. These authors developed a study of incubators in five developing countries, and concluded that the main benefits of TBIs are: (i) development of the local economy; (ii) job creation; (iii) creation of new businesses; and (iv) technology transfer. The fundamental difference is that, in developed countries, TBIs are a means to transform the technology created by universities and research centers into trading products, whereas in emerging countries, TBIs help to promote technological development by demanding more commitment from universities and research centers (Manimala & Vijay, 2012).

7.2.1 Evaluation of Technology-Based Incubators

The analysis of the phenomenon responsible for the implementation of incubators, as well as their performance and outcomes, is an emerging topic in several countries. According to Bergek and Norrman (2008), in countries where incubators are object of public policies, there is a recurring concern about the credits and capital invested in this sort of organization, as well as their profits and contribution to society. Hence, there is an effort to create an accountability of public investments for this action, in order to emphasize its relevance in the public agenda.

As a result, more efficient measurement methods have been used for evaluating the performance of incubators (Allen & Mccluskey, 1991). Bergek and Norrman (2008) mention that it is already possible to observe a large number of researchers that discuss the importance of these methods in order to identify best practices. Hence, we can say that this research is in line with these objectives, since mapped and identified the characteristics of technology-based incubators in the state of São Paulo, especially regarding their management and the role of the government.

Accordingly, we created a theoretical framework to analyze this sort of venture, based on the key dimensions of technology-based incubators. The framework was essentially based on the studies of Bergek and Norrman (2008), Allen and Mccluskey (1991), Aernoudt (2004), Nolan (2003), Chan and Lau (2005), Phillips (2002), and Lewis (2001), and regards four dimensions: (i) infrastructure conditions for establishment;

(ii) shared services to reduce fixed costs; (iii) support and business consulting; and (iv) promotion of internal and external networks.

The proposed approach addresses some specific items, for instance: (i) quality and availability of both physical and managerial infrastructure, to reduce the fixed costs faced by new companies in the market, that is physical space, desks, telephony, electricity, condominium fees, etc., and (ii) consulting services and networks for the identification and facilitation of business opportunities, which, in the case of technology-based companies, are commonly found in knowledge transfer and by prospecting venture capitalists. These issues are very relevant because, although the sharing of fixed cots is important, since it lowers the barriers for the settlement of new businesses, an incubator should not be seen as a simple hotel, but as a structure with abilities to share knowledge and experiences (Lewis, 2001). Internal and external networks are considered, therefore, essential items.

We used a framework based on seven dimensions, presented in Table 7.1.

The proposed framework handles dimensions that are relevant to the basic pipeline of an incubation process. First, it is necessary to identify some criteria to select a company for incubation, which are essential to anticipate the business model that the incubator should adopt, as well as the resources to be allocated. The second stage, related to infrastructure, suggests that the physical area where the incubated company will settle is relevant for two reasons: (i) proper space conditions to accomplish companies' activities and to receive potential clients, and (ii) shared services to reduce fixed costs. Thus, it is possible to evaluate which kind of infrastructure is available at the incubator, as well as its quality.

Regarding business support, it is possible to map which are the services and consulting offered by technology-based incubators in the state of São Paulo, and, as in the previous case, evaluate their quality. As to financial sustainability, we observed how incubators receive funding, as well as the origin of the resources and the strategies for prospection. For this dimension, it is also possible to identify what are the main costs and their importance for the incubator's management. The governance dimension tries to characterize how governance is created and conducted, especially because of its relevance for the incubator's daily activities—from management to the relationship with incubated companies. Regarding relationships, it is possible to identify the main strategies and alliances built by incubators, where stakeholders, strategies and

Table 7.1 Incubators analysis' framework

Dimension	*Content*
Selection	Criteria to select a company for incubation
infrastructure	Physical and shared services infrastructure for reducing fixed costs
Business support	Support activities and consulting services provided to incubated companies
Financial sustainability	Origin of incubator's resources and prospection/revenue strategies
Governance	Governance model (from board creation to the management itself)
Relationship	Relationship strategies with stakeholders and insertion in business and knowledge networks
Graduation	Graduation criteria and relationship after incubation

links stand out. Finally, graduation indicates criteria for dismissing an incubated company, especially regarding its performance in the market. Based on the information above, we created the framework applied in this research, presented in Fig. 7.1.

Therefore, it is important to bring up that although such dimensions are based on the incubators' point of view, one important counterpoint must be considered: the incubated companies' standpoint. They are the ones that use the services, the main reason for the existence of the incubators and, obviously, the focus of all actions. Consequently, these dimensions must be improved by incorporating the incubated companies, in order to better understand their governance—and, if possible, observe the results they have accomplished, which can be a way to indirectly measure the effective outcomes of the incubation process.

7.3 Technology-Based Incubators: Background

According to our study, 34 technology-based incubators in the state of São Paulo were mapped, based on this institutional framework, and were active until June 2013. It is important to comment on that, because according to previous data, the estimated number was 48. Several incubators, however, had shut down and were not included in this study. Geographically, 50% of the researched incubators are just 150 km away from São Paulo City; the others ones distributed throughout the State.

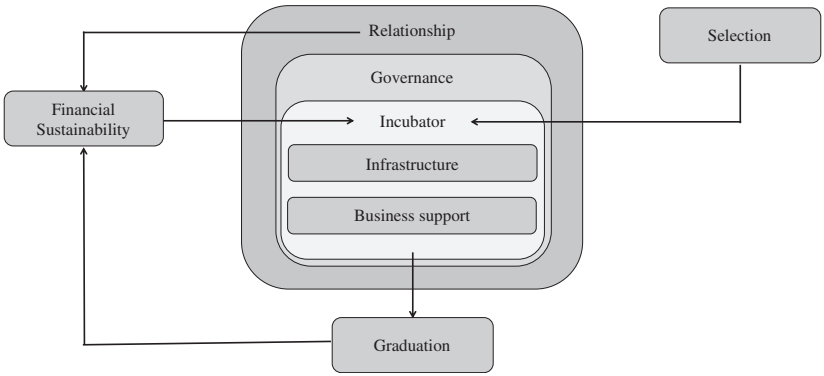

Fig. 7.1 Analysis framework

In the countryside, however, this distribution covers—mainly—two areas: around the region of Ribeirão Preto and around the region of Marília. Twenty-eight interviews were conducted with the mapped incubators, in which a semi-structured script was used.

In the state of São Paulo, technology-based incubators correspond to 29,503 m^2 of built area—27,090 m^2 refer to incubation modules, which correspond to 525 units, with an average size of 30 m^2. Thus, the average number of modules per incubator was 15.4 units. Segmented by business sectors, the most relevant areas were automation, biotechnology, information technology and chemistry. Automation and biotechnology account for 73.8% of all incubators. Regarding the strategic focus of the incubator's governance, 92.9% of the interviewed managers answered that technological innovation and the creation of knowledge were their main mission. The focus on innovation and technology is so strong that entrepreneurship motivated by unemployment is irrelevant in most incubators. On the other hand, when we observe their secondary objectives, the number of patents was the most important goal for most of them, followed by the internationalization of incubated companies.

Regarding the items related to infrastructure and services offered to incubated companies, some points should be highlighted. First of all, regarding services, most incubators in the state do not have essential items for technological activities, such as support to access private investments (50%), support to take part in fairs (57.1%) and elaboration of studies and research (67.9%). As to infrastructure, although they all

provide telecommunication services and good internet services, 67.9% of the incubators do not have laboratories for tests and/or experiments. However, the most interesting data relates to governance, funding, dynamics, processes and perspective, according to the developed framework.

7.3.1 Governance

Regarding the structure of governance, field research revealed diverse situations when it comes to creation and structure. In the visited incubators, we could not observe a pattern or standard procedures that could be widely spread. On the contrary, each governance has a peculiar structure and trajectory, involving different players, especially municipalities, which in some cases are regional and, rarely, national. As to municipal players, there was a strong presence of local governments, represented by departments for economic development, as well as by local trade associations. Regarding regional actors, there was a decrease of public support since the Brazilian Service for Support of Micro and Small Firms—São Paulo office (SEBRAE/SP), a very relevant funding body for TBIs, quit its involvement with this sector since 2010, due to legal and labor issues. The participation of SEBRAE/SP was regulated by the Federation of Industries of the State of São Paulo (FIESP), and occurred through the Center of Industries of the State of São Paulo (CIESP). In some cases, the participation of the state government is noticed, through a more indicative role by the State Department of Science, Technology and Economic Development. Moreover, federal actors—although almost inexistent—are usually related to the Ministry of Science, Technology, Innovations and Communications (MCTIC) and/or the National Bank for Economic and Social Development (BNDES).

Regarding the dynamics of governance, although there are still considerable differences in their creation, structure and legal instrument for operation, its organization tends to follow a certain pattern, basically defined by: a board of directors (responsible for strategy and management); an auditor (responsible for payments); and a technician (responsible for the approval of projects for incubation). However, in almost every case, in the daily management of incubators and strategic planning processes, the board of directors, which plays the formal role of governance, basically approves projects, and has little, or no influence on those

matters—which are carried out by the executive board, composed of operational managers or coordinators.

The interviews revealed that in most incubators governance is not very active. Meetings of the board of directors occur generally twice a year, which means that they are forums responsible for the approval and validation of executed projects during six months. Active governance is seldom present in the strategic and operational routine of incubators. The results indicate that although there are differences between incubators, the most active governance stage is the technical board, responsible for the approval of incubation projects. There are exceptions—where the board of directors is active, with monthly meetings, but this is a rare event.

7.3.2 Funding

Field research showed that technology-based incubators in the state of São Paulo have only one common way to create their annual budget: charging fees from incubated companies, whose values and names vary considerably. Regarding a common funding strategy, they charge different percentages; in some cases, it is lower than 10% of the annual budget; in other cases, it can reach 100%. There are other types of funding. Sometimes, part of the revenue comes from courses and services. But, in general, the main part of their funding are financial transfers from municipal governments (direct or indirectly) or trade associations. There was not any other case with different sources of funding, neither the participation of incubators in the capital of incubated companies.

7.3.3 Dynamics and Processes

The dynamics and processes found in the incubators show convergence in some points and differences in others. The main convergence relates to the stages of prospection, selection, incubation and graduation of incubated companies. Usually, these steps are similar, without major differences. According to the results, the prospection of incubated companies is mostly accomplished through public notices, published in websites, and conferences at universities, and selection occurs through the analysis of the business plan, carried out by a technical board composed only by university faculty. The criteria used for selection are very similar and include the profile of incubated companies, feasibility of

the business and, especially, innovation. Regarding the incubation process and considering some differences, it is divided in two steps: preincubation and incubation. This period usually lasts two years and can be extended for another year. Finally, graduation occurs in practically all incubators over time.

If the pipeline is similar for all incubators, how incubation occurs over time may differ. This varies and depends on how the company is hosted, how it passes through the available instruments for its development, and how it establishes a link with the incubator. It is important to emphasize that this substantial difference is an important indicator of the success rate, and does not happen due to strategic and managerial issues, but mainly because of the financial and economic resources of the incubators. The relationship between an incubator and an incubated company varies, after all, and may indicate a closer governance with stronger bonds. Furthermore, the existence of resources to spare support instruments can be a differential in this relationship, not only for incubated companies but also for better results in general.

7.3.4 Challenges

For most managers of technology-based incubators in the state of São Paulo, there was a strong feeling related to economic and financial resources, considered the strongest challenge to overcome. This issue is part of the debate on possible ways for a technology-based incubator to be able to keep itself economically and financially safe over time. Of all the interviews, only a minority considers that these resources should be provided by third parties, since they are now basically public (municipal and state entities are the funding bodies). Efforts have been directed to consider other forms of self-sustainability, clearly business-oriented. In other words, it is necessary to turn incubators into companies that need to capitalize, generate profits, keep themselves and continue to grow.

As to the issue of overcoming financial and economic challenges through a business-oriented perspective, managers with previous experience in multinational corporations emphasize this model, strongly suggesting actions towards this initiative. These actions are organized as follows (according to data from the research): (i) a fee over the gross income of the company after its graduation, for the same period it was incubated, (ii) success fee over the approval of subsidy projects accomplished by the company, considering a direct participation of the

incubator, (iii) success fee over venture capital subsidies in which the incubator has direct participation, and (iv) revenues from courses, consulting and alike: the incubator as a business school.

We emphasize that although SEBRAE/SP is no longer a funding agency for incubators, which was stressed as the greatest challenge to overcome since 2010, its financial impact occurred mainly on the management of incubators, and not necessarily in supporting activities, since consulting is still being done in most of them. Not by chance, self-sustainability strategies have no priority according to the managers.

7.4 Technology-Based Incubated Companies

The survey with incubated companies in technology-based incubators in the State of São Paulo comprised a sample of 100 firms, from a research universe of 461, representing 22% of this universe. Respondents were partners-entrepreneurs in 93% of the cases. Regarding their qualification, 22.6% have doctorate or postdoctorate degrees; 12.9% have a Master degree. Therefore, highly educated people work in this kind of technological enterprise, whose main field of study is engineering. The average time of professional experience is 17.9 years (standard deviation: 11.6 years).

We highlight that 78.5% of these partners spend most of their time in the company doing Research, Development and Innovation (R,D&I); only for short periods they get involved in planning and administration issues. Of all the incubated firms analyzed, 42% started their activities from 2011 onward, and the main capital source came from a physical person, in 83% of the cases. Only 5% of the companies counted on venture capitalists. Although technology is usually associated with goods and assets, 72% of the firms' outputs are services, especially related to automation.

Their main market is the national market (for 50% of them), but one quarter of these companies already operate in the global market. 26% of them are in the process of market expansion, having overcome the stage of improvement of ideas or development of prototypes. Nevertheless, regarding their market insertion, most of them have no revenue yet—of those that have some revenue, only 6% earn more than R$ 500,000.00 annually. Such fact has a strong impact on their financial autonomy, since 65% have not reached the break-even point.

The resources used by these companies for technological innovation come mainly (32%) from the Foundation for Research Support of the State of São Paulo (FAPESP). However, 45% of them claim that they do not resort to any source of funding for innovation, which reveals difficulties to manage projects and product development. We estimate, based on data provided by the companies, that 922 innovative products and services were launched in 2012, and 207 applied for intellectual property protection (patents, brands, property rights).

Regarding their perception on the dimensions of our framework, some points deserve mention. First, the general perception on the incubators' infrastructure was good in every aspect. Furthermore, the general perception regarding services was also positive. According to the data, 32% said that the incubator provides a good support service for private investments; but 19% said that the service is bad; 7% classified it as terrible, and 17% did not use such service. By considering these percentages, the positive evaluation became less important.

About the incubators' managers, companies also made important statements. Managers are concerned with a business vision, but their perception on the financial sustainability of incubated companies was unsatisfactory. In other words, although incubated companies notice the efforts of managers to create a business-oriented incubator, they do not consider that this action is effective. Not by chance, 40% agree that raising funds is the main challenge for their financial sustainability. For an expressive part of the companies, the (poor) qualification of the incubator's manager is a barrier to their growth.

7.5 Technology-Based Incubators: A Brief Analysis

The study data show some results and key issues to discuss when considering technology-based incubators in the state of São Paulo, especially because we did not analyzed only the incubators' perspective, but also the incubated companies'. Thus, it is possible to present different perceptions of the same phenomenon. Among the results, the most important is that the number of technology-based incubators in the state of São Paulo has decreased: between 2009 and 2010, there were 48 active incubators in the state; in 2013, they were only 34.

These incubators can be considered as small-sized companies, since only one of them has more than 70 modules. The average size of other

incubators corresponds to 17 modules. As to incubated companies, we observed an average of 10 firms per incubator (excluding the largest one, which has 125 incubated companies). Therefore, we observe an idle capacity in these incubators.

According to our observations, incubators do not seem to be able to fund themselves. Only one has reached economic self-sustainability, which resulted from charging incubation fees. Most incubators, however, rely on other organizations, such as trade associations, local governments and universities. The biggest challenge that we identified was the economic and institutional self-sustainability of the incubator, and raising funds is the highest barrier. It is important to keep in mind that the financial contribution made by regional and municipal agents is small, and the financial situation of incubators has been affected by the end of SEBRAE/SP financial contribution, in 2010. The fact that practically all incubators are economically fragile led to the discussion on more proper ways for incubators to become self-sustainable and self-funded. This proposition does not involve only a financial contribution from municipal, state and national governments (the traditional model), but also the provision of services by incubators, which would include success fees and share of their income (a business-oriented model).

The concern among incubators' managers regards the type of business model that should be adopted. One important issue is the reduction of public financial contribution and the exit of SEBRAE/SP from the direct support of operations in incubators. So, we did not expect that most of the incubators understand that the business-oriented model is the most appropriate to overcome the shortage of economic and financial resources and the future scenario. The incubators highlight, among the most pertinent and feasible strategies, the adoption of some actions, such as: (i) charging a percentage of the company's revenue proportional to the period of incubation; (ii) charging success fees in the case of approval of subsidy projects and venture capital contribution, considering that the incubator had an effective role; and (iii) revenues from courses and consulting.

This new direction seems to be widely accepted, but it also faces some barriers. First, due to the way governances are built. Despite the fact that governances are constituted by processes that respect the context and are strongly rooted in municipalities, which can be seen as an advantage by incorporating regional and sectorial specificities, the diversity of models brings fragilities over time, as many of the resource transfers are

connected to political cycles of executive and legislative powers. In some cases, political cycles can harm long-term policies and planning. It is important that critical issues associated with the operation of incubators be addressed in more stable regulatory frameworks. There are, after all, federal and state legislations concerning this issue—Law 10973/04 and Complementary State Law 1049/08-, as well as Decree 56424—which regards the creation of the Network of Technology-Based Incubators in the state of São Paulo), but they do not address their internal rules, especially when it comes to contracts, revenues, and taxation.

The incubated companies' point of view indicates that their perception is aligned with the need of incubators to become more sustainable. On the other hand, there is a rising concern that this effort might never lead to concrete actions for the sustainability of the enterprises. According to our data, the services of investors' prospection is considered irrelevant. In addition, incubated companies say that the efforts of incubators' managers toward economic sustainability do not include them. It is evident—based on the data analysis—that incubated companies lack subsidy lines and funding for their projects. The funding agency that incubators mostly use is FAPESP, even though it is difficult to get support. Links with university projects are very rare, although there are some exceptions. The lack of laboratories for tests and research in the incubators are important barriers for technological experiments.

7.6 Conclusions

The study examined technology-based incubators in Brazil, more precisely in the state of São Paulo. The objectives of this chapter enabled us to present a more complete scenario regarding incubators. The objectives were: (i) to map the main incubators and identify aspects of their management, particularly the strategies adopted by governance; and (ii) to observe the main models and initiatives, highlighting the barriers that affect the development of entrepreneurship and technology innovation, mostly related to results and interactions with municipal and state governments. We identified 34 active incubators, which is a significant reduction compared to the number of incubators in 2009—almost 30%. They are not large, with an average size of 15 modules per incubator, although there is an idle capacity. Incubated technology-based companies usually work in sectors related to automation and biotechnology.

Regarding the main aspects of the incubators' management, we notice that governances, usually composed of several municipal agents, are not active. The daily strategic conduction of incubators is handled by the local management, which seldom makes meetings with governance for validation. Thus, we can say that the larger part of state incubators are driven by their managers, with low governance participation, which weakens the idea of network. The main strategies adopted by the managers revealed a more normative than empirical profile. In other words, there are several ideas in course, especially regarding financial sustainability, but only a few in action.

This situation occurs mainly due to the difficulties to raise funds and generate revenues in incubators. Technology-based incubators in the state of São Paulo are not able to advance in laboratory infrastructure and a more incisive support for prospection of venture capitalists, their budget does not cover fixed costs. This also happens because of some local problems. The exit of SEBRAE/SP as a financial contributor to the management of incubators in 2010, caused by legal issues, was a considerable barrier, which harmed the execution of projects. It is important to mention that, by reason of the governance characteristics observed, most incubators are linked to municipalities (local government and associations), which connects their budget to political cycles. After all, there is no institutional norm in most municipal governments regarding the budget of these incubators, as well as with trade associations. It means that these contributions are related to the decisions made by the current management, and can easily change with new directors. Several incubators complained that the budget of these entities is not well defined, and, sometimes, the resources come through an indirect way.

Another important issue is the weak connection between incubators and universities. Although some incubators are kept by universities, their relationship with research is poor. The main connection between these institutions happens when the university presents incubators as a potential way for students to create and develop new ideas, but there is not a strong research relationship for the development of technological innovation.

Hence, we conclude that technology-based incubators in the state of São Paulo seem to be handling the subject with a strong positive attitude, proposing actions for their improvement. Yet, despite being a welcome initiative, as seen by the main involved actors, it still lacks a clear direction, especially regarding financial sustainability and action models. In such context, the role played by the state is very relevant.

The establishment of a normative framework that creates institutions for public–private–university partnerships, that is able to format the institutional environment with safety and clarity, for the articulation of all players involved, into what would be a part of the State System of Innovation, is really important. Thus, the Network of Technology-Based Incubators in the State of São Paulo could play a more important role, by promoting debates on: (i) generation of revenues, (ii) fund raising, and (iii) partnerships with universities and other entities. However, as we noticed, this network has not reached its potential regarding the discussion and transfer of best practices. The first step would be to recover this network, in order to redirect this initiative in the state of São Paulo.

This research provided significant contribution for the theory, and also to practitioners and policy makers, which increases the effectiveness of incubators in the economic, technological and social spheres. In the theoretical field, technology-based incubators, especially those located in emerging countries, depend on public policies to sustain themselves, and the proximity to universities and research centers could boost the development of technology in incubated companies. Therefore, it is necessary to formulate new governance models, as well as to stimulate the synergistic performance of players that belong to the same innovation ecosystem, considering the incubator as a basic factor for supporting related enterprises.

For practitioners, incubator managers and incubated companies' entrepreneurs must pay a special attention to the constitution and consolidation of networks, so that they are not episodic and voluntary, but structured, with regular and frequent meetings. Representatives of the local innovation ecosystem should take part in such meetings, such as large companies (suppliers, buyers and partners), public authorities, funders, universities and graduated companies, and others considered important within the context. Finally, practices for management excellence should be incorporated by incubators' managers. By defining the vision, goals and strategies, besides knowing the local market for new businesses and opportunities, the incubator will directly affect the quality of its companies.

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CHAPTER 8

Practices and Indicators of Sustainability in Business Incubators

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8.1 Introduction

The purpose of this chapter is to analyze the adoption of sustainability practices and indicators in incubators and incubated companies, as well as to suggest relevant indicators to monitor their performance, taking into consideration social and environmental responsibility or sustainable development.

One way to promote economic development is the formulation of public policies; one of the main pillars of this formulation is the support for innovation and entrepreneurship. In this context, the agenda of economic development has been marked by the acknowledgement and government support for business incubators, as an effective strategy to promote entrepreneurship in national economies. Through innovation, technical progress and productivity are achieved, which, in turn, boost the creation of

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jobs and income. This is a relevant issue. Considering that entrepreneurship is a chain of events of value creation and innovation, due to attitudes and decisions that arise over time (Jones & Coviello, 2005), the strategic planning of the company's objective is essential for its success. By supporting innovation and entrepreneurship for economic development, business incubators become very important, since they are organizations that create environments favorable to the development of new companies. Incubators are spaces used for the establishment of facilities and shared services (administrative or logistic), and a way to create business networks and market opportunities, which, strengthened by consulting in strategy and markets, stimulate and support newborn companies in their processes of consolidation. Not by chance, incubators are traditionally associated with economic development, because they provide startups with the necessary conditions to face typical periods of uncertainty.

In this context, where economic development is sustained by new companies, there are some undesired effects, such as the increase in the use of energy and natural resources. Debates on the planet's capacity to support these development processes called public attention, in the beginning of the 1970s, with the report from the Club of Rome, which suggested limits to growth as a way to stop environmental degradation. The concept of sustainable development, which became more prominent during the 1972 Stockholm Conference, attracted attention during the Earth Summit, also known as ECO-92, held in Rio de Janeiro. In 2000, the Millennium Development Goals (MDGs) were elaborated and, in 2012, issues related to sustainability were discussed one more time at the international level, during Rio + 20.

In the business sphere, the incorporation of the environment into the formulation of strategies occurs mainly due to the perception that, in the

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near future, polluting companies will lose competitiveness, and the lack of environmental commitment will restrain economic activities (Barbieri, 2007). Thus, it is necessary that small and medium-sized companies start to think about sustainability in order to do business with larger organizations, taking into consideration the demands of stakeholders in the value chain.

Sustainable development requires proactivity, long-term perspective, monitoring decisions and implementing actions. Therefore, indicators are instruments that enable measuring the current situation of a society and its development objectives, as well as the incorporation of sustainability in formulating public policies.

One of the tasks of an incubator is to help manage incubated companies by stimulating the development of practices that create competitive advantage. During the national conference promoted by Instituto Ethos[1] in 2004, some relevant issues related to the management of small enterprises were discussed (Instituto Ethos, 2004). In the particular case of incubated companies, it is important to emphasize the difficulties related to the socially responsible development of micro and small-sized companies, such as informality, lack of access to capital and to new technologies, corruption, lack of personnel skills, unfair regulation, and comparison with large companies, which hinder the possibility of growth (Ribeiro & Andrade, 2007). With the adoption of sustainability practices as a way to create competitive advantage for companies, it is necessary to measure such practices. Therefore, several indicators were created, such as Ethos indicators, Entrepreneurial Sustainability Index, Global Reporting Initiative, Ecological footprint, among others.

Based on such context, we answer the following research question: How do issues related to sustainability in business incubators located in the state of São Paulo have been taken into consideration?

We propose that sustainability practices must be part of the management of business incubators, not only regarding daily activities, but also strategic aspects. To attain these goals, we used a mixed-method approach, with both quantitative and qualitative analyses. To collect quantitative data, an electronic survey was forwarded to incubators

[1]The Ethos Institute is an organization that help companies to manage their businesses in a socially and environmentally responsible way.

located in the state of São Paulo; as to the qualitative data, semi-structured interviews were conducted with the managers of these incubators. Our sample comprises 37 incubators.

The findings can help the development and consequent adoption of sustainability practices and indicators, not only by business incubators, but also their incorporation into public policies that encourage economic development, guided by sustainable development.

8.2 Theoretical Framework

8.2.1 Business Incubators

Business incubator is a mechanism that encourages the creation and development of micro and small-sized companies (industrial, provision of services, technology-based or light manufacturing), offering technical and managerial support and additional training for entrepreneurs (AUSPIN—USP Innovation Agency, 2018). The incubator also facilitates and speeds up the process of technological innovation in micro and small companies by providing facilities with basic infrastructure, such as internet, telephony and services, especially built or adapted to host these companies temporarily. The incubator provides several services, such as management training courses, consulting, guidance for submitting projects to funding agencies, administrative services, access to information, etc. Since business incubators encourage entrepreneurship by developing micro and small-sized companies, these firms boost local development through the creation of jobs and income.

Data provided by the Brazilian Service for Support of Micro and Small Firms show that 49.4% of these businesses close before 2 years of activity (SEBRAE, 2014). This percentage increases to 56.4% if we consider a period of up to three years, and to 59.9%, up to four years. After these companies go through the innovation process, these indicators are reduced to the level of European and North-American standards, where mortality rate of incubated companies is 20% (ANPROTEC, 2012).

A study by the Ministry of Science, Technology, Innovations and Communications (MCTIC, 2012) showed that two thirds of Brazilian business incubators focus on high-tech fields, and these incubators were more and more spreading across the country, which reduced the concentration of this sort of emerging companies in the capitals. In the 27

states, there were 384 incubators in 2012. However, there was a reduction since 2007, when the number of incubators was 400.

These 384 incubators generated 2509 graduated companies, with annual revenues of R$ 4.1 billion and 29,205 employees. In 2012, there were 2640 incubated companies, which created 16,394 jobs and had revenues of R$ 533 million. This indicates the growth capacity of these organizations (incubated companies, technology-based and traditional incubators), not only regarding revenues, but also the number of jobs created (ANPROTEC, 2012).

8.2.2 Sustainability and Indicators

The expression "sustainable development" is derived from the 1987 Brundtland Report, and its definition was made by United Nations World Commission on Environment and Development. The report "Our Common Future" defined sustainability as the development that meets the needs of the present generation without harming future generations. The report emphasized the need to establish an economic, social and environmental balance; the integration among these three dimensions results in sustainable development (Brundtland, 1987).

Just as sustainable development, sustainability is also based on the triple bottom line, which refers to the economic, social and environmental pillars. The economic dimension includes not only the formal economy, but also informal activities that provide services for individuals, which increases the income and the living standards of the population. The environmental or ecological dimension stimulates companies to consider the impact of their activities on the environment, the use of natural resources, and contributes to the integration of environmental management into working routines. The social dimension consists of the characteristics of individuals, such as abilities, dedication and experience, which includes the company's internal and external environment (Almeida, 2002).

There are scholars that mention different dimensions, such as Sachs (1993), who points to the existence of the ecological, economic, social, cultural, political and institutional dimensions. These six dimensions of sustainability indicate that they are more inclusive and extensive than those of the triple bottom line; therefore, they are more appropriate for sustainable development and sustainability.

However, while looking for better definitions, scholars started to believe that sustainable development was a government's duty, while companies should only be concerned about profits and stockholders. Stoner and Freeman (1985) agree with such statement and claim that the only way for companies to develop social responsibility is to use resources to generate as much profit as possible, meeting the expectations of stockholders, within the law and without frauds. However, companies must get involved with social issues, being proactive regarding the problems that emerge in the social sphere (Drucker, 1997).

The 1970s and 1980s were marked by the concern with companies' obligations regarding their social responsibilities, which occurred especially after the definition of sustainable development by the report "Our Common Future", which encouraged firms to think about development in a different way (Carroll, 1979). Companies started to change by abandoning the traditional management solely oriented to productivity, to include social, ethical and environmental aspects.

With emphasis on the concept of sustainable development, the entrepreneurial sphere—as is the case of business incubators—must put in practice a sustainable production model. Sustainable production is the incorporation of the best possible alternatives to minimize social and environmental costs of goods and services (PNUMA—United Nations Environment Programme, 2014). Such preventive approach improves the competitiveness of companies while reducing risks related to human health and the environment. From a global perspective, sustainable production must incorporate the balance between the availability of natural resources and the environment's capacity to absorb the impacts of human activities.

In order to ensure sustainability in businesses, it is necessary to consider all dimensions. For an organization to be sustainable it must at the same time be efficient in economic terms, respecting the environment capacity and be an instrument of social justice, promoting social inclusion, protection of minorities and vulnerable individuals, etc. (Barbieri, 2007). Such definition of sustainable development contrasts the prevailing traditional development model, which promotes the merge of companies, the concentration of capital and income, the increase of social inequality, human segregation, social exclusion, and degradation of the environment.

Many internal decisions of organizations require explicit considerations regarding the influence of the external environment, which

includes social and political aspects that must be added to the traditional economic perspective. In other words, in a society more aware of its social and environmental problems, organizations are forced to adopt a more sustainable development.

To encourage a change of paradigm, from the traditional development toward the new sustainable development model, it is necessary that companies start to consider the challenges and opportunities involved. Acknowledging the challenges and opportunities of sustainability is the first step for executives to create sustainable value for the corporation as a whole (Hart & Milstein, 2004). In the same direction, Porter and Kramer (2006) claim that there are four reasons that encourage companies to reach sustainable development: moral duty, sustainability, legal requirements and reputation. Moral duty is related to doing good, that is, the organization must act as a citizen, adopting a behavior that society sees as correct.

The strategic and operational decisions of companies that take into account social, economic and social aspects are known as Social Environmental Responsibility, or sustainable development (Aflalo, 2012). A socially responsible company is one whose executives consider several interests. Instead of aiming at larger profits for stockholders, a responsible organization must also consider employees, suppliers, local communities and the country, including the entire value chain, which will become more critical in adopting sustainability practices (Johnson, 1971).

Instituto Ethos (2007) affirms that Social Environmental Responsibility brings some benefits to companies. Some of them are the reduction of conflicts (principles and values that help companies to keep solid relationships with the public and in legal processes), promotion of the institutional image and brand (socially responsible practices add value to the business, which can affect strategies), consumer loyalty (consumers admire companies that appreciate their employees, develop social projects, care about the environment and fight corruption), greater ability to recruit skilled personnel (employees feel motivated and want to be part of organizations that have a clearly defined and socially responsible management), flexibility and adaptability (companies capable of including social responsibility in strategic decisions are in accordance with society's demands), long-term sustainability of the business (socially responsible practices reduce the risk of companies and businesses as a whole), access to markets (meeting social and environmental demands enables the

company to operate in countries or regions that adopt more rigid standards), and access to capital (when ensuring the control over social and environmental risks, the company gets more access to credit and funding for projects).

Considering that the concept of sustainable development has been highlighted since the 1990s, and became one of the most used terms to define a new model of development, sustainable practices are more present in the governance and processes of organizations. However, the growing legitimacy of the concept was not followed by a critical discussion regarding its effective meaning and the necessary requirements to meet its goals (Van Bellen, 2004).

The main purpose of an indicator is to gather and quantity information in order to emphasize its significance. Indicators simplify information on complex phenomena to improve the communication process. They can be either qualitative or quantitative; some scholars believe that the most appropriate indicators to evaluate sustainability should be qualitative due to the explicit or implicit limitations that exist in purely numeric indicators; an indicator represents a variable that assumes a certain value within a specific time (Van Bellen, 2004).

The need to create indicators to measure sustainable development emerged around 40 years ago. The Gross Domestic Product (GDP) was used as a sustainability indicator; however, considering that it only measures the economic dimension, leaving social and environmental dimensions outside, it is not the best indicator. The development of a region is related to several factors other than economic growth. The development of a country, for instance, entails other factors, such as food, education, health and basic infrastructure, like water supply and sanitation. For this reason, GDP, which only measures economic growth, was substituted by other indicators, such as Human Development Index (HDI), Gross National Happiness (GNH), etc. (Veiga, 2010). Sustainability indicators have to provide figures for the three dimensions: social, environmental and economic (Van Bellen, 2004).

Modern enterprises use the evaluation of sustainability for internal and external reasons, because these indicators can effectively improve business management.

Therefore, Instituto Ethos created the Social Responsibility Ethos Indicators as a way to evaluate the social planning of organizations. Several companies use these indicators to adapt to this new entrepreneurial paradigm of sustainable development. The indicators also express

different stages of social responsibility, and to go from one stage to the other, it is necessary to have commitment, planning and investment (Instituto Ethos, 2015).

Another tool is the Business Sustainability Index[2] (ISE), used for a comparative analysis of the performance of the companies listed in BM&FBOVESPA (São Paulo Stock Exchange), based on corporate sustainability, economic efficiency, environmental balance, social justice and corporate governance. In other words, other dimensions besides the economic are taken into consideration for granting credit. This index expands the understanding about companies and groups committed to sustainability, separating them in terms of quality, level of commitment to sustainable development, equality, transparency, accountability, and type of product, in addition to the entrepreneurial performance in economic, social, environmental and climate change dimensions (BM&FBOVESPA, 2018).

According to the report "Sustainable Practices in Large Companies and Demands for Micro and Small-sized Companies", most micro and small companies already adopt sustainability practices and perceive image gains and reduction of costs, among other advantages, since they incorporated such differentials into their products, services and brand. Instituto Ethos and the Brazilian Service for Support of Micro and Small Firms (SEBRAE) created the Ethos-SEBRAE indicators of Social Entrepreneurial Responsibility for micro and small companies, which function as a self-diagnosis tool to analyze the firm. Another instrument that can be used for that purpose, by any type of company, is the newly launched Ethos Indicators for Sustainable and Responsible Businesses.

However, despite the growing number of companies that use these international performance evaluation methods, firms can also use their own evaluation methods. In our research, we considered economic, environmental and social dimensions.

8.3 Presentation and Analysis of Results

8.3.1 Profile of the Incubators

We visited and collected data from 37 incubators located in the state of São Paulo. Based on the collected data, 41% of the incubators are of

[2] Entrepreneurial Sustainability Index.

mixed-use and 19% are technology-based; i.e., more than half are somehow related to the creation of technology, which provides empirical support to data from provided by MCTIC, 2015. These data indicate that two thirds of the Brazilian business incubators focus on high-tech areas, as seen in Fig. 8.1.

Contrary to the expectation that technology-based incubators are established in knowledge-intensive areas, i.e. universities and research centers, our study shows that most of them are settled in central and industrial neighborhoods, instead of universities or technology parks (see Fig. 8.2). Such finding is in accordance with MCTIC (2015), which claims that incubators are moving toward the countryside, opposite to the characteristic of concentration of such businesses in capitals. This result is positively related to sustainable development, that takes into consideration social technologies, which aim to develop the region where they are created, through the interaction with the community, leading to the social transformation of its reality. The presence of the incubator stimulates regional entrepreneurship, while creating jobs and boosting local development.

8.3.2 Incubators and Sustainability

In this context where new companies are emerging, there is a concern that such development occur in a sustainable way. Therefore, the

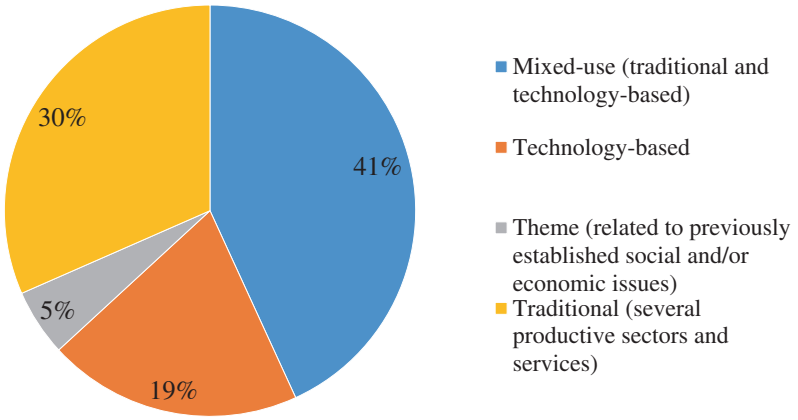

Fig. 8.1 Types of incubators

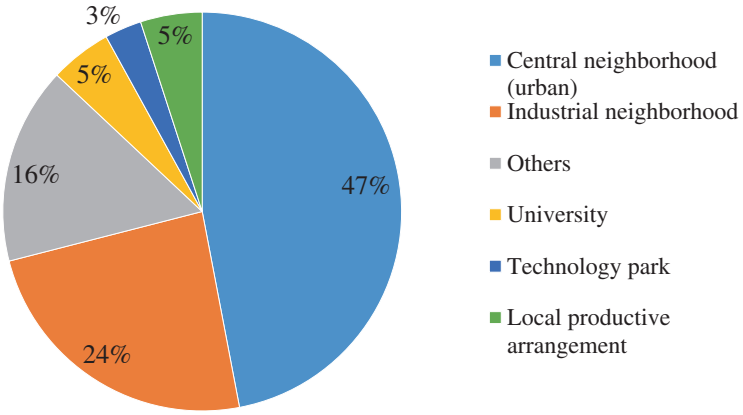

Fig. 8.2 Location of incubators

adoption of sustainability practices and indicators in business incubators is very relevant, once they are the cradle of newborn companies. Indicators can help to turn the concern for sustainability into a consistent public action. Thus, it is necessary to formulate such indicators for incubators, in order to foster economic growth. The incorporation of sustainable issues into incubators can support the complementary formulation of public policies, assuring that growth is guided by sustainability.

Therefore, the creation of jobs can be an indicator of the adoption of practices related to sustainable development. Figure 8.3 shows that one of the objectives of incubators is the creation of direct and indirect jobs. We noticed that 51.9% of the respondents believe that the creation of jobs should be a relevant item in managerial planning.

Encouragement to create jobs can start during the selection of companies for incubation. All incubators that took part in the research agree that one of the criteria to select companies should be job creation, which strengthens the importance of this indicator for sustainable development. Another suggestion was the level of commitment of the firm to the promotion of social and environmental issues, which 70% of the respondents considered important or very important. This should be another indicator of business sustainability.

Criteria related to innovation were considered important because almost 90% of the respondents believe that the company must develop

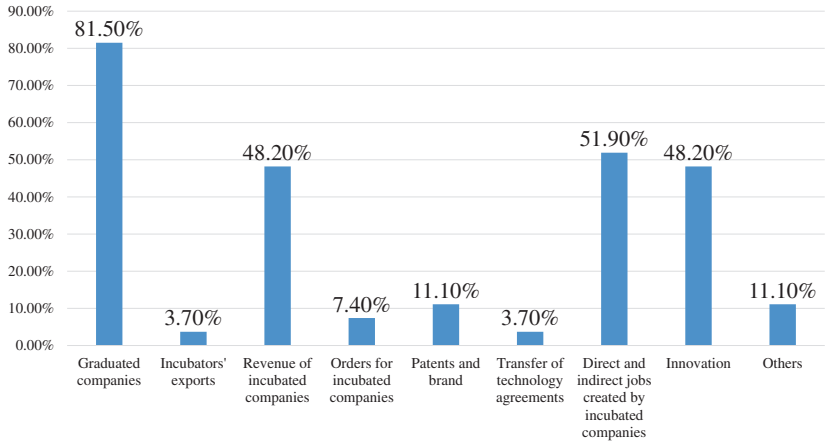

Fig. 8.3 Relevant items considered as goals in the planning accomplished

product, service and process innovation. This selection criterion can be related to social technology, as mentioned before, and to sustainable innovation, which, according to Barbieri, Vasconcelos, Andreassi, and Vasconcelos (2010), is the innovation that brings the production, assimilation or exploitation of products, production processes, management or business methods—new or significantly improved—into the organization, while bringing economic, social and environmental benefits. The outcomes of these types of innovation can foster local development through the creation of jobs, in addition to the production of goods and services that are at the same time socially and environmentally responsible. Data are presented in Table 8.1.

Another sustainability indicator that could be created is based on the infrastructure of incubators. Expenses related to water, energy and printing are usually afforded by the incubator (see Table 8.2). An indicator that measures these expenses could raise awareness on the consumption of each of these resources. The incubator could reward incubated companies that present a conscious consumption, providing benefits for the economy and the environment by reducing the use of natural resources.

None of the respondents has social or environmental certifications. However, managers usually consider social and environmental management a relevant issue, which is perceived by analyzing the answers on this topic (highlighted in Table 8.3). Around 40% of agree that the

Table 8.1 Criteria to select incubated companies

	Not considered		*Slightly important*		*Important*		*Very important*		*Total*	
Level of engagement of the business in the promotion of social and environmental issues	1	2.8%	10	27.8%	14	38.9%	11	30.6%	36	100%
Level of process innovation	1	2.8%	3	8.3%	21	58.3%	11	30.6%	36	100%
Maturity of the presented idea	0	0.0%	7	19.4%	20	55.6%	9	25.0%	36	100%
Job creation	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100%

Table 8.2 Expenses of the incubator

	Non-existent		*Exclusively of the incubator*		*Shared among incubated companies*		*Exclusively of the incubated companies*		*Responses*
Water consumption	1	2.7%	25	67.6%	10	27.0%	1	2.7%	37
Energy	1	2.7%	15	40.5%	8	21.6%	13	35.1%	37
Copy/printing	4	10.8%	8	21.6%	9	24.3%	16	43.2%	37

incubator would have a better reputation by adopting social and environmental responsibility practices. Therefore, the creation of an indicator that acknowledges this practice could stimulate incubators to adopt them. The best practices adopted by the incubators could be awarded, which would provide better visibility for the incubator, improving its own reputation and, consequently, the reputation of the incubated companies.

Among the incubators' managers, almost half of them received social and environmental management trainings in their companies, which they considered positive for the development of entrepreneurs. If there were an indicator to evaluate such trainings, they probably would be included in the management of the incubators. These trainings are important for the companies; since most of them are still looking for financial sustainability, they end up by abandoning the search for sustainable development.

It is worth mentioning that 73% of the respondents agree that there are market opportunities related to social and environmental practices,

Table 8.3 Opinions regarding social and environmental management

	Strongly disagree		Disagree		Undecided		Agree		Totally agree		Responses
The incubator has a reputation for its social and environmental responsibility	1	2.7%	6	16.2%	15	40.5%	13	35.1%	2	5.4%	37
The incubator accomplishes trainings related to social and environmental management with incubated companies	1	2.7%	9	24.3%	9	24.3%	17	45.9%	1	2.7%	37
There is a market opportunity related to social and environmental issues	1	2.7%	2	5.4%	7	18.9%	22	59.5%	5	13.5%	37
Customers demand a socially and environmentally correct behavior from the incubated companies	1	2.7%	6	16.2%	7	18.9%	22	59.5%	1	2.7%	37
Customers are not willing to pay for socially and environmentally correct products/services	0	0.0%	6	16.2%	13	35.1%	18	48.6%	0	0.0%	37
Strategies related to social and environmental responsibility create value for incubated companies	0	0.0%	0	0.0%	6	16.2%	28	75.7%	3	8.1%	37

which could be a reason for the adoption of such practices. An indicator that evaluates the launch of products and services with social and environmental appeal could stimulate incubated companies to look for the promotion of these market opportunities. Such finding is supported by 62.2% of the respondents, who claim that customers demand a socially and environmentally correct behavior from incubated companies. The results also show that 48.6% of the respondents state that customers are not willing to pay for socially and environmentally responsible products, which represents a challenge for developing goods and services with competitive prices and a sustainable appeal.

The most positive result indicates that 83.8% of the respondents agree that social and environmental strategies create value for incubated companies, which, as already mentioned, affects the reputation of the company while meeting market and customers' demands. There is a perception of an unrealized market potential associated with the strategic sales of products and services with sustainable appeal, which depends on a raising awareness about social and environmental issues.

When asked about the relationship with the surrounding community, 70.3% of the respondents claimed to communicate with it. As shown in Fig. 8.4, the initiatives related to the community are: lectures (92% of the respondents give lectures), courses (80%), trainings (56%), and

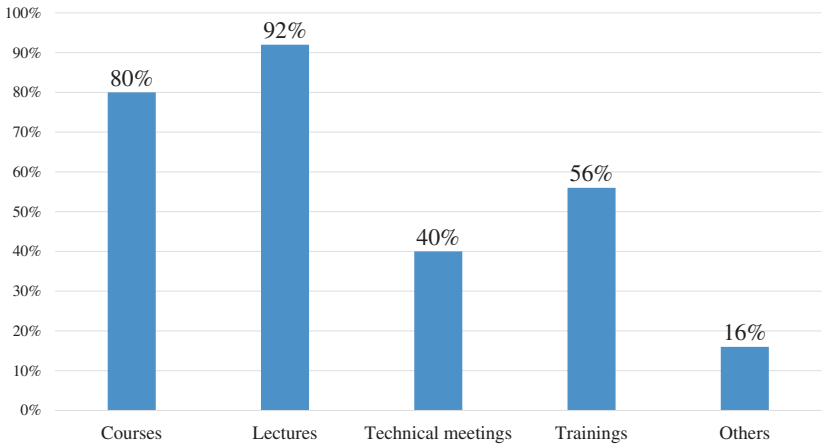

Fig. 8.4 Initiatives for the community

technical meetings (40%), among others. Despite being incipient, the fact that incubators are related to the community is a positive outcome. Therefore, one might expect an increase in local development caused by the promotion of entrepreneurship, creation of jobs and income.

As mentioned before, incubators are important for economic and sustainable development because they influence the strategy of newborn companies. The situation was observed in the state of São Paulo, where incubators enabled the survival of companies through development, job creation, promotion of entrepreneurship, and innovation. Such importance is confirmed by data in Table 8.4. We see that all of the respondents agree that incubators induce local development; this is why the formulation of public policies for the creation and promotion of new companies guided by sustainable development practices is significant. 97.3% of the respondents believe that incubators, through incubated companies, leverage the creation of income, stimulating and promoting local development. Such statement can be also confirmed by 97.2% of the respondents, who agree that incubators create jobs through incubated firms.

Therefore, besides the importance of incubators for the economic development of the country, they are also essential for sustainable development. This is why the adoption of management practices related to economic, social and environmental criteria is crucial for this development to become a routine for incubators and incubated companies. In order to evaluate such criteria, indicators are essential, and their elaboration can allow incubators to create incentive methods for encouraging the sustainable management of their incubated companies. However, despite its importance, the adoption of sustainability practices and indicators is not a reality in business incubators yet.

Therefore, it is necessary to emphasize the importance of the collected data. They show that, despite the awareness of companies and entrepreneurs of the need to adopt sustainability practices and indicators, only a few put it into practice. Incubators, during the selection of companies, must show the importance of this topic to newborn companies, if they wish to survive.

Table 8.4 Role played by incubators regarding the development of the country

	Totally disagree		*Disagree*		*Undecided*		*Agree*		*Totally agree*		*Responses*
Incubators boost local development	0	0.0%	0	0.0%	0	0.0%	18	48.6%	19	51.4%	37
Incubators leverage the creation of income through the incubated companies	0	0.0%	0	0.0%	1	2.7%	21	56.8%	15	40.5%	37
Incubators promote job creation through the incubated companies	0	0.0%	0	0.0%	1	2.8%	16	44.4%	19	52.8%	36

8.4 Conclusions

This was a descriptive study on the practices and indicators of social and environmental management in business incubators located in the state of São Paulo. The results show that, despite acknowledging the importance of adopting them, incubators still have a long way to meet the expectations. Although they consider these issues important, none of them has social or environmental certifications and planning is still based only on economic issues; for instance, 81.5% are more concerned about the number of companies that are about to graduate than with sustainability. Such companies do not worry about the costs of graduation or how companies are developed.

This study shows that there is still a lot to be done and a great potential to explore regarding social and environmental management in business incubators. Market opportunities and the benefits for companies that adopt sustainability practices are already well defined. And incubators are aware of the beenfits and opportunities they will bring to companies by adopting sustainability indicators.

As contributions, we present two main reccomendations for managers of business incubators in the state of São Paulo:

a. Adoption of practices of social technology: such as the indicators proposed to measure the degree of sustainable development of business incubators, the practice of social technology should be a requirement for creating incubators and for the incubation of companies, considering its relevance for the local development of the region where incubators operate. The incentive for developing such practices should be accomplished by the government, and the formulation of public policies must be aligned with the main agents of social tansformation. An example is the case of social incubators supported by the National Program of Incubators of Popular Cooperatives[3] (PRONINC), which creates social technologies for collective and self-managed enterprises. This process will only be effective if it adopts another development model, which ensures the development of the whole community, without exclusion.

[3] National program for popular incubators.

b. Incentives for the creation of sustainable business incubators in the state of São Paulo: there are several unexplored business opportunities in this sector. The PNRS[4] (National Plan for Solid Waste) (Ministério do Meio Ambiente [Ministry of the Environment], 2011), for instance, enforces companies to recycle products, closing the product life cycle. Newborn companies that adopt such approach could be supported by the government, benefiting entrepreneurs, customers and the society. It is important to emphasize incentives for the creation of social incubators, which are associated with recent movements in the social and solidary economy and take into account sustainability and the social impact of social innovation. Hence, it is possible to meet the requirements of economic development through the formulation of public policies, whose central pillars include the support to innovation and entrepreneurship and sustainable development (economic, environmental and social dimensions).

As contributions to this field of knowledge, it is important to notice that, despite the importance of adopting sustainability practices and indicators, due to the demand of the value chain, incubators still haven't done it. As mentioned before, Barbieri (2007) claims that, in the entrepreneurial sphere, the incorporation of the environmental variable in the formulation of strategies occurs because, in the near future, polluting businesses will lose competitiveness, and the lack of environmental commitment will limit economic activities. Thus, the creation of such indicators and the adoption of sustainability practices by newborn companies is essential, if they want to graduate and enter the market with a strong image against its competitors.

Our study shows that incubators need to stimulate incubated companies to incorporate sustainability into the orgnizational strategy, once they are already aware of the importance of such issue for the business and for consumers. This is another contribution of this chapter, which emphasizes that, despite the lack of implementation of sustainability practices and indicators, entrepreneurs are aware of their importance and will need them in the near future. Finally, a relevant limitation of this study is its restriction to the state of São Paulo, which hinders it as a representative model for the rest of the country.

[4] National Solid Waste Management Plan.

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CHAPTER 9

Acceleration Programs in Brazil: A Government Case Study of SEED.MG

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9.1 Introduction

The main purpose of this chapter is to analyze how a Brazilian government startup accelerator works, by considering some possible indicators of its outcomes.

Micro and small-sized enterprises are responsible for a large share of revenues of all Brazilian companies. While active in every sector of the economy, these companies represent 27% of the Brazilian Gross Domestic Product (GDP) (SEBRAE—Brazilian Service for Support of Micro and Small Firms, 2014).[1] Considering that micro and small-sized enterprises are active in a highly competitive scenario, they also present high shutdown rates: according to SEBRAE (2014), almost 80% of small-sized firms end their activities during the first year of operation. This happens, in most cases, due to poor management, severe labor and

[1] SEBRAE (Brazilian Service for Support of Micro and Small Firms) was established in 1972 as an autonomous social service to stimulate entrepreneurship in the country.

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social charges, lack of managerial and accounting consulting, and difficulty in keeping up with market presence (Lopes de Sá, 2006).

Despite the difficulty of running an enterprise during the first years of operation, many companies find in crisis scenarios an opportunity to develop and stand out in the market (OECD, 2016). That seems to be the case of most startups, defined as small-sized enterprises, in early stages of development, that have a perspective of fast growth, and whose activities are related to research and development of innovative ideas, usually related to technology (OECD, 2016).

Startups are associated with the concepts of innovation and entrepreneurship, due to the dynamic and competitive market where they operate, which can change according to the emergence of laws and political changes (Arruda, Cozzi, Nogueira, & Costa, 2013).

In Brazil, the startup ecosystem is now consolidating: according to EXAME magazine, the volume of resources allocated to startups has grown 30% yearly since 2011; until 2016, it reached US$ 1.3 billion (Branco, 2016). A survey conducted by the Brazilian Association of Startups, identified that the number of companies in early stages of development by the end of 2015 was 4151, which indicates a growth of 18.5% in only six months (Tozetto, 2016).

The states of São Paulo and Rio de Janeiro host, respectively, the largest numbers of startups in Brazil. The city of Belo Horizonte became an important center in such matter and ranks 3rd (OECD, 2016) in the Brazilian ranking of startups; the large number of startups located in the neighborhood of São Pedro boosted the establishment of the San Pedro Valley community, a name inspired by the largest global center for technology—Silicon Valley, located in California (Branco, 2016).

The expressive growth of such market resulted in the reallocation to this area of more resources addressed to the development and establishment of startups (Abreu & Campos, 2016). That seems to be the case of startup accelerators, an investment system originated in Silicon Valley, where there is a specific focus on new technology-centered companies or ideas with a high potential for growth (Engel, 2015). Accelerators are financially supported by private capital to foster the growth of startups in the short term. The accelerator can hold an equity interest, in exchange of the necessary consulting for an intensive program of acceleration of new enterprises (Cohen, 2013).

Accelerators are divided in five categories: open accelerator, corporate accelerator, pre-accelerator, social accelerator and public (or government) accelerator. Public accelerators, which are the main focus of this research, operate with financial support provided by public institutions in order to develop the regional economy (Ribeiro, Plonski, & Ortega, 2015).

The literature on accelerators is still in its early stages worldwide; therefore, there are few references on this specific matter. In Brazil, we found only a few studies regarding government accelerators. It is important to mention the research developed by Abreu and Campos (2016), who provide an overview of Brazilian accelerators; however, they do not explain how these public or government accelerators effectively operate or what were the outcome in terms of performance.

In order to achieve the objective of describing and analyzing the operation of a government enterprise accelerator, we developed a case study based on the accelerator Startups and Entrepreneurship Ecosystem Development (SEED), a program created in 2013 by the government of Minas Gerais.

We chose this specific accelerator because SEED is one of the few public accelerators in Brazil, and its program has been offered for some years, which indicates a certain maturity in the field. SEED's creation was based on the public capital accelerator Start-Up Chile[2] (Start-Up Chile, 2017); both invest in local and international startups while boosting the entrepreneurial economy and ecosystem of their respective regions. SEED is, therefore, an accelerator funded by public resources whose objective is to support and encourage networking between entrepreneurs to develop technology-based projects and businesses, while strengthening sustainable technological innovation in the region of Minas Gerais and also in Brazil. From 2014 to 2016, the program was responsible for the acceleration of 112 startups.

In order to evaluate the accelerator's performance, we used two different approaches: analysis through a questionnaire applied to the accelerator, and another questionnaire applied to the startups accelerated by SEED; this second approach recognizes the role played by the accelerator in the success of the startups, and evaluates its performance indirectly.

[2]Start-Up Chile invests in local and international startups since 2010, and has changed the Chilean economy and entrepreneurial ecosystem.

SEED has already supported 73 projects from entrepreneurs of 19 different nationalities; in 2015, SEED's revenue was over R$ 20 million and the accelerator received R$ 10 million in investments. In 2016, the third round of the program received 40 new startups, which graduated in 2017 (SEED, 2016).

This study is relevant due to the use of government resources in a successful program and the results attained, in addition to the description of performance indicators employed for its evaluation, thus contributing for the improvement of future programs.

9.2 Theoretical Framework

9.2.1 What Is a Startup?

The growth in businesses related to information and communication technology is associated with the emergence of the concept of startup, which is the stage of a technology-based company when it is necessary to find a sustainable long-term business model, while developing a structure with a scalable potential (Ries, 2012). According to SEBRAE (2017), startup is defined as a group of people looking for a repeatable and scalable business model, who work under highly uncertain conditions. In another definition, startup can be understood as any organization with an innovative business initiative focused on high growth, market leadership and a highly scalable business model; in other words, a model that can multiply its reach and revenue in the short term, if the product is validated (Kidder & Hindi, 2013). In addition, the activities of the company must have started at most one year before, and its revenue should be less than R$ 360,000.00 per year.

In summary, startups are small newly emerged firms that invest essentially in innovative products and business models while having little experience, a developing structure and, especially, limited capital. Such initial stage is necessary for entrepreneurs to work on their ideas and make adjustments in the specific product or service they intend to develop, taking into account the demand and financial feedback.

9.2.2 What Are Accelerators?

An accelerator is an organization that aims to speed up the creation of new enterprises, by providing the necessary training and guidance for

such enterprises for a limited time (Cohen & Hochberg, 2014). In this process, entrepreneurs should define and develop their products, identify customers and get resources (Cohen, 2013). Some accelerators can also provide a small amount of capital, work space, networking, and mentoring with entrepreneurs, lawyers, technicians, investors or even business executives (Cohen, 2013; Hallen, Bingham, & Cohen, 2014; Wise & Valliere, 2014).

There are five types of accelerators (Ribeiro et al., 2015):

i. Open accelerator: provides financial resources within the company property (with strings attached); it is usually oriented to high growth and information and communications technology-based enterprises;
ii. Corporate accelerator: as the first type, it provides financial resources within the company property (with strings attached); however, it focuses on the business branches of the companies that support the acceleration programs;
iii. Pre-accelerator: in this case, there is no financial investment and the process of acceleration occurs in a limited period when compared to the other accelerators (on average five weeks). Financial resources depend on sponsorships, events and other diverse partnerships;
iv. Social accelerator: focuses on programs related to the development of social businesses, without an established financial relationship. Its operation is usually linked to investment funds;
v. Public accelerator: in this case, there are financial resources—with no strings attached—provided by public institutions in order to boost regional or national economic development.

9.2.3 Performance Indicators of an Accelerator

There is still no consensus on how the performance of an accelerator should be defined and measured. It can be evaluated by the number of accelerated companies that failed or succeeded after the acceleration program. However, other parameters can be important, such as the provision of highly qualified mentors in startup operations, the number of investments in these companies, the evident focus on technology and/or industry, and the establishment of an efficient network (Christiansen, 2009; Wise & Valliere, 2014).

The ability of accelerators to speed up the development of companies occurs through a combination of formal education and network development, which depends directly on the quality and experience of the accelerator (Hallen et al., 2014). In addition, the success rates of accelerators are mainly measured by the number of enterprises that get subsequent funding, or firms looking for investments compared to those that failed (Hernández & González, 2016; Radojevich-Kelley & Hoffman, 2012).

9.3 Results

9.3.1 Description of the Case Study

The creation of SEED was inspired by the public capital accelerator Start-Up Chile (Start-Up Chile, 2017), as already mentioned. In order to enable such initiative, the following actions were taken: elaboration of the regulatory resolution of the program (Law 20.704/2013 and Decree-Law 46.258/2013); approval of the budget and financial resources; editing and launching a public call to choose a non-profit organization of the private sector to develop the program; rental of a proper facility to implement the program; partnerships to assist foreign entrepreneurs in getting a work visa; advertising the program to reach target audiences; and selection of startups to take part in the first phase of the program.

Entrepreneurs from all over the world can submit their business proposals during the selection process, according to the schedule of each notice. The 40 best projects in each public call receive seed capital between R$ 68,000 and R$ 80,000, and startups must fund an additional 10% of the total investment. Each team of entrepreneurs is composed of two or three participants.

For the selected projects, there is a dynamic space with conference rooms for entrepreneurs and managers to use. In order to enable the projects, other sponsors within the ecosystem are contacted, such as universities, SEBRAE and other funding agencies. During the six months of the program, participants get personalized monitoring, a proper facility for co-working, networking with a global community of entrepreneurs, and participation in workshops, training sessions and consulting. At the end of the program, startups present their accomplishments to investing companies during the Demo Day. As a mandatory requirement, entrepreneurs must reside in the state of Minas Gerais during the full duration of the program, since one of its purposes is to boost the local ecosystem.

Ever since its launch, the accelerator attracted Brazilian and foreign entrepreneurs to Minas Gerais, who increased local technological development and the economy, strengthening the innovation culture and entrepreneurship in Brazil (Figueiredo, Figueiredo, & Braga, 2017).

Between 2013 and 2017, 142 startups took part and completed the program offered by SEED-MG. In our study, 11 companies were analyzed; two of them are international companies.

9.3.2 Data Analysis Methods

Data collected in the study was used to elaborate the following figures. Data related to the answers given by accelerated startups and SEED were analyzed through the technique of content analysis, where we identified terms, expressions and sentences that related to the experience of the respondents in the program. Thus, essay questions from both questionnaires were analyzed by the software ATLAS.ti and crossed with the codes previously elaborated, as shown in Fig. 9.1. After the analysis of the interviews' material, we found excerpts that had no relation with the proposed terms (codes).

Figure 9.1 indicates the search terms (codes) used in the analysis of the interview conducted with SEED coordinators. All terms used (Areas for improvement in the SEED program, Impact of the program in the region of Minas Gerais, Development of networking, Program offered, Strengths of the accelerator, Evaluation of startups during the program, Self-evaluation—Mentoring offered, Self-evaluation—Number of successful companies) are related to a central term (Performance indicator), which is the basis of this research.

Likewise, in order to analyze the essay questions of the questionnaire, we selected some terms (codes) that could help to meet the research objective. Figure 9.2 shows the search terms used to analyze the content of the interviews conducted with the startups, where once again the central theme (SEED performance) is related to the other proposed terms.

9.3.3 Result of the Interview Conducted with SEED

In order to meet the purpose of the study, we contacted SEED coordinators; However, some of them were replaced during data collection, which implied the reestablishment of partnership and trust between us (the researchers) and the accelerator.

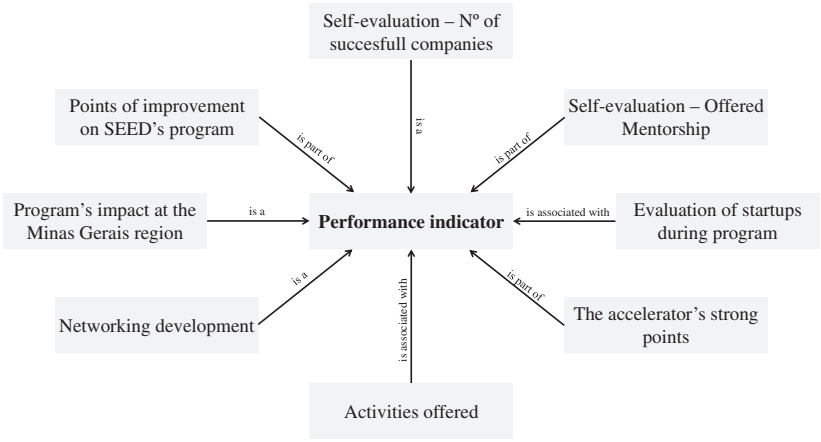

Fig. 9.1 Search terms (codes) used to develop the questionnaire for SEED

Table 9.1 presents the results, where we identified 7 quotes related to areas for improvement in the SEED program, which comprises not only the areas mentioned by the coordinators, such as the difficulty to keep up with accelerated startups, but also the lack of a systematized method to evaluate startups and the lack of clarity in some expressions of the coordinators' speech. In addition, SEED explained about the program offered (5 quotes), where it states its flexibility, according to the needs of each startup. Another subject addressed in the interview was the qualification of the chosen mentors (4 quotes); for that matter, SEED emphasized that they all need to know the universe of startups, they must be innovative and entrepreneurial, besides knowing about the development of innovation ecosystems. Finally, SEED also explained its performance (4 quotes), mentioning that, besides the qualitative perspective, the SEED team monitors the revenues of the startup group, jobs created, investments raised, people affected, visitors and connections.

9.3.4 Result of the Interview Conducted with Accelerated Startups

From the 11 participant companies, 4 (36.4%) were accelerated in 2014, 3 (27.3%) in 2016 and 4 (36.4%) in 2017.

Despite the elaborated method and the effort to obtain detailed content from companies, many interviewees did not answer the essay

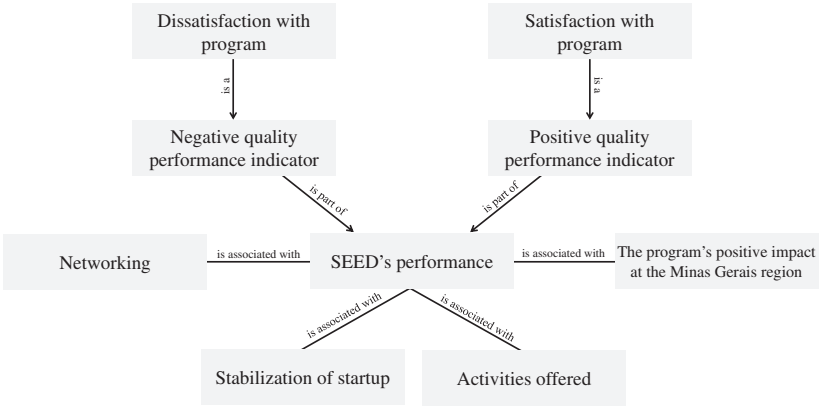

Fig. 9.2 Search terms (codes) used to develop the questionnaire for startups

questions; the ones who answered did not do it in depth. That way, it was not possible to develop a detailed analysis. Besides, in the first contact, most companies questioned if the total time to answer the questionnaire 'would take more than 5 minutes'. Some companies only answered the objective questions, which were elaborated based on secondary data, reducing the amount of qualitative data generated for analysis. Nevertheless, it was possible to collect information to support the evaluation of the performance of the program offered from the point of view of startups and the impact of SEED on Minas Gerais.

It is possible to observe in Table 9.2 that there is a relationship among the main terms (codes) with regard to the distribution and frequency with which they were quoted during the interview of each company, where it is possible to observe that the most quoted term by companies is the networking developed during the acceleration process (10 quotes); these quotes correspond to the number of companies that kept in touch with other startups after the program was over and that raised investments and customers through the relationship network offered by SEED. Besides, it is possible to observe that terms related to the positive impact of SEED in the region of Minas Gerais (7 quotes) were mentioned and, in short, correspond to references on the opening of the entrepreneurial market in the region of Minas Gerais and business opportunities.

Table 9.1 Terms related to the performance of SEED—accelerator's point of view

Main codes found in speech and example of a related sentence***	*QTY codes*
*Areas for improvement in the SEED program **"Only a few startups are willing to share information with SEED after taking part in the program"	7
*Program offered **"The program is quite flexible and it takes into consideration the stage of development of each one of the 40 startups…"	5
*Self-evaluation—Mentoring offered **"We evaluate the resume of the person that is willing to take part in the mentoring network, besides talking to him/her to understand his/her motivation, trajectory and the main accomplishments within the area of expertise he/she wants to mentor"	4
*Performance indicator **"…revenue of the group of startups, jobs created, investments raised, people affected, visitors, and connections…"	4
*Network development **"At the end of the program we have the Demo Day, which is the event of graduation of the startups that took part in the program"	4
*Impact of the program in the region of Minas Gerais **"Through the results provided by the startups and through the diffusion program"	3
*Strengths of the accelerator **"Everybody working at SEED must have: knowledge about the startup universe, innovation and entrepreneurship… We are all curious, we want to develop new connections and we want to cause an impact on the global market"	3
*Self-evaluation—Number of successful companies **"Only a few startups are willing to share information with SEED after taking part in the program"	1
*Evaluation on startups during the program **"Some of the startups could not meet the minimum requirements of the public notice during the program. In that case, the startup is removed from the program, some of the these entrepreneurs did not read the public notice or the program requirements and only later on realized they wouldn't be able to carry out the activities…"	1
Total	32

*Codes

**Parts of the quote that categorize the sentence in the selected codes

9.3.5 *Analysis and Discussion of the Acceleration Process*

Participant companies were asked about the establishment of partnerships with other companies and/or universities during the program: 5 (45.5%) established partnerships, while 6 (54.5%) did not. We also asked their opinion about the mentors that monitored the development of their respective projects (Fig. 9.3), and 63.7% of the companies said that

Table 9.2 Terms (codes) related to the stabilization of the companies during and after the acceleration process

Main codes found in speech and an example***	*Companies that took part in the research (PC)*											*Total*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	
*Networking **PC 5: "… SEED networking allowed us to raise investment, attract customers with more than 15 stores"	1	1	1	1	2	1	1	1	1	0	0	10
*Positive impact of the program on MG **PC 1: "…large companies got to know startups"	1	0	0	1	1	1	0	1	1	1	0	7
*Offered program **PC 8: "Mentoring, workshops, lectures, contact with investors…"	0	0	0	1	1	0	0	1	1	1	0	5
*Dissatisfaction with the program **PC 11: "I reckon that Minas Gerais needs to adapt its ecosystem for foreign people…"	0	0	0	1	0	0	0	0	0	0	3	4
*Stabilization of the startup **PC 9: "…through SEED it was possible for us to get new clients in Belo Horizonte"	0	0	0	1	1	0	0	0	1	0	0	3
*Positive quality performance indicator **PC 9: "Lots of business opportunities"	0	0	0	0	0	1	0	1	1	0	0	3
*Negative quality performance indicator **PC 6: "Many startups are being created, only a few get established"	0	0	0	0	0	1	0	0	0	0	1	2
*Satisfaction with the program **PC 4: "…It was a valuable experience for us, not only for the technical training, but for citizenship"	0	0	0	1	0	0	0	0	0	0	1	2
Total	2	1	1	6	5	4	1	4	5	2	5	36

*Codes
**Parts of the quote that categorize the sentence in the selected codes
PC: Participant company

mentoring met or overcame their expectations. Two companies mentioned that mentoring could have been better, especially in specific areas of expertise, such as hardware. On the other hand, when questioned if the program was relevant for entrepreneurial training, more than half said that training could have been better (Fig. 9.4).

Companies were asked if they kept in touch with other accelerated startups after the end of the program, and 9 (81.8%) gave a positive response. We also asked the average number of firms with which they kept in touch (Fig. 9.5). Most of the companies that answered the question (44.4%) said that they kept contact with at least 5 companies after the acceleration process. Additionally, most companies could not inform (63.6%–7 companies) if these startups reached stability on their own or were bought by other investors.

Startups were asked if they established partnerships with companies and/or universities after the acceleration process, and 6 (54.5%) gave a positive response.

Finally, we asked about the impact of SEED on the region of Minas Gerais, considering the startups' point of view. After the analysis, we observed that national companies believe that there was a positive impact of the program on the region, by improving the entrepreneurial ecosystem and business opportunities. On the other hand, international companies did not stay in the region for a sufficient time after the end of the program; therefore, they could not give further information on this

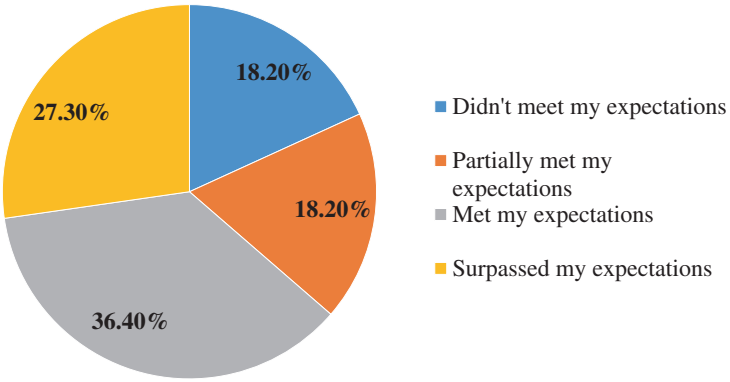

Fig. 9.3 Opinion of companies about the mentors

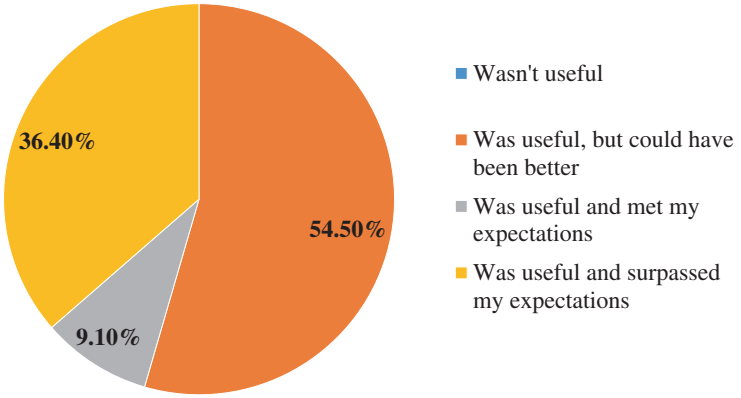

Fig. 9.4 Opinion of companies about the schedule/agenda of the program

matter. One of these companies believes that the region is not ready to host foreigners.

Based on the data, we observed a link between SEED and startups' speeches (Fig. 9.6). Subjects such as networking, impact on Minas Gerais and the offered schedule were quoted in both speeches.

As presented here, one of the objectives of SEED was the development of an entrepreneurial ecosystem in the region, which was observed in both speeches. On the one hand, SEED tries to bring a positive impact on the ecosystem of Minas Gerais and, on the other hand, startups mention that the region of Belo Horizonte is welcoming and favorable for business. This relationship was also observed during the development of networking, for which SEED offers tools to help and encourage partnerships; on this issue, most part of the respondents said:

> We had access to a network of benefits like cloud services and digital marketing, among others. Through SEED it was possible to get new customers in BH.

Regarding the agenda and the offered support, SEED mentioned that:

> The program is quite flexible and takes into account the level of development of each of the 40 startups. Therefore, the only daily routine of the program is the check point with the acceleration agent, when startups and

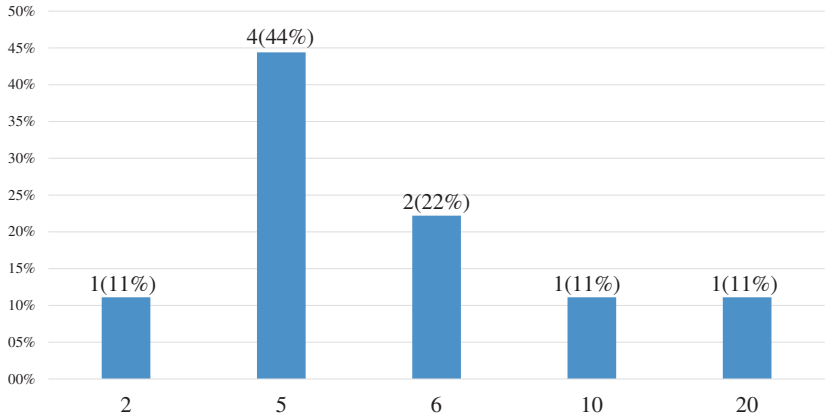

Fig. 9.5 Number of companies that stayed in touch with other companies after the program was over (networking)

> acceleration agents talk about strategic development and other business issues. We offer personalized mentoring, lectures, co-working, external mentoring, entrepreneurial training programs, seed capital with no strings attached and, for foreign entrepreneurs, we facilitate the process for a 2-year work visa applications.

In that sense, most part of the startups present a routine of events that strengthen the agenda offered by SEED: "Mentoring, workshops, lectures, contact with investors", "Monitoring accomplished by an acceleration agent and weekly lectures".

With the growth of the startup market, specifically in the region of Minas Gerais, new accelerators emerged to help startups grow. Among them, SEED is one of the few public resource-based accelerators in the country that supports startups from all over the world. In this context, we evaluated the performance of the accelerator SEED and the role it played, through the results of the companies that took part in the program between 2013 and 2017.

In fact, there is a great variety of necessary specializations to meet the demand of companies with different operation focus (Delgado, Porter, & Stern, 2014).

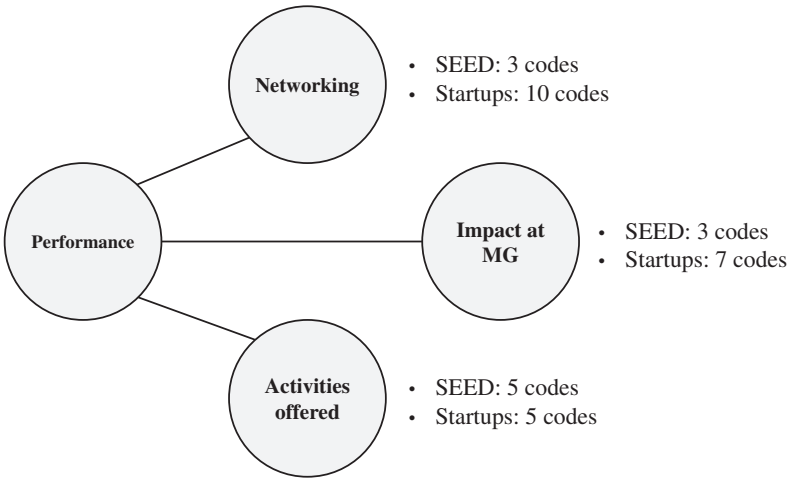

Fig. 9.6 Common codes found in SEED and startups' speeches

With regard to the quantitative analysis of data, companies mainly mentioned the positive impact of the accelerator on the region of Minas Gerais and the networking established during and after the process. In that sense, the program highlights the mentoring network and the investors that took part in the creation of startups during and after the program. This fact confirms the results of previous studies, which show that networking is extremely important for the success of companies in early stages, by facilitating information sharing and critical resources that are essential for entrepreneurship (Hochberg, Lindsey, & Westerfield, 2015; Hochberg, Ljungqvist, & Lu, 2007). In addition, investors also play the role of mentors, getting to know the startup more deeply, as well as its business plan, group dynamics and progress throughout the program (Hochberg, 2016).

The Demo Day, also known as launching event, is considered the end of the program networking, since it allows startups to present their work for several investing companies in one single place (Hochberg, 2016).

With regard to the Demo Days promoted by SEED, the first one (2013) received 95 investors, 426 participants, 40 exponent startups and 9 mentors. In the second (2014), there were over 800 people from the management area; the purpose was also to attract investments for startup

projects developed in Belo Horizonte, besides helping to develop networking among companies.

With regard to the SEED interview, the qualitative data analysis showed that the coordinators mainly focused on the defined agenda and also on the evaluation of mentoring offered during the acceleration process. However, it was not clear how mentors are prepared to meet the needs of each startup in a customized way, and which are the criteria used in their process of selection. The interview also indicated some issues related to areas that need improvement, related to the lack of monitoring/follow-up of the accelerated startups (coordinators mentioned that such process would begin in 2018).

SEED states that 90% of the accelerated companies established partnerships during the program; however, when companies were asked about it, only 54.5% confirmed such partnerships. Information inconsistencies may be due to the lack of available data during the interviews or to inefficiencies of the data collection method. Also, it was not clear which are the methods used by SEED to evaluate its own performance.

9.4 Conclusion

This chapter analyzed the operation of a Brazilian government startup accelerator, by investigating potential indicators of its performance.

The government accelerator SEED was used as a case study in order to meet such goal. This accelerator, located in Minas Gerais, is inserted in a growing and promising market.

Despite the difficulties presented in our study, such as problems in data collection, their accuracy, and the lack of metrics to evaluate the performance of accelerators, this research raised important issues on this topic.

Some scholars mention that the success of acceleration programs depends on a complex combination of human capital, networking and experience, which must be developed during the program (Hallen et al., 2014). Some success indicators suggested are the number of companies that succeed after the acceleration process, total amount of jobs created, duration of the life cycle, return on investment, revenues generated by the acceleration process, and amount of subsequent investment raised and generated. But, even when the performance is defined and measured, there is still little understanding of the factors that boost the performance of an accelerator (Wise & Valliere, 2014).

The metrics used in this study to evaluate the performance of accelerated startups was based on a combination of suggestions found in the literature, considering that there is no consensus about the standardization of such evaluation.

We observed that the program offered by SEED fostered a networking for companies, because almost all the accelerated firms kept in contact with at least 5 other companies after the acceleration process.

With regard to the agenda offered, a considerable part of the companies pointed that it met their expectations, but could have been better; on the other hand, most of the companies were dissatisfied with the mentors chosen to help them during the process, except for international participant companies, which felt that the city of Belo Horizonte was not ready to welcome them. From this perspective, we can observe that in the acceleration program Start-Up Chile, between 2010 and 2015, 75% of the accelerated companies were not Chilean, but the survival rate of companies was higher for Chilean (55%) than for foreign companies (less than 50%) (OECD, 2016).

Regarding satisfaction with mentoring, one company stated that the mentor did not know much about its area of operation (hardware), and another mentioned that several startups had to face the same problem, which indicates the need for more technical or skilled mentors in issues related to technology developed by startups.

It became clear that, in order to facilitate the process of evaluation of the acceleration process results, it is necessary to develop more precise metrics. However, studies in this area did not advance with such metrics so far; research is still in an exploratory phase that aims at understanding the acceleration process, and it is still not clear how the performance of an accelerator should be defined and measured.

In the interviews, neither SEED nor the startups mentioned data about the total amount of jobs created or the return on investment, as well as the revenue generated by the acceleration process, which are indicators suggested by the literature to measure the success of acceleration; they only mentioned issues related to the satisfaction with mentors and creation of networks, suggesting that it is necessary to develop and measure indicators objectively, in order to conduct an in-depth analysis of accelerators.

With regard to the regional impact of the acceleration program, we identified a positive impact on the Minas Gerais region, considering that the program received good evaluations with regard to the networking

provided for accelerated companies and the agenda offered during the acceleration process; such indicators relate to the performance of SEED, whose program was successful according to the accelerated startups interviewed.

One important contribution of this study is to show that some initiatives, such as those proposed by SEED, help to strengthen the local economy and establish technology-driven startup clusters. However, it is important to discuss the impacts of these investments on the economy; it is still necessary to analyze the relevance of the return of this investment for the national economy. We believe that this research can help future investigations on the field, which can validate indicators to evaluate the performance of accelerators and identify measurable results of startups (such as the number of jobs created, employed labor, return on investment, evolution of the revenue of companies after the acceleration process, creation of new products, among others).

This research has some limitations, such as the difficulty to collect data and their accuracy. It was difficult to collect data, considering that only 11 companies agreed to take part in this research, from the 142 existing accelerated companies, and 2 of them are international. In addition, some companies only answered multiple choice questions, and not the essay questions as well, which limited the amount of data for analysis. Among the companies that answered the essay questions, most of them only gave generic answers, without providing an in-depth opinion about the topic, as we had proposed initially.

We suggest that future studies should develop means to evaluate not only the performance of accelerators, but also the results achieved by startups after the acceleration program.

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CHAPTER 10

Grassroots Movements: New Gears in the Engine of Brazilian University Entrepreneurship Ecosystems

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10.1 Introduction

This chapter presents the grassroots phenomenon with regard to entrepreneurship in Brazilian universities. The so-called grassroots movement has an emerging nature and is led by students, regardless of an institutional agenda; in the Brazilian scenario, the movement began to take shape over the last 10 years.

The importance of entrepreneurship in universities became prominent after understanding that innovation created within universities was a very relevant matter in terms of economic development. Such perception was

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reinforced by the success of entrepreneurial regions that usually considered the university as a key pillar: such assumption is exemplified by the cases of Stanford and the Silicon Valley, and Massachusetts Institute of Technology (MIT)/Harvard and Route 128.

Thus, academic managers played an important role in the development of promising regions, such as Frederick Terman, one of Stanford leaders, who is often credited as the father of Silicon Valley. Besides bringing together William Hewlett and David Packard and encouraging the creation of HP, Terman is known for the model of development of Stanford University, which (i) strengthened technology transfer, (ii) redesigned models of academic remuneration towards a more entrepreneurial orientation, (iii) encouraged the establishment of technology-based companies around the campus, and (iv) developed projects in collaboration with companies.

Nevertheless, even the most successful models can become obsolete and demand reinvention, such as the Stanford case shows. According to Etzkowitz (2013) in "StartX and the 'Paradox of Success': Filling the gap in Stanford's entrepreneurial culture", the institution was affected by the paradox of success—a challenge in which successful cases made the university accomodate and neglect several demands made by students to support entrepreneurship. The solution for such problem came from the students themselves, instead of university managers. On its own initiative, a Stanford students' organization created a startup accelerator, known as StartX, in order to provide the necessary support that students did not get from the university—such initiative attracted several innovative projects. Four years after its creation, the accelerator had dozens of accelerated companies—including a startup acquired by Apple for 20 million dollars—and then started to get institutional support through physical and financial resources provided by the university. Such pattern was seen in different countries, such as Finland and the United Kingdom (Lehdonvirta, 2013; NACUE—National Association of College & University Entrepreneurs, 2018).

The situation in Brazil was similar. A study conducted by Endeavor Brasil (2012) showed that not much was being done in terms of providing the necessary support for students, although there was a considerable number of students interested in entrepreneurship. In 2010, the University of São Paulo (USP) Entrepreneurship Society was created and, in 2012, the Entrepreneurial League of the University of Campinas; both chose as target to fill the gaps found in providing support for entrepreneurship within the universities, both had a non-institutional

character, and were led by students. Currently, there are around 50 grassroots organizations for the support of entrepreneurship in Brazilian universities.

In order to present the grassroots phenomenon in Brazilian universities, this chapter analyzes the history and the process of maturity of these organizations, by validating a maturity model proposed by a British institution that was used to analyze such organizations in the United Kingdom. To do this, we used a multiple case study, whose development was based on 10 in-depth interviews conducted with leaders or participants of these movements in the country. The results indicate that grassroots are new gears in university entrepreneurship ecosystems, and their impact indicates a transformation in the culture of the institutions where they operate.

10.2 Theoretical Framework

10.2.1 Universities and Entrepreneurship Ecosystems

By definition, entrepreneurship emerges from a complex economic system in constant reinvention. Such complexity indicates an important requirement for those who want to boost the phenomenon: it is necessary to pay attention to the several players in a unique way, making the development of local environments not a repeatable act, but an effort based on the individual condition of each region and its characteristics.

In Biology, it was possible to come up with the best illustration for the development of entrepreneurial regions: the ecosystems—a structure of relationships between several agents that survived through their interchange. In this respect, Isenberg (2011) improved his studies by developing an entrepreneurship ecosystem, based on the interaction of six players (public policies; financial structure; local culture; support agents; human capital; and market) that underpinned the emergence and survival of new enterprises. By making a connection between this model and ecology, we notice that these actors represent the complex factors that ensure the development of a crop (nutrients; humidity; luminosity; and pollinators, among others).

The existence of the proper pillars for the creation of entrepreneurship ecosystems is relevant, but the dynamics of the relationship between them is crucial. According to Feld (2012), four dynamics are important

for developing an ecosystem: (i) such ecosystem must be driven by entrepreneurs; (ii) the leaders must have a long-term commitment with the ecosystem; (iii) the environment must be inclusive; and (iv) it is necessary to develop frequent activities and events to keep a vibrant atmosphere in the region. Isenberg (2011) emphasizes the importance of developing an ecosystem based on a structure that provides feedback to the system, considering the improvement and success of entrepreneurs (feedback loop): entrepreneurs begin their trajectory by developing basic skills, advance by achieveing an entrepreneurial mindset, make the decision to be entrepreneurs, launch their startups, grow and attain success and wealth; in the loop, these entrepreneurs in the advanced stages (growing or reaching success and wealth) return to support the trajectory of new early-stage entrepreneurs, offering inspiration from their success stories, financial investments through the application of their capital, and mentoring by sharing concrete experiences they have gone through.

In addition, what is the role played by universities? Although some scholars limit their activities to training human capital, studies and concrete examples show new roles that universities can play for the improvement of entrepreneurship ecosystems:

i. development of academic research-based technology;
ii. management training for potential entrepreneurs;
iii. qualification of human capital to operate in the early stages of companies;
iv. entrepreneurship education, by presenting tools and specific methods;
v. development of activities that affect the community outside the campus;
vi. availability of infrastructure for the development of events, research, etc.; and
vii. connections between the academic community, government agents and market.

However, which are the gears responsible for the awakening of all these functions? This question indicates the need to analyze some specific case of universities, as well as their agents and mechanisms.

10.2.2 Grassroots Movements: New Gears in Universities

For some scholars, the ecosystem-based view can be incorporated into the specific context of universities—it is necessary to understand that universities can have their own agents that interact with one another in order to promote the creation of new companies; such institutions are known as entrepreneurial universities. According to Guerrero, Urbano, and Fayolle (2016), the entrepreneurial university model is defined by the provision of an adequate environment for the university community, which will serve as a conduit for entrepreneurial initiatives (p. 106). In the Brazilian context, Lemos (2013) presents a structure of players of a research university based on the entrepreneurship ecosystem's perspective (Fig. 10.1).

Despite being visually separated, these agents can be put together and operate in a collaborative way; the entrepreneurship center, for example, can operate as part of the technology transfer office.

It is important to emphasize that the elements of entrepreneurship ecosystems in universities are subject to constant reinvention. The grassroots movement is a recent phenomenon, although it had already been mentioned as a potential research decades ago. The definition relates to its non-institutional nature and full autonomy—it is an organization led by students that, by analogy to grass roots growth, rises bottom-up (Hossain, 2016). Several scholars (Etzkowitz, 2013; Kezar, Bertram Gallant, & Lester, 2011) associate the phenomenon of grassroots movements in universities with transformation engines—the nature of these movements are different from traditional institutional structures, which have top-down initiatives and usually less key players than these bottom-up initiatives led by students.

> The usual assumption in most organizations is that change comes from the top — through the usual top-down, hierarchical initiative of the boss — but oftentimes administrators are more experienced at perpetuating the *status quo* than at changing it. On the other hand, individual faculty members or students at the bottom of the pyramid often know that there is a problem and have good ideas about how to fix or improve it, but their bottom-up initiatives flounder, not because they don't work — they do — but because they don't diffuse or spread throughout the organization. (Goldberg & Somerville, 2014)

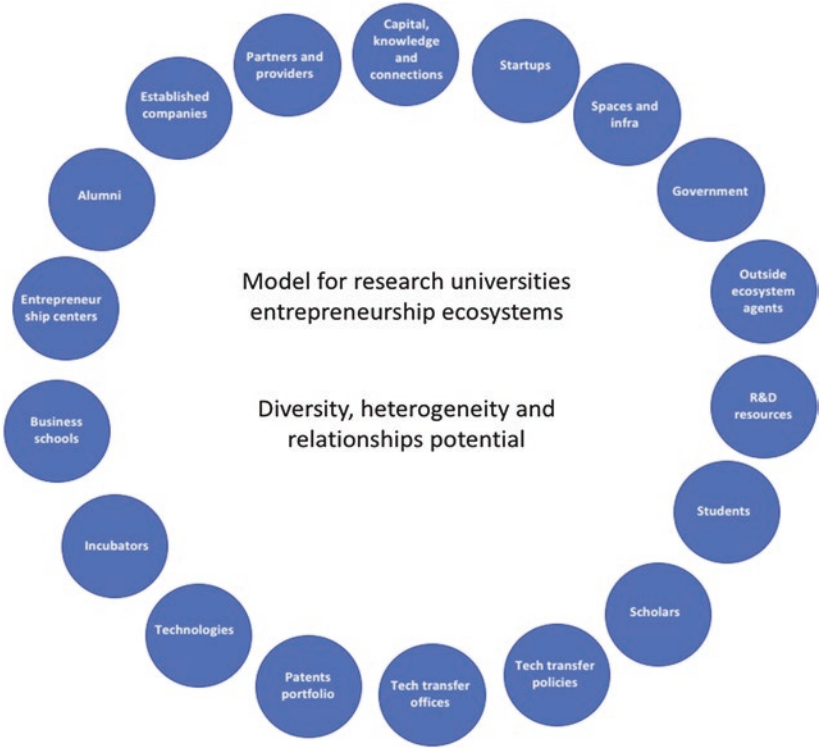

Fig. 10.1 General representation of a university entrepreneurship ecosystem (*Source* Lemos [2013, p. 43])

Currently, there are studies that address the role played by student organizations in entrepreneurship, in the process of universities' transformation. One example of how the concept was incorporated in the analysis of university entrepreneurship ecosystems is the study "Creating university-based entrepreneurial ecosystems—evidence from emerging world leaders", produced by MIT in association with Skolkovo Institute of Science and Technology (Graham, 2014): in this study, two transformation drivers are presented: a institutional one (top-down) and a grassroots movement (bottom-up). According to Clark (2004), such transformation process demands from students what the author calls a proactive autonomy concept; i.e., the need to become autonomous and a

protagonist, associated with the obligation to use such freedom in order to improve the university where they are inserted.

In order to understand the phenomenon, we selected three international case studies, which are presented in the next section. These studies describe the transformation process of a grassroots movement. Internationally, these movements are defined as entrepreneurial societies, enterprise societies, entrepreneurship clubs or e-clubs.

10.3 International Cases

The phenomenon of grassroots movement occurs globally. They are usually presented as "Entrepreneurship Societies", however with different maturity levels—in Stanford, for instance, the students movement evolved to a non-profit accelerator that provided the necessary support for university entrepreneurs. In order to illustrate the impact of these organizations, we selected three successful cases: (i) Aalto Entrepreneurship Society; (ii) Stanford's StartX; and (iii) Oxford Entrepreneurs.

10.3.1 Aalto Entrepreneurship Society

In 2008, after feeling discouraged by a professor in Helsinki regarding university entrepreneurship, students from Aalto University decided to go to MIT to visit Bengt Holmström, a Nobel Prize winner Finnish professor. Holmström instigated the students to discuss the mindset presented in MIT's mission: *mens et manus*, i.e. mind and hands working together while putting in practice the knowledge acquired at the university. The students went back to Finland and created the Aalto Entrepreneurship Society (Aaltoes), a grassroots movement that promotes entrepreneurship.

The genesis of Aaltoes is in accordance with characteristics found in the literature on grassroots movements: one of the main drivers for its emergence is the reaction to excessively orthodox thinking by some institutional agents that opposed entrepreneurship. In order to respond to the need for a change in the mentality of the Finnish university, Aalto Entrepreneurship Society started its activities in an abandoned warehouse, which later became one of the main co-working places in Finland, the Startup Sauna.

The activities started from the effort of to bring entrepreneurs to share their stories, in order to inspire students to take a risk in an

entrepreneurial journey. In 2010, the warehouse became Aalto Venture Garage, with pre-acceleration programs and proper space for students to start their business. In 2011, this independent effort was responsible for the first official European partnership with the Stanford Technology Venture Program.

The story of the organization stands out for its ability to generate great movements that had an impact throughout Finland. One example is Slush, an event originated in Aalto Entrepreneurship Society, which became the largest event for startups in Europe, with the presence of 17,500 guests and investments in hundreds of startups in 2016. In 2010, the term "#aaltoes" became Finland's trending topic on Twitter. Such initiative is related to the creation of the National Failure Day, on October 13th, the most quoted topic in Finnish media (Farny & Kyrö, 2015). The transformation, which started with a small group of students from Aalto University, turned national—which strengthens the capacity of mobilization of autonomous and non-institutional movements. Further developments on the Finnish phenomenon can be found in the study "The Helsinki Spring: an essay on entrepreneurship and cultural change" (Lehdonvirta, 2013), published by the journal Research on Finnish Society, or in the chapter "Entrepreneurial Aalto" (Farny & Kyrö, 2015), in the book *The Entrepreneurial University: Context and Institutional Change*.

10.3.2 Stanford's StartX

In the article "StartX and the 'Paradox of Success': Filling the gap in Stanford's entrepreneurial culture", Etzkowitz (2013) presents the grassroots phenomenon from an interesting perspective: StartX, the startup accelerator created and led by students, was filling a gap ignored by the University of Stanford, known for its support to entrepreneurship in Silicon Valley. The success stories of companies created from research carried out in Stanford made the university change, in terms of new challenges for transfer of technology. Hence, StartX emerged as an answer from students, who were aware of the deficiencies of the *status quo* and directly affected by them.

> The "Paradox of Success" is the reduced motivation to seek improvement in a highly successful enterprise. The student government-launched accelerator project in 2010 dramatically increased the rate of firm formation by

> the university, demonstrating the validity of what heretofore had been an untestable proposition about Stanford's untapped entrepreneurial potential. Unrealized capabilities, hidden behind a bureaucratic maxim for legitimating the *status quo*: "if it's not broken, don't fix it", were brought to light by StartX, an extra-curricular student-originated experiential entrepreneurship education and mentoring initiative, based on a converse premise: "If it's working well, make it better." (Etzkowitz, 2013)

Established in 2010, it stemmed from a research project supported by Stanford's Student Government, related to the experience of university entrepreneurs (Etzkowitz, 2013), the accelerator offers (i) access to more than 300 recognized mentors in Silicon Valley; (ii) US$1.2 million in resources offered by partners; (iii) access to a community of more than 1200 entrepreneurs from the StartX network; and (iv) a customized startup development program, offered by the accelerator. Its emergence is a spin-off of the student organization Stanford Student Enterprises, also developed and led by students, and regards establishing contact with students with experience in entrepreneurship.

Currently, the accelerator has more than 400 supported startups and successful cases, such as WifiSlam, acquired by Apple for around US$20 million. As startups' effects became more relevant, Stanford University took part in the program by investing US$3.6 million to ensure 3 years of operation of the accelerator, allowing it to rent a larger space with several specific environments for different areas, such as a biotechnology lab, hardware workshops, programming areas and even a real elevator used exclusively for "elevator pitches". Besides these resources, the university directed more investments to the startups, and started a partnership between the University hospital and the accelerator for the development of health care solutions.

10.3.3 Oxford Entrepreneurs

As the oldest Entrepreneur Society in Europe, Oxford Entrepreneurs was created in 2002 and has the mission to spread the entrepreneurship spirit throughout the university. The organization relies on sponsors from different areas—Oxford University partners, startups in search for talented professionals, consulting companies and traditional companies, such as Unilever. The financial structure ensures a better provision of activities for students and also the remuneration of its members. In addition to

paid members, the organization relies on volunteers to help with events, community management and social media.

The activities organized by Oxford Entrepreneurs are based on three pillars: (i) Inspiration—with lectures, social events and hackathons that create a vibrant atmosphere and introduce the theme "entrepreneurship" to students; (ii) Education—with classes, workshops and discussion with specialists; and (iii) Support—with the activation of a network of mentors that guide students that are starting their businesses. The organization emphasizes that it is not only oriented to technology-based companies, but also to small businesses and productive creations, such as the creation of a book. Among the main activities offered, we point out three big events:

i. Oxford Inspires: a large event with several lecturers covering 8 different themes. It counts with the presence of dozens of guest entrepreneurs, attracting an audience of 400 people. Besides these lectures, there are one-to-one mentoring sessions and network activities on specific topics.
ii. Idea Idol: a competition of ideas whose 6 finalists compete for an award of £10,000. Students also get access to venture capitalists, specialized mentors, workshops, discussion groups and exercises to improve the abilities for presenting an idea.
iii. Oxford Hack: sponsored by large companies, such as Microsoft, Facebook, JP Morgan, Morgan Stanley, among others, the hackathon involves hundreds of students for the creation of technology solutions. With a two-day duration, it allows students to show their competencies to industry experts, besides distributing some awards (drones, 3D printers, smartwatches, etc.) to the best projects.

The Oxford Entrepreneurs journey relies on successful results, such as the creation of Oxford Entrepreneurs Incubation Centre, which provides facilities for students to create their own companies, while monitoring the organization; the center was also responsible for the creation of some companies such as PlinkArt, the first acquisition made by Google in the United Kingdom. The pioneering spirit of this grassroots movement led to the establishment of other Entrepreneurship Societies in the country;

there are currently more than 200 similar organizations spread throughout universities.

10.4 Brazilian Grassroots Movement: A Multiple Case Study

In order to analyze the grassroots movements in Brazil, we conducted an exploratory research to understand historical processes, main activities and success factors of national organizations. It is a multiple case study that aimed to identify patterns in the emergence and growth of four grassroots organizations—USP Entrepreneurship Society (University of São Paulo), Unicamp Entrepreneurial League (University of Campinas), UNIFEI Entrepreneurship Center (Federal University of Itajubá) and FEA Ribeirão Preto Entrepreneurship Society (School of Economics and Administration of University of São Paulo, Ribeirão Preto campus). These institutions were chosen because they have been active for a long period and are acknowledged in several areas (success stories, solid institutional support, impact acknowledged by media and strong commitment to students on social media).

10.4.1 Data Analysis: The Rise of Brazilian Movements

10.4.1.1 Context and Historical Process

In Brazil, grassroots movements emerged between 2010 and 2012, when the topic "entrepreneurship in undergraduate programs" was drawing attention after (i) the sale of the startup company Buscapé, created by USP students, for more than US$300 million, and (ii) the success of the movie "Social network", which presented the creation of Facebook in the hallways of Harvard. At the same time, good practices for the creation of startups became stronger, e.g. the Lean Startup model, and more undergraduate students (or recently graduated) started their technology-based businesses, such as 99Taxis and iFood. In this period emerged USP Entrepreneurship Society, Unicamp Entrepreneurial League and UNIFEI Entrepreneurship Center, besides the reactivation of FEA-USP Ribeirão Preto Entrepreneurship Society.

There are currently 50 grassroots movements in Brazil, most of them called Entrepreneurial Leagues. Such movements (mostly

autonomous and led by students) are sometimes supported by institutional interfaces; in some hybrid models, institutional agents work with the organization.

According to the interviews conducted, it was possible to emphasize some similar standards. First, the historical process of creation, with analogous dates and significant events; second, the type of activities offered, which we cover in the next topic; finally, characteristics of the organizational culture. The emergence of these movements was similar: most of them started from informal networking between student entrepreneurs and alumni that realized that there was in the Brazil the same gap observed in international cases: a need for new support mechanisms for entrepreneurship that was not addressed by the institution. The entrepreneurial urge of these students would start the movement, attracting new student entrepreneurs and structuring a more formal operation to support entrepreneurship during the undergraduate course. Another feature of the historical process was the instability during the early years of operation—since it was a student initiative, the turnover of the movement was high and the structure was hard to maintain. Despite having leaders committed to medium and long-term development, many of these initiatives ended. These leaders are acknowledged as essential pieces in the story of Brazilian organizations, since they were responsible for their survival in hard times, for the establishment of networking, and ensured the persistence of the existing organizational knowledge.

The cultural factor identified in the interviews is related to (i) the contact with startups and more dynamic cultural practices; (ii) risk-oriented and non-institutional nature; and (iii) intensive undergraduate students' commitment. At USP Entrepreneurship Society, for instance, Nubank's cultural practices were spread by founders and first employees—and their implementation turned the company into a more agile and result-oriented organization. The feedback from the founders of several fast-growing startups also helped the organization develop a culture of business excellence in the services provided. In addition, the two elements related to the nature of the organization—non-institutionalized and with students committed to the project almost full-time (in parallel with the undergraduate course)—enable higher speed, development of new projects, and organization of large events.

With the growth of organizations, their ability to influence institutional agents and create new activities led to maturity and economies of scale. Many of the interviewees currently develop activities together with professors, pro-rectories, incubators and participants of the local ecosystem where universities are inserted. Such organizational strengthening allowed the emergence of established services that currently work as new gears in the entrepreneurship ecosystem of these universities.

10.4.1.2 New Gears Running in University Engines

One of the main characteristics of these agents is to offer new services to the entrepreneurship ecosystem of universities where they operate. This is due to three factors: (i) proximity of newly graduated to the startup network, to engage in lectures, courses and mentoring; (ii) contact with students happens in a horizontal way, ensuring another perspective on demands and interests; and (iii) quickness in performing activities due to the non-institutional and autonomous profile.

Through the interviews, these new services, or new gears in the ecosystems, showed a distribution pattern that can be divided in three pillars: inspiration/incentive; training/education; connection/structure. This section deepens the description of the activities accomplished in each of these pillars.

Inspiration/Incentive

The inspiration activities are based on the assumption that many students are not aware of entrepreneurship, or do not perceive it as a career option. Thus, inspiring activities help bring the student closer to the theme, develop a connection with inspiring stories, and reduce psychosocial barriers related to the possibility of starting a business. Among the activities developed by the organizations studied, we emphasize:

i. Events accomplished with several lecturers: the organization of events, in addition to drawing attention to interesting stories, allows students to realize that they live in a community with similar people. The feeling of belonging, the contact with inspiring stories and the connection with other students, who are also interested in this specific topic, help to build a vibrating and friendly atmosphere towards entrepreneurship.

ii. Events related to building solutions: events related to the development of startups or even punctual solutions for specific challenges were seen as a key factor to stimulate the interest of students in enterprises. The weekends dedicated to the creation of startups, usually with the trademark Startup Weekend™, are pointed out as very important factors in the history of the development of Brazilian grassroots movements (phenomenon that also occurs globally). Hackathons, 48-hour programming marathons with specific challenges, are a good way to gather students with technical background, while bringing them closer to a sponsored startup ecosystem with several mentors involved.
iii. Other ways: besides large events, there are also other possibilities that help create an open culture of entrepreneurship. Some examples are (i) the connection with professors, so that startups can be addressed in the classroom; (ii) the accomplishment of "entrepreneurship lunches", where a select number of students have the opportunity to have lunch with entrepreneurs in a more intimate and significant atmosphere; and (iii) the use of social media to disseminate success stories of *alma mater* colleagues.

Despite tight schedules and a large amount of invitations, it was possible to observe that the participation of entrepreneurs in the activities is natural. Usually explored in the United States, the entrepreneur's feeling of "giving back" is a key element of commitment to the university he/she went; many of them take the opportunity to attract skilled employees and to spread information about their companies—a relationship that can be beneficial to everybody involved.

Training/Education

Activities related to training, which are usually a follow-up of inspiration activities, aim to offer the necessary guidance for the student to become an entrepreneur with more experience and background. Among the training mechanisms mentioned in the interviews, some of them stand out:

i. Courses and workshops: different types of training, such as methodologies for startup creation, tools to support the entrepreneur,

and competencies needed to be an intern at a startup company. In some cases, as the courses related to the development of skills for interns at a startup, offered by USP Entrepreneurship Society, founders and leaders of startups were the lecturers, ensuring the necessary forefront tools and content for students.

ii. Support to the formal structures of the University: organizations work together with faculty, either to suggest innovative teaching material or to coach students on entrepreneurship, such as UNIFEI Entrepreneurship Center. There is a support to spread information about the existing disciplines, such as the mapping accomplished by USP Entrepreneurship Society, through which the university spread among students more than 100 school courses related to entrepreneurship.

iii. Pre-acceleration: it promotes the necessary support for students that are interested in entrepreneurship. The pre-acceleration activities are based on methodologies, such as the "four steps to epiphany" developed by Steve Blank, a step-by-step for the first stages of the entrepreneurship journey. Usually students are stimulated to better understand their business models, talk to potential customers and build a first version of their test product. Here, the shared workspaces offered by some organizations also play an important role—such infrastructure allows students to get in touch with other students interested in the same theme, and have direct contact with the daily routine of more mature startups.

Connection/Structure

The third pillar, connection/structure, meets the needs of more complex resources demanded by entrepreneurs in more advanced stages. As autonomous and student-led organizations have no resources, they have to develop some strategic connections. In the specific case of Unicamp Entrepreneurial League, the access to the alumni network, accelerators, Inova Unicamp incubator and companies operating in the area guarantees the continuity of projects developed at the university. Among the several practices adopted by organizations, the most frequent are:

i. Organization network: Having a formal network of alumni startups can enhance the opportunities for events, mentorship and other activities. The Entrepreneurship Center of the University of São Paulo (NEU) Network, for instance, guarantees access to investors of the main Brazilian and international funds, besides contacting the founders of large companies, such as Nubank, 99, Kekanto, among others. In addition to having specific contacts, many organizations rely on digital tools (Whatsapp and Facebook groups, etc.) to stimulate a free exchange of information between members. Through such digital tools, participants exchange recommendations of suppliers, customer contacts, solutions feedback, etc. It is important to notice that physical interface is necessary to strengthen these networks, as happens when Unicamp Entrepreneurial League carries out the event known as Happy Hours.
ii. Connection between students and startups: stimulus programs for internship in startups are beneficial for entrepreneurs, because they have access to qualified human capital (organizations often make an extra effort to look for the most talented and qualified people), and for students, who live new experiences at startups. The organizations understand that an internship at a startup company is one of the best schools for entrepreneurs; therefore, such effort is common among them. UNIFEI Entrepreneurship Center, has such a program, and also the Startup Bus, where students are invited to make a tour of different startups in the region.

10.5 Results

The purpose of this chapter was to state that universities play an important role by promoting entrepreneurship, and grassroots movements are essential elements to boost such transformation. Our study identified patterns in the historical process of Brazilian organizations and understood the functions performed by these organizations within institutions.

10.5.1 A Single Phenomenon, Similar Stories

Whether through international or national organizations' case studies, the historical process of grassroots movements arose from the perception of student entrepreneurs that there was no such support from their universities. Most of these cases emerged between 2010 and 2012, a period marked by the outbreak of dozens of lean structure-oriented startups, which stood up for the concept of "starting small" and keeping on learning during the process. These movements were led by students with entrepreneurial traits—being their long-term commitment a success factor related to the growth of organizations. Such fact is in line with studies conducted by Feld (2012), who defends the development of healthy entrepreneurship ecosystems.

The resistance to institutional processes also characterizes the process of development of these organizations. On the one hand, institutional approaches, of top-down nature, are distinguished by slowness and low level of responsiveness to students' interests; on the other hand, grassroots movements are based on the demands that are daily presented by student colleagues (Kezar et al., 2011). The ability to communicate and commit to other students makes a big difference, and, in the Brazilian case, the organizations were able to establish networks with supporting companies in a more effective way than with institutional agents. Data show that institutions that got involved in supporting such emerging organizations, without influencing their agenda or turning them into institutional assets, benefited from the creation of a vibrant atmosphere inside campi. At the same time, we understood that, aligned with the proactive autonomy concept developed by Clark (2004), institutional support was a consequence of grassroots' solid efforts and independent achievements. Considering the emergence of student groups, the process of maturity and acknowledgement (first on the part of students, followed by professors, and later institutional agents) is a result of the independent efforts made by student entrepreneurs. During the first stages, the best that universities can do is not to interfere. Unfortunately, some of the cases pointed out barriers created by institutions—such as charging for space use, processual obstacles and even public attitudes against the movement.

10.5.2 Reapplying New Gears

As found in theory, grassroots movements stand out for their ability to provide cutting-edge services for the community they belong to, being many times ahead of institutional initiatives. The quality of some projects, for example, have relevant impacts on their institutions—such as the case of two projects developed by USP Entrepreneurship Society: (i) the training program for students to work in startups, which receives more than 200 students annually, and (ii) the platform of online courses promoted by the organization, with over 20 thousand subscribers, which has reached more than 10 countries. At UNIFEI Entrepreneurship Center, some famous success cases in the region originated from projects such as Lab001, a startup accelerator program that addresses hardware and hard science businesses.

Several projects of Brazilian grassroots organizations can be a reference to entrepreneurial universities that want to reinvent themselves. The structure that Brazilian grassroots have adopted is connected to the feedback loop model proposed by Isenberg (2011)—students are inspired by alternative entrepreneurship professionals (hitherto unknown), are empowered to develop their business and get the proper connections and structure when they start to manage their firms; after a while, success cases are portrayed at the University, bringing inspiration, knowledge, capital and connections. In that sense, one of the main assets of these organizations is the organic construction of a business network with strong links and a hard "give back" feeling. The activities are described in Table 10.1.

10.5.3 Grassroots in Brazil: A Maturity Model

More than illustrating the phenomenon of grassroots movements, it is important to demonstrate the process of maturity of such movement as a "flow frame", which in our analogy represents a movie that will be analyzed. In that sense, the research aimed to validate an international maturity model in a Brazilian context. The model below divides organizations into different maturity levels, in a format structured to guide organizations and universities in promoting the growth of these mechanisms (Table 10.2).

Table 10.1 Activities and potential quantitative metrics

Inspiration/incentive	*Training/education*	*Connection/structure*
USP entrepreneurship society		
Lectures; lunch with entrepreneurs; inspirational content in social media; participation in classroom; sharing of successful stories; significant events, such as startup weekends; Hackathons	Mapping and promotion of more than 100 subjects related to entrepreneurship in all campi; pre-acceleration program (customer development model); courses and workshops; training program for students who want to work at a startup (lessons given by entrepreneurs); public notices to fund students' projects; video courses; guiding digital books for new students	NEU network—virtual group composed of alumni entrepreneurs; connection with mentors, specialists and companies; connection between students and startups in order to spread internships; informal chat with alumni network; coworking to stimulate connections
UNIFEI entrepreneurship center		
Entrepreneurship May (event accomplished in order to get students' attention); startup weekend; Hackathons; TEDx; lectures	Institutional effort to teach entrepreneurship; pre-acceleration of startups (Lab001); "get it done" program (a program established to encourage the creation of companies); technology workshops	Startup bus (visits to startups located in the region); internship programs in startups; coworking to stimulate connections
FEA/RP entrepreneurship society		
Global entrepreneurship week; presentation of possibilities for students; inspiration events	Regional training for the low-income population; pre-acceleration of projects developed by students; training and courses for students	Coworking; local entrepreneurs network
Unicamp entrepreneurial league		
Inspiration and motivation events; startup weekend	Methodology training, entrepreneurship training	Happy hours; alumni network

Table 10.2 Structure of the adapted National Association of College & University Entrepreneurs (NACUE) maturity model: pillars × maturity levels

	Early stages	*Consolidation*	*Maturity*	*Self-sustaining*
Strategy	Non-existent (first actions)	Definition of mission and activities	Long-term strategies and vision	Focus on scale and large impact
Governance	Non-existent	Support from non-students	Support from and relationship with faculty and external players	Effective presence of advisors
Internal procedures	First activities and procedures	Recurring projects/ procedures	Transparent routines and a common working space	Well-established culture
Succession	Non-existent	Focus on training leaders	Mature after some crises, involvement of long-term leaders	Succession without knowledge deficits
Internal relationships	Actions to attract new members	Internal partnerships with faculty	Acknowledgment by the university	Influence in existing institutions
External relationships	Mapping external players	Establishment of support network and alumni	Activities that expand the network	External agents interested in providing support
Impact generated/businesses created	Non-existent	First training and connection actions	First success stories and wider reach of activities	Recurring success stories and relevant external impact
Funding portfolio	Mapping and dialogue with funding sources	First sponsored projects	Healthy resource volume, financial support provided for members	Diversified sources and high-cost projects in development
Marketing and branding	Efforts to attract students	Growth in the digital front	Full events and activities. Strong trademark	Regional and mediatic acknowledgement
Schedule of activities and events	Main projects are inspiration events	Customized events and solid activities	Solid activities of inspiration, training, and connection	Major activities, vast amount of participants and impact

10.6 Conclusion

Somehow, new events are always coming up. In this study, we presented the case of grassroots—an internationally known phenomenon, which still lacks deeper studies in the Brazilian context. Here, history repeats the pattern of international cases, where grassroots are responsible for promoting change in universities, while fostering other regional changes, as already mentioned. Therefore, it is possible to understand the need to develop new studies on these mechanisms and deepen the analysis on the main practices and operational models. Considering that these structures are not institutional, they present several fragilities that new business usually do, thus requiring special attention and support. The risks involved, due to their suppression by formal institutions or to the misuse of the freedom granted by institutional actors, can unfold several discussions in future studies.

It is possible to add three contributions to theory. The first relates to the new body of agents, which can be analyzed in debates about entrepreneurial universities, bringing up reflections about the participants of the entrepreneurship ecosystem of a university. The second contribution is about teaching entrepreneurship, considering that many of the activities presented by grassroots movements occur outside the classroom, while much of the theory on entrepreneurship is discussed by professors inside classrooms. Finally, the last contribution addresses studies on sociology in universities, especially regarding the process of institutional transformations, which raises issues such as "to which extent grassroots movements take part in the process of transformation of entrepreneurial universities?" or "which are the strategies adopted by such organizations that are relevant to the institutional agenda?"

This study has also some managerial contributions for practitioners. For grassroots movements in early stages of development, the maturity model helps to understand what are the best strategies for the movement's evolution, while offering an effective tool for self-analysis and strategic improvement. For the managers of higher education institutions, the historical process of these movements helps to provide the best supporting mechanism, as well as a healthy relationship with students. For public decision-makers interested in the development of entrepreneurial universities, grassroots movements can show how an active and efficient agent can provide support to entrepreneurship and promote the education of young entrepreneurs. Therefore, our research

is a structured source of complementary information for such public decision-makers.

The grassroots movement is a new phenomenon, especially in Brazil. Therefore, this chapter provides an insight that opens up horizons in research and practice of this phenomenon.

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CHAPTER 11

Cases of University Spin-Offs

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11.1 Introduction

Spin-off firm is a generic term that refers to a new organization derived from an existing one. In business administration literature, we find two different phenomena: the creation of university spin-offs and corporate spin-offs. University spin-off firms have several definitions, which emphasize different aspects. In our study, these are companies created from knowledge generated in a university laboratory or research group, that turn this knowledge or technology into goods or services of commercial interest, leading to positive economic and financial results. The key concept is knowledge created at the university, as well as its availability for the society through new companies.

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In this chapter, we answer the following question: what are the factors that can influence the performance of Brazilian university spin-offs? Based on this research question, we developed some objectives:

i. To understand the scenario for the creation and development of spin-offs: the actors, their motivation and instruments.
ii. To identify the concept of success for the several players involved in the creation and development of university spin-offs.
iii. To validate growth models for Brazilian university spin-offs.
iv. To identify the barriers to success of Brazilian university spin-offs.
v. To identify the process and the role played by the entrepreneur.

Spin-off companies are one of the ways to transfer technology, expertise or knowledge from universities, as the new knowledge is incorporated into goods and services produced by these firms, which make them available to the public. The expected impact benefits the economy of a specific region in several ways: by promoting the increase of competitiveness of firms and competition between them, strengthening the entrepreneurial culture, creating qualified jobs and income, and spreading innovation, among others (Bathelt, Kogler, & Munro, 2010; Borges, Porto, & Dias, 2017; Guerrero, Cunningham, & Urbano, 2015; Saxenian, 1998; Vincett, 2010). Most studies focus on the process of creation of spin-off companies, the influence of the several players on the process, the relationship between macroeconomic and regulatory factors, and the role played by intellectual capital in developing companies. There are only a few studies that address the growth and performance of spin-offs, and little discussion about their growth process, compared to the evolution of "traditional companies".

In this study, we used a qualitative methodological approach based on a multiple case study of successful Brazilian university spin-offs. No national database of spin-offs is available. Thus, the first step of the research was the identification of the microenvironments of two of the three top research universities, namely University of São Paulo (USP) and Federal University of Rio de Janeiro (UFRJ), and the spin-off firms created in their laboratories and research groups. During this stage, we conducted 18 interviews with those involved directly or indirectly in the creation and development of academic spin-offs, and asked the names

Table 11.1 Spin-off companies: origin, market segment and purpose

Company	*Origin*	*Market segment*	*Purpose*
OilFinder	COPPE UFRJ	Oil: drilling and production	Services for locating oil reserves
Ambidados	COPPE UFRJ	Offshore industry	Equipment and services—offshore
PAM Membranas	COPPE UFRJ	Industry	Solutions for water recycling and reuse
EloGroup	COPPE UFRJ	Large corporations	Process consulting
Veduca	POLI USP	Distance education—physical person	Education
Technomar	POLI USP	Offshore industry	Simulation services
Buscapé	POLI USP	Internet retail	Price comparison
LSI Tec	POLI USP	Clients with R&D projects	Prototype development

of successful ones. These firms were ranked and we selected the eight most frequently mentioned. We collected public data and interviewed entrepreneurs from seven of the selected spin-offs. In one specific case, Buscapé, we only used available public data (Pavani, 2015).

The eight companies addressed in the multiple case study were created from knowledge developed in graduate courses, research groups and laboratories of the Polytechnic School of University of São Paulo (POLI USP) and of the Alberto Luiz Coimbra Institute of Graduate Studies and Research in Engineering, of the Federal University of Rio de Janeiro (COPPE UFRJ). Their areas of operation are shown in Table 11.1.

11.2 Literature Review

A spin-off company is a new company created to commercially explore knowledge, technology, or research results developed at the university. This definition is in line with the most recent studies on academic entrepreneurship, where the presence of the inventor is not a necessary condition for its characterization (Freitas, Gonçalves, Cheng, & Muniz, 2012).

One part of the literature covers the conditions in which organizations, and their respective social, economic, business and technological

context, support the creation of spin-off firms. Several scholars tried to identify and to propose models to better understand the process, in order to support the formulation of public policies. Some of them are: the institutional spheres that affect the creation and growth of spin-offs (Fini, Fu, Mathisen, Rasmussen, & Wright, 2017; Gilsing, van Burg, & Romme, 2010) and a performance model for the creation of companies (O'Shea, Allen, Morse, O'Gorman, & Roche, 2007). Although these studies focus on the process of creation of these companies and their efficiency, we inferred that all factors mentioned by these authors also affect the growth and success of the created firms. The elements analyzed by the authors, which influence the growth and success of companies, are described in Table 11.2.

Table 11.2 Factors that affect the success of spin-offs

Factors	*References*
National policies and laws	Beckers et al. (2006) apud Gilsing et al. (2010), O'Shea et al. (2007), Gilsing et al. (2010), Vincett (2010)
Regional context	O'Shea et al. (2007), Beckers et al. (2006) apud Gilsing et al. (2010), Vincett (2010), Gilsing et al. (2010)
University characteristics: resources (volume and source) available for science and engineering; leadership and policies; qualification of the academic staff, entrepreneurial guidance	O'Shea et al. (2007), Beckers et al. (2006) apud Gilsing et al. (2010)
Characteristics of the supporting organizations: incubators, mechanisms related to the transfer of knowledge, other supporting programs	Fini et al. (2017), Botelho and Almeida (2011), Lockett, Siegel, Wright, and Ensley (2005)
Characteristics of the research group	Clarysse, Wright, and Van de Velde (2011)
Characteristics of knowledge and technologies	Gilsing et al. (2010), Clarysse et al. (2011), Lockett et al. (2005)
Characteristics of traditional and university spin-off companies	van Geenhuizen and Soetanto (2009)
Characteristics of the spin-off team	Lockett et al. (2005)
Characteristics of the spin-off's entrepreneur	Timmons (1999), Sarasvathy (2001), Hisrich, Peters, and Shepherd (2008), Lockett et al. (2005)

Regarding the process of development and growth of spin-off companies, the resource-based view is a theoretical reference used explicitly or implicitly by most scholars that address this topic. This approach emphasizes the assets and competencies that a company has to acquire through its development path. However, its original formulation does not enable the differentiation between the growth stages of the company, or explores the challenges involved in the growth process. The knowledge-based view is a derivation of this theory, and emphasizes the asset "knowledge" as a company's key resource. Based on such theory, we designed a matrix that addresses knowledge gaps in the development stages of a spin-off company, and the role that relevant players can play to solve them (Lockett et al., 2005). Another proposition is the assumption that the success of a spin-off is associated with the technological knowledge from which it emerged (Clarysse et al., 2011). Therefore, the success of university spin-offs would be a consequence of technological knowledge, derived from the perspectives scope/specificity, innovation/accumulation of technology, degree of tacit knowledge, and relationship between the technology (or knowledge) and the parent institution.

The specific models of growth of spin-off companies, such as the development stages of university spin-outs (Vohora, Wright, & Lockett, 2004) and the model of stages (Helm & Mauroner, 2007), were considered the most appropriate for this study. In the model "Stages of development of spin-outs and critical junctures", the authors propose five phases (research, opportunity sketch, pre-organization, re-orientation and sustainable returns) and identified four critical junctures or challenges (opportunity recognition, entrepreneurial commitment, credibility and sustainability) to be overcome by the company. In the stage model, the authors formulated a linear model composed of three phases (pre-spin-off, spin-off establishment, and post-spin-off).

Regarding the research line that addresses facilitators and barriers to the growth of spin-off companies, we analyzed studies that tried to identify these factors. One conclusion is that barriers can be classified in two groups:

i. Common barriers, considering the growth path of any traditional micro and small-sized company.

ii. Specific university spin-offs barriers. These factors are related to the university origin of these companies or to the physical insertion into university networks. Flaws in the performance of supporting organizations for new companies (incubators and mechanisms responsible for knowledge transfer in universities) and gaps in the policies regarding university intellectual property policies can hinder the development of companies.

Regarding facilitators, they are connected with the university origin of companies. Therefore, they can relate either to the institution of origin or to the environment where companies are inserted.

There is another approach in the literature that addresses the entrepreneurial process and the attributes of individuals for the creation of successful companies, especially regarding the role played by the entrepreneur in spin-offs. Due to its coverage and impact, the theme is also studied in several areas such as economics, business administration, psychology and law. Literature still does not present a single approach that is widely accepted, since it involves so many different fields of knowledge, altough it is a prevailing subject. The most recent definitions of entrepreneurship tend to gather several concepts predominant in different historical moments, such as "entrepreneurship is a way of thinking, reasoning, and acting that is opportunity obsessed, holistic in approach, and leadership balanced for the purpose of value creation and capture" (Timmons, 1999). Due to its reach, and in order to incorporate several principles, we adopted the definition by Hisrich et al. (2008) "creating something new with value, by devoting the necessary time and effort, assuming the accompanying financial, psychic and social risks and receiving the resulting rewards of monetary and personal satisfaction and independence".

We used two models for the analysis structure, regarding the process and the role played by the entrepreneur: the triadic model opportunity-team-resources (Timmons, 1999); and the effectuation analysis (Sarasvathy, 2001). While in the triadic model the role played by the entrepreneur—as the individual responsible for opportunities—, the teamwork and resources are emphasized, the effectuation model highlights the process of entrepreneurship, in which there is a way of acting more adapted to moments of uncertainty, and aspects that are relevant in

the business layout. This approach is the opposite of the usual way of venturing, known as causation, which is more appropriate for environments and contexts with less uncertainty. In both the triadic and the effectuation models, some specific characteristics and abilities of the entrepreneur are necessary (Hisrich et al., 2008; Sarasvathy, 2001; Timmons, 1999). Table 11.2 summarizes the factors that affect the success of spin-offs.

Therefore, it is important to mention that only a few recent studies in Brazil focus on the main objective of this research: the success of university spin-off companies. When analyzing eight Brazilian cases, Botelho and Almeida (2011) concluded that the fragility of support organizations, and their attitude regarding intellectual property affect the development of companies. Their study led to three conclusions: (1) the innovation policy of Brazilian public universities is more focused on the creation of intellectual property than on technological innovation; and (2) this policy has raised the awareness of spin-off companies' founders, by moving them away from the necessary dedication to identifying opportunities, strategies and new business models for the creation of spin-offs; and (3) the need for survival has pushed spin-offs toward consulting, which removes all energy and efforts of the management team from tasks that are necessary for the diversification of products, services and business models. There is a risk of these companies becoming traditional small and medium-sized companies. Figure 11.1 shows the conceptual model of the analysis.

Where:

i. "National regulatory and institutional environments" refers to the existence of institutions, funding sources and federal laws and regulations, whose scope of operation may influence the development of spin-offs;
ii. "Regulatory and institutional environments, culture and regional factors" represents the presence of institutions, funders, investors, clients and active and innovative regional suppliers. These players are involved with the local culture, which affects entrepreneurship in a specific regulatory environment;

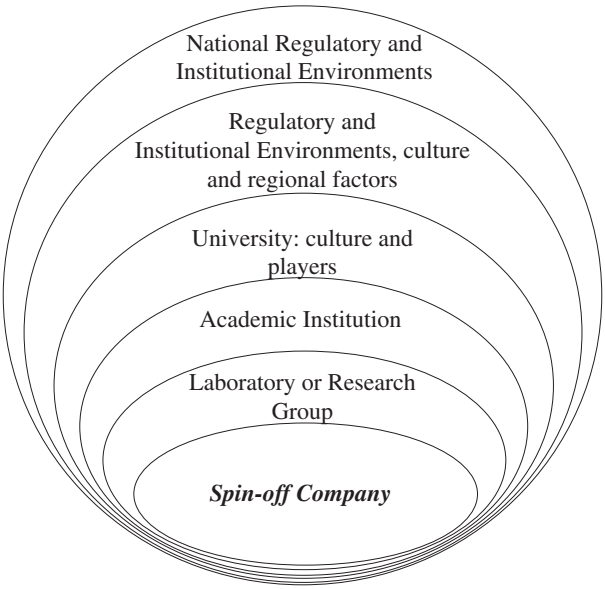

Fig. 11.1 Conceptual model

iii. "University" addresses the characteristics of universities that may influence the development of spin-offs, such as regulations and code of conduct, existence of support organizations, university entrepreneurial culture and support organizations' culture;
iv. "Academic institution" relates to the characteristics of the generating center or college, such as quality of the faculty, infrastructure for research, culture, rules, relationship with companies, funders and investors;
v. "Laboratory or research group" characterizes the group or laboratory where the company was created; relationship with companies; quality and type of the research carried out;
vi. "Successful university spin-off" is the company whose creation was based on knowledge developed in laboratories or research groups, which belong to an academic institution or a university located in a region with a dynamic economy and active local institutions, in a country guided by its own laws and national institutions. The pillars of the analysis are:

- Knowledge, technique and technological characteristics. The dimensions are the degrees in which knowledge is codified, the degree of innovation, the extent of the application of knowledge, and the degree of relationship with the parent academic institution.
- Adherence to the growth model of spin-offs. The models of spin-offs' growth have stages and literature indicates specific characteristics of each of the selected models.
- Overcoming growth obstacles.
- Entrepreneurial process and role played by the entrepreneur.

Table 11.3 presents the factors that may influence the success of university spin-offs, grouped by the dimensions of the conceptual framework, descriptions, and literature references that address these factors. Table 11.4 presents the dimensions and factors that may influence the success of spin-offs and some indicators to better identify them.

11.3 Results

The results of the research are organized according to the objectives.

Regarding the first objective, (a) To understand the scenario of creation and development of companies: players, their motivation and their instruments, the main conclusions, they are summarized in Table 11.5:

i. National context. We analyzed the regulatory mark and the role played by institutions in Brazil. The regulatory mark regarding innovation, to which university spin-offs are subject, is ruled by the New Innovation Law (2016) and its regulation (2018), and the so-called "Good Law" (2005), which grants tax incentives to organizations that develop research and development for technological innovation. The recent legal frame for innovation, despite being favorable to spin-offs, still presents some ambiguities, gaps and areas that need to be improved and regulated. The federal funding institutions National Bank for Economic and Social Development (BNDES), Financing Agency for Innovation and Research (FINEP) and National Council for Scientific and Technological Development (CNPq) have financial

Table 11.3 Factors that may influence the success of university spin-offs: dimension, description and literature references

Dimension	*Description*	*References*
National regulatory and institutional environments	Existence of institutions, funding sources, laws and legislation that support and encourage academic entrepreneurship	Beckers et al. (2006, apud Gilsing et al., 2010), O'Shea et al. (2007), Gilsing et al. (2010), Vincett (2010)
Regulatory and institutional environments, culture and regional factors	Existence of institutions, presence of funders, investors, clients and suppliers in the region, involved with the local culture and affecting academic entrepreneurship in a specific regulatory environment	Guerrero et al. (2015), O'Shea et al. (2007), Gilsing et al. (2010), Vincett (2010)
University	Represents the features of the university that affect the development of spin-offs, such as regulation and code of conduct, existence of support organizations, form of action, entrepreneurial culture of the university and of support organizations	Locket et al. (2005), O'Shea et al. (2007), Gilsing et al. (2010), Botelho and Almeida (2011)
Academic institution	Characteristics of the parent center or college, such as quality of the faculty, infrastructure for research, culture, regulations, relationship with companies, funders and investors	Clarysse et al. (2011)
Laboratory or research group	Characteristics of the group or laboratory where the spin-off company was created: number of projects accomplished with companies, quality of the research, and type of accomplished research	Clarysse et al. (2011)
Successful university spin-off company	Characteristics of knowledge and technology	Clarysse et al. (2011), Gilsing et al. (2010)
	Adherence to growth models	Vohora et al. (2004), Helm e Mauroner (2007)
	Overcoming growth obstacles	van Geenhuizer and Soetanto (2009), Botelho and Almeida (2011)
	Entrepreneurial process and the entrepreneur	Timmons (1999), Sarasvathy (2001), Locket et al. (2005), Hisrich et al. (2008)

Table 11.4 Factors that may influence the success of university spin-offs: dimensions, factors and indicators

Dimension	*Factors*	*Indicators*
National regulatory and institutional environments	Existence of federal institutions that have programs and/or actions for the development of spin-offs	Existence of national actions and programs
	The federal regulatory framework recognizes spin-offs and provides actions for their development	Existence of laws, programs, actions and tax incentives
	Existence and access to federal sources of funding for innovation	Fund raising by the company with federal agents
Regulatory and institutional environments, culture and regional factors	Existence of an innovative economic context	Innovative clients and suppliers in the region
	Existence and access to regional sources of financing	Fund raising by the company with regional agents
	Existence and access to investors	Fund raising by the company with investors
	Regional regulatory framework recognizes spin-offs and provides incentive for their development	Existence of a regional set of laws, actions and tax incentives
University	Culture that supports entrepreneurship	Existence of a set of rules of conduct that encourage entrepreneurship
	Existence of actions and organizations that support entrepreneurship	Existence of a set of actions, rules and incentive programs for entrepreneurship
Academic institution	Quality of the faculty	Grade given by the Coordination for the Improvement of Higher Education Personnel (CAPES) to the parent laboratory or research group of the spin-off
	Culture that supports entrepreneurship	Existence of a set of rules of conduct that encourage entrepreneurship
	Actions and structure to support entrepreneurship	Existence of a set of actions and structures that support entrepreneurship

(continued)

Table 11.4 (continued)

Dimension	*Factors*	*Indicators*
Laboratory or research group	Patents that the group or the laboratory have	Number of patents
	Type of research	Basic/applied
	Cooperation with companies	Projects with companies
Successful university spin-off	Codified vs. Tacit knowledge	Production of knowledge: patents, copyright, industrial secret, expertise
	Applications	Market niche, segment or broad market
	Innovation	Radical x Incremental innovation Innovations brought up by technology
	RBV Framework	Is it possible to own or use the necessary assets? Did the supporting institutions share knowledge? Is it in line with the model proposed by Clarysse et al. (2011)?
	Vohora model	Did it go through all the model stages? Did it overcome the critical junctures?
	Helm & Mauroner model	Did it go through all the model stages?
	External and Internal obstacles	Did it overcome external and internal obstacles?
	Entrepreneurial process	*Effectuation* x *Causation*
	Characteristics of the entrepreneur—Timmons Model	Does he/she have the necessary characteristics?
	Characteristics of the entrepreneur in situations of uncertainty	Does he/she have the necessary characteristics?

Table 11.5 COPPE and POLI spin-offs: comparison between national and regional contexts, university, academic institution and laboratory

	COPPE spin-offs	*POLI spin-offs*
National context	There is a favorable regulatory and institutional framework under construction and being practiced. Gaps and doubts need to be properly observed and solved	
Regional context	Economy strongly marked by the oil industry and services regarding public administration	Latin America's financial center. Hosts more than 60% of all multinationals operating in Brazil
University	It has the following supporting institutions: UFRJ Agency of Innovation, technology-based incubators, foundations and science parks The regulatory framework does not recognize spin-offs and presents some gaps University culture is diffuse	It has the following supporting institutions: USP Agency of Innovation, technology-based incubators, foundations and science parks The regulatory framework does not recognize spin-offs and presents some gaps University culture is diffuse
Academic institution	Access to large amounts of funding from government and private sources It has explicit policies, programs, actions, contracts and defined operation rules	Access to large amounts of funding from government and private sources It has no explicit policies, programs, actions, contracts and defined rules of operation. There is no specific regulatory framework
Laboratory	High level of cooperation with companies. Programs to which they belong have a medium–high excellence	High level of cooperation with companies. Programs to which they belong have a medium–high excellence

support programs that can be accessed by spin-offs; our research proved that the companies really sought these funds. We also identified other national institutions that play an important role, such as the Ministry of Education, the current Ministry of Economy and the Ministry of Science, Technology, Innovations and Communications. Other relevant organizations are regulatory institutions, such as the National Agency for Oil, Natural Gas and Biofuels (ANP) and the National Telecommunications Agency (ANATEL), and trade associations, such as the Brazilian Association of Private Equity and Venture Capital (ABVCAP), the National Association of Research and Development of Innovative Companies (ANPEI) and the National Association of Entities for the Promotion of Innovative Ventures (ANPROTEC). Of the eight companies interviewed, 75% of them use federal funds and 87.5% are related to the mentioned institutions.

ii. Regional context. Companies were created in different regional contexts: São Paulo is a megalopolis, the largest financial center in Latin America, and hosts around 60% of the foreign multinationals that operate in Brazil; Rio de Janeiro hosts an important oil and gas cluster. The UFRJ campus houses the huge Leopoldo Américo Miguez de Mello Research Center (CENPES), other federal research centers, a business incubator and a science park. The trajectories, cultures and localization of the parent institutions are related to the companies they create. Five of the eight spin-offs analyzed have longstanding partnerships with CENPES; two of them are a direct outcome of studies developed by POLI USP. Although they are located in the same country, in its two largest cities, differences of the local contexts reflect on the spin-offs, both in their products and in the access to investors. Three quarters of the firms use regional sources for funding, 50% are located in places where they can receive municipal tax incentives, and 50% of the firms that originated in POLI USP have private investors (while spin-offs originated in COPPE UFRJ have no private investors). It is important to emphasize that state regulatory marks, despite being very favorable to spin-offs, are new and still lack regulation.

iii. University. USP and UFRJ are always among the top three Brazilian institutions in global rankings. Both are public research universities. Nevertheless, they have their own specificities.

Regarding the university attributes according to the Spinoff performance model by O'Shea et al. (2007), we observe:

- Quality of graduate programs: 36% of USP and 40% of UFRJ programs have been graded 6 or 7 by CAPES during the four-year evaluation period (2014–2017).
- The entrepreneurial orientation of both universities, related to the strengthening of entrepreneurial behavior and attitudes, regards the creation and promotion of innovative environments. In such aspect, both universities are very active, given their internal organization and supportive initiatives. Future research can question if the actions are sufficient and effective to generate and develop spin-offs. We could not observe in the universities clear policies for supporting academic entrepreneurship. And the regulatory environment for spin-offs is still incomplete in both universities. Faculty and researchers are public workers, whose activity is defined and regulated by statutes that explicitly forbid them to manage companies. Our conclusion is that in both universities the culture does not strengthen entrepreneurial attitudes and behavior. However, this has remarkably improved in recent years, mainly for students.

iv. Academic institution. Although they are part of large public universities, and are located in cities with active business environments, some particularities are present.

- Science and engineering resources. Academic institutions have a large volume of resources that come from projects, agreements and contracts with private companies, multilateral institutions and government agencies.
- Quality of the faculty. All professors have at least a doctoral degree. In COPPE UFRJ, 100% of them are full time; in POLI USP, only 74%.
- Leadership and supporting policies. Despite the fact that both leaders acknowledge the importance of academic entrepreneurship and the role played by spin-offs, POLI has no specific supporting policies, while COPPE does.
- Organizational characteristics. At COPPE UFRJ, the support to spin-off companies is well structured. There are supporting programs, whose policies are put into operation by a foundation, through specific contracts and regulations. At POLI USP,

we could not identify specific structures or tools for using USP facilities, such as the campus business incubator.
- Entrepreneurial orientation. It refers to the culture that strengthens attitudes and entrepreneurial behavior among its members. COPPE UFRJ has defined actions toward the support of academic entrepreneurship, while POLI USP has not. In both institutions, culture is still not completely formalized.
- Knowledge accumulated in spin-offs. While the trajectory of POLI USP regarding spin-offs dates back to the 1970s, the trajectory of COPPE UFRJ is more recent, regarding the rise of the offshore oil and gas business.

v. Laboratories. The laboratories are similar, regarding the degree of excellence of the program. Four of the eight programs to which laboratories are related scored 6 or 7 in the 2017 CAPES evaluation. The other four programs scored at least 4. The eight laboratories that generated successful spin-offs have strong relationships with companies through contracts and agreements.

The second objective was (b) To identify concepts of success for the several players involved with the creation and development of university spin-offs. For university actors we found in our interviews that:

> The successful spin-off company is the one that has continuity, transferring knowledge from the university to the society, generating innovation, creating value and accomplishing its mission.

In other words, the dimension "continuity" was incorporated, as well as "innovation as a process" and "value creation". For spin-off entrepreneurs, the definition found in the interviews is similar to that in the literature:

> The successful spin-off company presents high revenues, is recognized by the market, has stability and financial security, while accomplishing its mission.

With regard to the third objective, (c) To validate the growth model for Brazilian university spin-offs, it was not possible to identify a growth pattern; this is a research area that should be deepened in future studies. One of the outcomes of this study is that the adherence to specific

models regarding the dynamics of spin-offs, such as the stages of development of spin-outs and critical junctures (Vohora et al., 2004), seems to be more adequate to planned spin-offs; the "Stages Model" (Helm & Mauroner, 2007) seems to be more adequate to companies that need resources from external investors. In the analysis of the model "technological knowledge and company growth" (Clarysse et al., 2011), the dimensions "scope" and "relationship with the laboratory" indicate a potential successful relationship.

The fourth objective was (d) To identify the obstacles to the success of Brazilian university spin-offs. The firms analyzed are successful and overcame obstacles to grow, internal obstacles (related to insufficient marketing competencies, difficulties with partners, lack of internal structure and products and processes not sufficiently developed) and external obstacles (absence of a classic customer, markets that are afraid of innovation, difficulties regarding regulations, unsustainable market prices).

At last, the fifth objective, (e) To identify the process and the role played by the entrepreneur, was partially reached. Regarding the typology of the entrepreneurial process (Sarasvathy, 2001), we observed that in three out of the eight cases, that is in 37.5% of the firms, the entrepreneurship path was more adherent to the Effectuation vision; in other words, the resources changed the path, but not the final goal. 62.5% of the companies followed the Causation vision, in which the planning (a pre-defined objective) supports the choice of strategies to accomplish a goal.

The following evidence derived from the eight cases studied:

i. Five of them are born-global companies; in other words, they established activities abroad right from the beginning or a few years after their creation.
ii. Four of them are residents in innovation habitats; two of them in science parks and the other two in business incubators.
iii. They all innovate systematically.
iv. According to the universities, they are all successful companies: there is continuity, they transfer knowledge from the university to society, they generate innovation, create value and accomplish their mission.
v. 50% of them were spontaneously created; 50% were planned.
vi. The intensity of the involvement of spin-offs with the parent laboratories is high in planned companies.

vii. Regarding the entrepreneurial team, in three cases it was composed of researchers and professionals with market experience; in the other cases, it was formed by researchers.
viii. 50% of the companies from POLI had private investors, while none of the firms originated in COPPE received private investments.

11.4 Conclusion

The main conclusion is that all layers of the conceptual model presented here are related to the success of spin-offs; there is a potential relationship—to be explored in future studies—between the quality of the parent laboratory and the success of the spin-off; in addition, there was no adherence to any growth model.

As contributions for further academic studies, we point out that the theories explain part of the process, and some of them show inconsistencies. We need studies that focus on successful spin-offs, according to the regional context, business segment, academic institution and parent university, in order to identify the role played by the several actors that affect the performance of university spin-offs in different contexts. The research indicated that the academic institution and the laboratory where the company was created are microenvironments that are critical for the process of creation and development of spin-offs. It is important to emphasize the dynamic of these microenvironments. It is also relevant to approach the regulatory framework, as well as the behavior of the university and the academic institution for the support of academic entrepreneurship.

For innovation and technology policy makers, it is worth mentioning that the federal, state and municipal regulatory marks are incomplete, despite being favorable to spin-offs.

To managers and professionals of supporting organizations, such as incubators and science parks, we suggest getting close to academic institutions, entrepreneurship laboratories and Technology Transfer Offices (TTOs), keeping some permanent programs to attract entrepreneurship students to incubation environments, and to host spin-offs in science parks, using TTOs in processes of technology transfer.

Universities can encourage the emergence of planned spin-offs through several actions, such as:

i. Acknowledging the phenomenon and creating regulations that address the way of acting and supporting companies, and defining what a spin-off company really means.
ii. To have procedures and standardized legal documents for TTOs, and support foundations and academic institutions. Such mechanisms and tools must seek agility and have a minimum of bureaucracy, so that the commercial exploitation of knowledge is fair for the society, university, academic institution, inventors and the company.
iii. Knowledge and acknowledgment of created spin-off companies, as well as fostering successful cases.
iv. Establishment of clear policies and supporting programs for academic entrepreneurship.
v. To provide TTOs with the appropriate structure, processes and professionals compatible with the complex mission of managing innovation policies for the university, adjusting processes according to the needs of companies, spin-offs or not. Agility, terms and creative business proposals are characteristics to be looked after.
vi. To strengthen in TTOs the idea that the protection of intellectual creation is a necessary step for its exploitation. The intellectual property issue is critical for spin-offs due to the need for transparency, legitimacy and guarantee that—if the opportunity turns into a successful enterprise—the entrepreneur will have legal rights over the results. But the process of protection cannot prevent the transfer of technology and the development of spin-offs.
vii. To foster and support the strengthening of innovation environments, such as incubators and science parks.

For the parent academic institution, it is important to establish a relationship with companies in order to accomplish research and development projects, and to stimulate the creation of planned spin-offs by developing a regulation that defines how they will support the spin-off firms. It is also relevant to define a spin-off company, while establishing clear policies and support programs for academic entrepreneurship.

The eight cases studied were chosen due to the individual perception of success of the players. Our analysis took into account the perception of the players from the university and from the spin-off companies. It is important to notice that the interviewees are both political actors that work at the university and spin-off entrepreneurs.

This study analyzed successful spin-offs in Brazil and tried to increase knowledge about this phenomenon. The creation of spin-offs and the provision of the necessary conditions for development is a way for a university to fulfill one of its missions, the transfer of knowledge for the society's benefit through the provision of goods and services, stimulating the economic dynamics of the region.

The foundations already exist. We need to develop, improve and strengthen the construction of favorable environments for successful spin-offs creation, including programs, coordinated actions, complementing and adjusting the existing regulations. Today's improvements, actions and policies will influence the entrepreneurial culture of organizations and regions, which, in turn, will enable the establishment of a virtuous development dynamics.

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Index

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