

LEAN STARTUP FOR OPPORTUNITY EXPLOITATION: ADOPTION CONSTRAINTS AND STRATEGIES IN TECHNOLOGY NEW VENTURES

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LEAN STARTUP FOR OPPORTUNITY EXPLOITATION: ADOPTION CONSTRAINTS AND STRATEGIES IN TECHNOLOGY NEW VENTURES

Abstract

Purpose: Most studies investigating the adoption of Lean Startup (LS) practices by technology new ventures focus on software startups in mature entrepreneurial ecosystems and disregard their applicability for opportunity exploitation in other technological backgrounds. This study contributes to this research stream by exploring how Brazilian technology new ventures (in different technological fields) tentatively adopt LS to exploit opportunities, and whether LS is suitable to their emerging economy context.

Design/methodology/approach: The authors adopt an exploratory multiple-case study based on qualitative data collection and analysis of nine Brazilian biotechnology, engineering, and software startups.

Findings: The study shows how technology new ventures tackle the activities of opportunity exploitation – namely, developing a product or service, acquiring human resources, gathering financial resources, and setting up the organization – by leveraging LS tools and practices for business model validation; also, it identifies six contextual constraints hindering the systematic adoption of LS and reveals how technology new ventures cope with such constraints in their early stages by integrating LS with complementary strategies and practices. Furthermore, the study reveals that the systematic and comprehensive adoption of LS nurtures the development of an entrepreneurial experimental capability to explore opportunities in a quasi-scientific and hypothesis-driven fashion.

Originality/value: The study investigates how Brazilian engineering, biotechnology, and software startups exploit opportunities and overcome constraints to business model validation through the combined adoption of LS and complementary strategies and practices, and provides a set of propositions to guide future research.

Keywords

Lean Startup; Business model innovation; Technology entrepreneurship; Minimum viable product; Entrepreneurial experimental capability; Emerging economy.

Introduction

We are currently experiencing the emergence and prominence of what has been dubbed startups, i.e., technology new ventures operating with low resources and under extreme risks, aiming at finding a business model that is both repeatable and scalable (Blank, 2013; Clarysse and Bruneel, 2007). Entrepreneurs running startups generally identify (or are exposed to) opportunities, and then engage in an opportunity-exploitation process (Alvarez and Barney, 2007) attempting to reach sustained and profitable stages in their business development (c.f. Picken, 2017).

To support these technology new ventures in their non-traditional settings, the Lean Startup (LS) proposes a set of practices to test and validate ideas and products through experimentation, thus responding more rapidly to market shifts. LS is increasingly getting the attention of practitioners and large organizations (Ganguly and Euchner, 2018; Power, 2014; Ries, 2017), as well as scholars striving to understand its origins, the entrepreneurial cognitions behind the approach and its impacts on entrepreneurs and business performance (Bortolini *et al.*, 2018; Mansoori, 2017; Shepherd and Gruber, 2020).

LS is centered on experimentation and hypothesis-driven practices, and its main principle lies in rapidly learning from failure (Ries, 2011, 2017), a line of inquiry long addressed by esteemed journals (Cope, 2011; Espinoza-Benavides and Díaz, 2019; Knott and Posen, 2005), and most recently again called upon (see Amankwah-Amoah and Wang, 2019; Omorede, 2020). Despite the increasing relevance of LS as a timely topic for technology entrepreneurship and business model innovation, extant research has largely explored its adoption among digital ventures, and scholars disregard the investigation of LS adoption and applicability in startups with technology backgrounds other than software (Silva *et al.*, 2019). This is particularly problematic considering the richness within the nexus of entrepreneurship and technology (c.f. Beckman *et al.*, 2012a).

Furthermore, the majority of studies investigating LS and technology new ventures are greatly concentrated in developed economies (Silva *et al.*, 2019). The context might constraint the development of technology new ventures (Amankwah-Amoah and Hinson, 2019) and scholars have long underscored the importance of investigating business performance in both developed and developing economies (Chacar and Vissa, 2005; Hoskisson *et al.*, 2000). More specifically in the Latin American context, Brazil stands out regarding its innovative behavior, leading the region in several manufacturing and innovation indicators (Frank *et al.*, 2016; Olavarrieta and Villena, 2014). Despite its relevance, the Brazilian startup ecosystem is still largely understudied.

Drawing on the above discussions, the research questions this study sets forth are: *how do LS (and LS-related) practices support opportunity exploitation in technology new ventures? And how does the Brazilian context affect the impact of LS practices on opportunity exploitation?* This study contributes to both theory and practice by exploring how LS practices assist Brazilian entrepreneurs (from three different technology fields) in exploiting opportunities. Based on an exploratory multiple-case study, the contributions of the present study are threefold: (i) we conclude that LS supports entrepreneurs in the process of opportunity exploitation and development of entrepreneurial experimental capabilities; (ii) we identify contextual constraints that may impose limitations to the extent to which LS is applicable in different technology fields; and (iii) we provide a set of propositions concerning LS adoption and the development of entrepreneurial experimental capabilities for opportunity exploitation.

The following section presents the theoretical streams in which the study is positioned. Next, the paper presents the research setting, as well as data collection and analysis. The empirical analysis and results follow the research method section. Finally, the

authors present the discussion of the findings, the conclusions with the study's contributions and limitations, and avenues for future research.

Theoretical Background

Opportunity exploitation and technology entrepreneurship

There is a vast literature addressing different sorts of sources from which entrepreneurs discover or create opportunities and engage in entrepreneurial action (Alvarez and Barney, 2007). The economist Israel Kirzner, of the Austrian School of economic thought, is one of the precursors of the discovery theory of entrepreneurship and he advocates the arbitrage-based approach to entrepreneurship, in which entrepreneurs do not necessarily search for opportunities; instead, they must nurture alertness for such opportunities to be discovered spontaneously (Kirzner, 1973, 1997). By contrast, whereas arbitrage concerns negotiating in existing markets, innovating and introducing new products involves market creation, including a new source of uncertainty for the entrepreneur (Wadeson, 2013). Hence, modern literature on entrepreneurship has also considered the previously disregarded processes of learning and adaptation, providing an alternative theoretical framework to the discovery lens, termed the creation theory of entrepreneurship (Alvarez and Barney, 2007; Gartner, 1985; Wadeson, 2013). According to the *creational* perspective, opportunities are not formed by exogenous shocks to an industry or market, nor are they necessarily derived from pre-existing industries; rather, opportunities are social constructs endogenously created by actions of entrepreneurs (Alvarez and Barney, 2007; Sarasvathy, 2001; Wadeson, 2013). More recently, extant literature has underscored the importance of regional competitiveness and university proximity to entrepreneurial activity by addressing the knowledge spillover theory of entrepreneurship (Acs *et al.*, 2013; Agarwal *et al.*, 2007). Firms and entrepreneurs can benefit from knowledge spillovers as a source of entrepreneurial opportunities.

Regardless of the source of the entrepreneurial opportunity, entrepreneurship comprises the “identification and exploitation of previously unexploited opportunities” (Hitt *et al.*, 2001, p. 480). Thus, opportunity recognition and exploitation are distinct aspects in the entrepreneurial process (Jarvis, 2016). As such, the essence of opportunity exploitation lies in refining competencies, technologies, and paradigms, and is heavily grounded in the acquisition of knowledge (Corbett, 2005; March, 1991; Sirén *et al.*, 2012). Recently, Kuckertz *et al.* (2017) discussed several issues within entrepreneurship literature stemming from unclear definitions concerning opportunity recognition and exploitation, and they put forth more explicit content domains regarding both concepts. Following their work, the present study acknowledges opportunity exploitation as “characterized by developing a product or service based on a perceived entrepreneurial opportunity, acquiring appropriate human resources, gathering financial resources, and setting up the organization” (Kuckertz *et al.*, 2017, p. 92).

Despite existing studies emphasizing the importance of integrating entrepreneurial and strategic thinking, underscoring how capabilities are critical for exploiting business opportunities (Agarwal *et al.*, 2010; Hitt *et al.*, 2001; Liao and Phan, 2016), these and other issues are surprisingly underexplored in the context of technology entrepreneurship (Lamine *et al.*, 2018). In this regard, technology entrepreneurship draws on the fields of entrepreneurship and technology-based innovation (Beckman *et al.*, 2012a), and it is critical to economic progress and regional transformation (Schumpeter, 1943; Venkataraman, 2004). Despite its positive impacts on national and regional levels, technology entrepreneurship comprises peculiarities and imposes several challenges, such as (but not limited to) design, implementation and measurement of supportive public policies (Brown and Mason, 2014; Dalmarco *et al.*, 2018), acquisition of competencies and strategic articulation (Prahalad and Hamel, 1990; Zahra, 1996), coordination of teams in high-technology environments

(Puranam *et al.*, 2006), and major concerns regarding the delivery of timely payoffs to investors (Islam *et al.*, 2018; Walsh *et al.*, 2002).

The mechanisms by which entrepreneurs shape technology new ventures are often contingent on several factors, such as institutional characteristics of the national economy or its industry sector (Beckman *et al.*, 2012b). Research on technology entrepreneurship has grown over the past few years, but many issues regarding opportunity exploitation remain overlooked. For instance, the very recent work of Yusubova *et al.* (2020) sheds light on how team formation evolves in technology new ventures according to changes related to technological knowledge needs; nevertheless, approaches used to generate revenues or environmental contingencies influencing strategies adopted by technology ventures in the opportunity exploitation lay outside their scope and aims, which are still needed (Bailetti, 2012; Mosey *et al.*, 2017). Hence, this study argues that a pragmatic approach that experienced a significant adoption in mature entrepreneurial ecosystems (i.e., Lean Startup) should be considered a relevant methodology to assist startups in exploiting opportunities and developing entrepreneurial experimental capabilities.

Lean Startup

The Lean Startup (LS) methodology is a set of processes and approaches derived from the application of lean principles (see Lean Enterprise Institute, 2019; Womack and Jones, 1997) to entrepreneurship, targeted at improving the way companies are developed and new products are launched through disciplined entrepreneurship. Eric Ries (2011) proposed LS aiming at eliminating waste often found in product and business development processes in startups, and assisting entrepreneurs at validating assumptions and cease activities with no value creation (Bortolini *et al.*, 2018; Frederiksen and Brem, 2017).

As Ries (2011) states, a startup is a catalyst that transforms ideas into products. To assist entrepreneurs, LS proposes a three-step process called Build-Measure-Learn (BML) loop. The Build phase is started quickly with the deployment of a minimum viable product (MVP), a version of the product with minimum amount of effort, although comprising a set of viable functionalities, that will allow the entrepreneur to measure its impact on the market, test fundamental hypotheses and get customer feedback in early stages. During the Measure phase, the challenge lies in determining whether the product development efforts are being effective by tracking actual customer behavior when interacting with the MVP based on a set of preordained relevant metrics. Finally, the BML loop completes with a reflection by the entrepreneur, who learns from the experimentation performed and has to decide whether to change the original business model based on customer feedback, persevere or drop it all together (Ries, 2011). This change in one or more elements of the business model is also known as *pivot*, and the organization can pivot shifting small features of the product or conducting significant changes in the whole project.

Although the BML loop may seem simple, LS is fundamentally based on a scientific method for developing hypothesis-driven entrepreneurship and innovation (Eisenmann *et al.*, 2011). Thus, it requires crucial attention during the definition of the assumptions to be tested. In the BML loop, each business model element is tested employing falsifiable hypotheses, i.e., hypotheses generated starting from the original business idea that can be rejected based on experiments. A motto commonly associated to LS is *fail fast*, which assumes that failure fosters learning, and in the early stages of a startup it is preferable to realize as soon as possible that the business should be dropped, rather than stubbornly persevering with a wrong idea that burns scarce resources (Eisenmann *et al.*, 2011).

One of the core components of LS lies in using performance indicators and metrics to measure the continuous development process (Maurya, 2012). In this operation, startups can

benefit from early ongoing interactions with customers, increasing their chances to succeed without vast amounts of outside funding to launch their products (Trimi and Berbegal-Mirabent, 2012).

During the entrepreneurial activity, business model design and innovation are critical operationalization tools in the strategy-making processes (Cortimiglia *et al.*, 2016). In this regard, entrepreneurial capabilities refer to abilities to sense, shape, and exploit opportunities through specific heuristics for competitive advantage (Abdelgawad *et al.*, 2013; Zahra *et al.*, 2011). Following this reasoning, we call entrepreneurial experimental capabilities the technology new ventures' ability to exploit opportunities in a quasi-scientific, hypothesis-driven, structured and rigorous fashion – as opposed to an overly complicated and often unsuitable planning approach (e.g. Ghezzi, 2019; Sarasvathy, 2001) or an unstructured, experiential trial and error process (e.g. Sosna *et al.*, 2010).

Recent literature has built connections between entrepreneurship theory and practice, advancing the understanding concerning the role of LS within discovery/creation theories of entrepreneurship, and investigating entrepreneurial cognitions behind its learning processes (Bortolini *et al.*, 2018; Contigiani and Levinthal, 2019; Ghezzi, 2019, 2020). Although LS has had a relevant impact on entrepreneurial research, most studies addressing LS are limited to investigating its application within digital startups located in developed regions (Silva *et al.*, 2019). This narrowed focus brings relevant implications.

First, in technology entrepreneurship, developments in science or engineering constitute core elements of the opportunity enabling the rise of a new venture or market (Beckman *et al.*, 2012a). Thus, studies investigating LS applicability should explore startups pertaining to fields beyond the digital domain.

Second, emerging economies generally comprise rapid-pace development countries with governmental policies favoring economic liberalization (Wright *et al.*, 2005). Scholars

have underscored the importance of such contexts, also investigating business performance in both developed and developing economies (Chacar and Vissa, 2005; Hoskisson *et al.*, 2000; Vissa and Chacar, 2009). These emerging economies are experiencing significant institutional transformations, with both opportunities and challenges for entrepreneurial firms (Boso *et al.*, 2013). Additionally, emerging economies account for a large proportion of populations in the “base-of-the-pyramid” with obstacles related to literacy, numeracy and cognition, which entail limited new product adoption and market consumption (Nakata and Weidner, 2012). Consequently, this scenario also presents relevant opportunities for entrepreneurship research, which is still limited, since these locations remain outside the typical focus of entrepreneurship scholars (Bruton *et al.*, 2008; Xu and Meyer, 2013; Yamakawa *et al.*, 2013).

Although all startups are intrinsically immersed in volatility, the risks are higher for ventures located in less developed regions, since “the environmental uncertainty is a major characteristic of emerging economies” (Yu *et al.*, 2018, p. 2). Furthermore, the context of emerging economies also challenges some assumptions of theories originally developed for mature economies (Xu and Meyer, 2013). By investigating technology new ventures in the Brazilian context, we shed light on LS applicability beyond software startups, as well as its adoption in different contexts and settings.

Research Methods

Research setting and cases’ selection: entrepreneurship in Brazil

The substantial growth potential of emergent economies in the global market has been strongly represented by the evolution of those countries summarized in the BRIC acronym, initially coined in a report by Goldman Sachs in 2003, and recently expanded to BRIICS, comprising Brazil, Russia, India, Indonesia, China and South Africa (Sengupta *et al.*, 2018).

More specifically in the Brazilian context, the creation, development, and consolidation of Science Parks are increasing in the last years. In a report developed by the Technological Development Center of the University of Brasília and the Brazilian Ministry of Science, Technology, Innovation and Communication, between years 2000 to 2013, the country has gone from 10 to 94 Science and Technology Parks (STPs) initiatives (CDT/UnB, 2014). Those STPs are important articulators for local and regional innovation systems, as well as inductors of qualification in degraded areas of large Brazilian urban centers (Zouain and Plonski, 2015).

In a national context, the Rio Grande do Sul state, in Southern Brazil, stands out for ranking fourth in the national GDP, housing 25 universities and federal institutes with about 53.3 thousand researchers (CDT/UnB, 2014). In terms of technology-based ventures, the state is home to a number of 150 digital startups, mostly located in the metropolitan region of Porto Alegre, the state's capital (SEBRAE, 2016).

Porto Alegre is ranked seventh in a recent report revealing the best 32 Brazilian cities for entrepreneurs (Endeavor, 2015), and its metropolitan region houses three relevant STPs: Zenit, Tecnopuc, and Tecnosinos. The STPs arise from federal and private educational institutes with importance in both regional and national settings. Zenit, Tecnopuc, and Tecnosinos foster research and technology-based innovation bolstering startups on fields such as Information and Communication Technology, Engineering, Biotechnology, Energy and Creative Industry. Additionally, the STPs are home to global-leading-companies like SAP, HP, and Huawei.

One can observe recent gradual efforts concerning the development of innovation and entrepreneurship studies in Brazil acknowledging its relevance as an emerging player (e.g. Fernandes *et al.*, 2019; Frank *et al.*, 2016; Gomes *et al.*, 2018). Nevertheless, the difficulties faced by Brazilian entrepreneurs driving technology new ventures lay outside the scope of the

extant literature, representing an important gap that needs to be backed by empirical investigation.

This study aims at extending theory using a multiple-case study (Eisenhardt and Graebner, 2007). In this regard, qualitative research is particularly suitable and favorable in the early stages of theorizing as it provides open-ended data, and allows detailed analyses of complex processes (Graebner *et al.*, 2012; Langley, 1999). Unlike other research strategies, case studies are not intended for predictions about statistical relationships and frequencies, but to gain new and useful insights on a contemporary phenomenon (Yin, 2014).

For the present study, the authors selected nine technology new ventures within Zenit, Tecnopuc and Tecnosinos STPs in Porto Alegre metropolitan region. The cases were selected through theoretical sampling, due to their particular suitability to illuminate and extend relationships and logics among constructs (Eisenhardt and Graebner, 2007; Sigglekow, 2007). Although empirical qualitative research has limitations in providing generalization reasoning, the authors collected data from ventures on similar fields, but in different environments, which enables a possible cross-case analysis, as well as ensures external validity and replication logic, central to building theory from case studies (Eisenhardt, 1989; Yin, 2014). In this regard, Patton (2014) identifies 40 purposeful sampling strategies organized within eight categories. In this paper, we adopted the sensitizing concept strategy (Patton, 2014) within the theoretical sampling (Eisenhardt and Graebner, 2007) category. Thus, the authors selected informant-rich cases that illuminate sensitizing concepts in the particular context (Patton, 2014) of the inquiry.

The authors investigated startups on three main technology fields: software, engineering and biotechnology. Those fields were designated based on the range of projects covered by the STPs; also, in a recent annual report developed by the Innovation Research Interchange on R&D trends forecast, innovation leaders mentioned systems from these three

fields as most important technologies in the following years, with special attention to Big Data, artificial intelligence and machine learning, 3D printing, automation and robotics, nanotechnology and bioengineering, among others (Innovation Research Interchange, 2018). Furthermore, all startups selected were still struggling to pursue the ideal business model, and were still being incubated in a somewhat ‘stalemating’ condition, which afforded useful appraisal considering the objective of investigating the opportunity exploitation process in technology new ventures. To mitigate bias, the authors conducted stratified sampling drawing on the design of experiments (DOE). The study adopted a crossed factorial design (Montgomery, 2017), collecting data from the same number of startups in all combinations of the levels of the stratification variables: environment (Zenit, Tecnopuc, and Tecnosinos) and technology field (software, engineering and biotechnology). For each field, one startup was contacted and interviewed in each Science Park, resulting in three startups per STP.

The ventures' existence ranged from three to eleven years. The study did not select the startups based on time of existence, since the main definitions of startups do not consider age, but rather their volatile and risky environment, as well as their search for business model scalability and replicability (Blank, 2013; Cooper and Park, 2008). However, the authors selected startups that have supplanted the ideation phase, developing prototypes or with products/services already in the market.

Data collection and analysis

This study adopts an exploratory multiple-case study approach on qualitative data collection and analysis (Yin, 2014). The authors opted for qualitative research as it is useful for theory building (Eisenhardt and Graebner, 2007), and is best suited for understanding the informants' perspective of the world, addressing *how*, rather than *how many* questions (Pratt, 2009). Additionally, the multiple-case approach increases external validity, mitigates

observer bias, and provides a stronger base for theory (Eisenhardt and Graebner, 2007; Voss *et al.*, 2002; Yin, 2014).

The authors relied on three sources of data: direct observation, interviews, and archival material. First, the first author attended to meetings related to the design and analysis of market strategies in each of the investigated startups. The first author took field notes concerning how decisions were made about adjustments in the products/services, market segmentation, or financial resources.

Next, the authors conducted individual interviews using a semi-structured questionnaire. The objective was threefold: (i) to know the background of the respondents and their ventures, (ii) to explore how the entrepreneurs understand the practices used for the validation of business model elements, and (iii) to investigate strategies put forth by the entrepreneurs to gather financial resources for their ventures. Although theory-building research should start as close as possible to no theory under consideration and no hypotheses to test, it is admittedly “impossible to achieve this ideal of a clean theoretical slate” (Eisenhardt, 1989, p. 536). Nevertheless, the authors attempted to sustain a neutral perspective. Hence, the participants were not exposed to any pre-ordained relationship regarding theory or approach, such as LS adoption, opportunity exploitation, and the development of entrepreneurial experimental capabilities, before or during the investigation.

Prior to collecting primary data, the researchers conducted two pilot interviews with founders from digital and engineering-based startups (not included in the sample). This strategy allowed the study to improve the clearness of the research questions and confirm the potential to draw insightful discussions. The authors interviewed at least two founders per startup. In the context of entrepreneurial firms, organizational and individual learning are roughly equivalent given the firm’s relatively small number of people and limited structure

(Bingham and Eisenhardt, 2011; Kim, 1993; Zahra *et al.*, 2000); thus, the number of founders suffices the disclosure of logics and mechanisms within early-stage technology new ventures.

The interviews, which lasted between 30 minutes and 75 minutes, were recorded, fully-transcribed, and analyzed. If any information was still unclear and/or more data was needed, the informants were later contacted for clarification. The entrepreneurs were also asked to provide complementary materials which they felt were relevant to their startups' development. Thus, secondary data was gathered in the form of business plans, canvases, and press news, which resulted in thick descriptions of each technology new venture. Hence, all data were iteratively compared. When the authors spotted changes in business model elements during the analysis of archival material, the entrepreneurs were again interviewed to provide additional reflections on past experiences. Table 1 depicts the cases and the data sources used.

Case	Founding year	Short product/service description	Data sources	
			<i>Interviews</i>	<i>Observation and archival material</i>
I	2016	Dating application	Two interviews (two entrepreneurs)	<ul style="list-style-type: none"> • Initial business plans (420 pages); • Business model canvases (current and previous versions – 43 canvases); • Press news; • Field notes from meetings (98 pages).
II	2011	Custom applications for businesses	Two interviews (two entrepreneurs)	
III	2014	Rural management software	Four interviews (two entrepreneurs)	
IV	2008	Radiology solutions for diagnostic imaging processes in clinics and hospitals	Three interviews (two entrepreneurs)	
V	2011	R&D of biomolecules for agriculture, environmental, pharmaceutical, cosmetics, and oil and energy industries	Two interviews (two entrepreneurs)	
VI	2016	Consulting and service provider in the development of Intelligent Materials, nanotechnological additives, advanced raw materials, and development of new materials	Two interviews (two entrepreneurs)	
VII	2015	Design and installation of distributed microgeneration systems based on photovoltaic solar energy	Three interviews (three entrepreneurs)	
VIII	2013	Consulting and development of 3D prototypes, mock-ups and specific products to different industries	Four interviews (three entrepreneurs)	
IX	2016	Development of industrial thermal energy recovery systems	Two interviews (two entrepreneurs)	

Table 1. Brief description of the cases and data sources

For the content analysis, the study borrowed coding practices from the Grounded Theory (Glaser and Strauss, 1967; Strauss and Corbin, 2008), a methodology for understanding how actors interpret reality, allowing systematic work out of hypotheses and concepts in relation to data during the investigation (Glaser and Strauss, 1967; Suddaby, 2006). The authors executed a coding procedure based on *in vivo* and constructed codes (Strauss and Corbin, 2008) drawing on the nine cases. The authors conducted a first-order analysis (Van Maanen, 1974; Pratt, 2009), thoroughly coding information from the three sources of data. Such data triangulation increased construct validity by developing converging lines of inquiry with the multiple sources of information (Yin, 2014), imperative to a reliable and persuasive qualitative research with stronger substantiation of constructs (Eisenhardt, 1989; Sigglekow, 2007). The authors used the constant comparative method, iteratively contrasting and comparing to discern major concepts of interest (Clark *et al.*, 2010).

The authors grouped second-order themes that subsumed the first-order concepts, allowing the study to explain the patterning and view the data at a higher level of abstraction (Clark *et al.*, 2010; Glaser and Strauss, 1967; Van Maanen, 1974). In the third and concluding stage of the analysis, the authors grouped the second-order themes into three overarching dimensions: opportunity exploitation, entrepreneurial experimental capabilities, and LS adoption. The systematic coding procedure enabled data interpretation and categorization, which is key for detecting patterns and proceeding with theory building (Saldaña, 2013).

After the individual analysis of each case and identification of isolated elements, the authors executed a cross-case analysis to identify similarities, differences, and patterns among cases. The study retained the relationships replicated across most (or all) of the cases under analysis to provide a more robust and generalizable resulting theory (Eisenhardt and Graebner, 2007). Finally, the authors cycled among data (contrasting the results of the cross-

case analysis) and relevant literature to develop a final integrated theoretical framework; the present study employed the cases as illustration to make a valuable conceptual contribution (Sigglekow, 2007). Ventures' and respondents' names were changed to preserve anonymity¹.

Figure 1 shows the data structure for the findings in line with the methods previously presented. It illustrates the first-order concepts, second-order themes and the overarching dimensions that emerged from the analyses, including the opportunity exploitation, entrepreneurial experimental capabilities and the LS adoption. Figure 1 depicts the core concepts and their relationships, with no intention of indicating causality or to be a representative dynamic model in itself.

¹ The ventures identification, contacts and full descriptions of product/service were provided to the editorial board of this journal in order to assure the transparency of the data collection process.

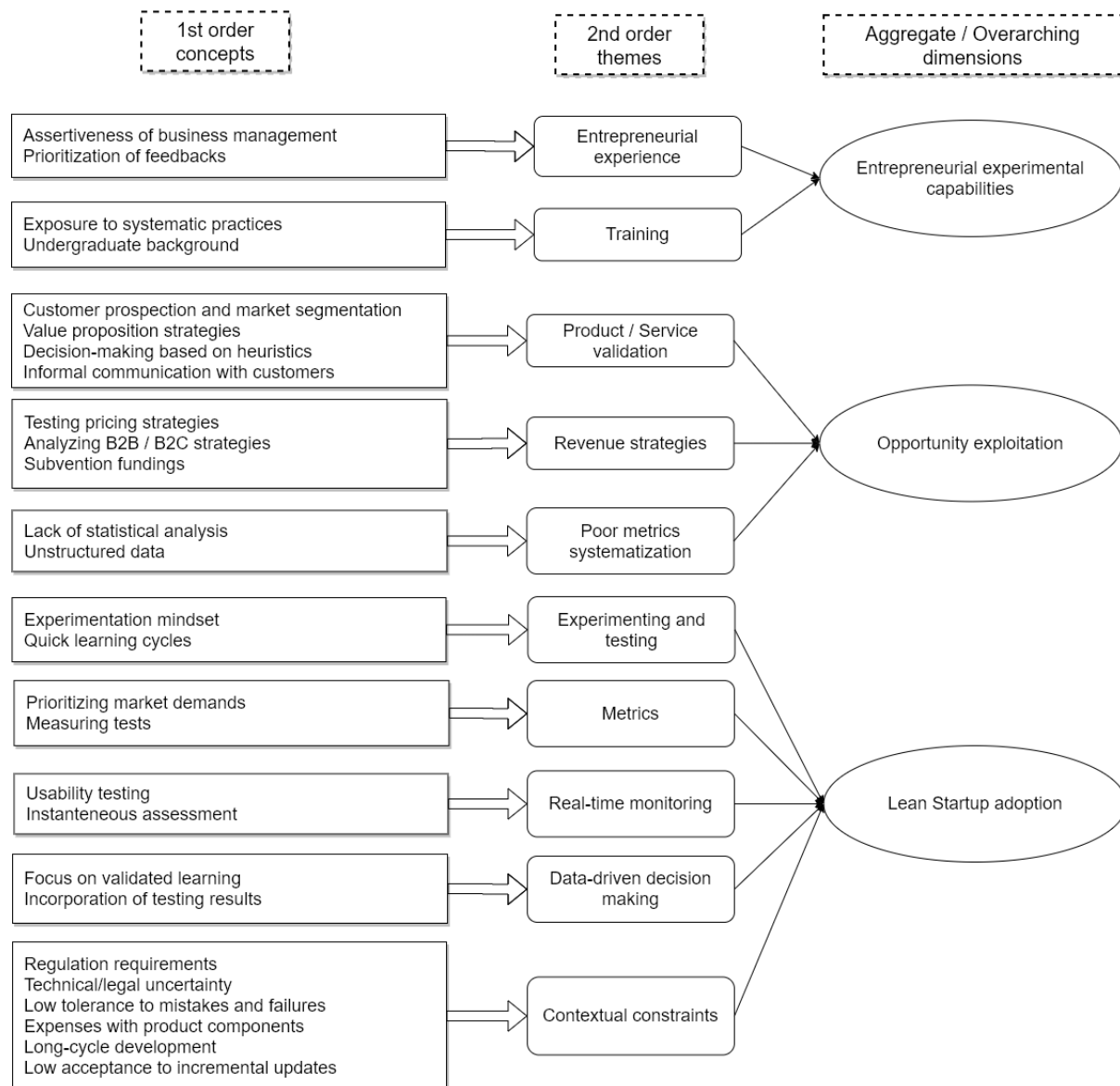


Figure 1 Data structure

The *modus operandi* of Brazilian technology new ventures

The authors identified different strategies adopted by the startups to exploit opportunities drawing on the different data sources provided. Table 2 summarizes the main practices each technology new venture made use of in their early stages.

Tools / Practices	Description	Biotechnology startups			Engineering startups			Software startups		
		B1	B2	B3	E1	E2	E3	S1	S2	S3
A/B testing	organization of customers into a <i>control group</i> using a <i>status quo</i> product, and a <i>treatment group</i> experiencing a product with one or more modified elements (Eisenmann et al., 2011)	-	-	-	-	-	-	X	-	X
Usability testing	observation of one or more participants performing specified tasks with a product in test environments	-	X	-	-	X	-	-	X	X
Structured surveys	use of fixed questions resulting in an amount of data in standardized form from a relatively large number of individuals	-	-	-	-	X	-	X	-	X
Informal interactions	casual approaches on which the observer gathers feedbacks	X	X	-	-	X	X	-	X	X
Market research	gathering of information related to target markets and/or customers	-	-	X	X	X	-	-	-	-
Business Planning	building a formal business plan outlining a summary of the venture's current state, as well as where the business intends to reach in the future	-	-	X	X	-	-	-	-	X
Lab-to-market	conducting technology translation while seeking market validation, mixing entrepreneurial strategies with the ability to discern the most promising innovations (c.f. Bazan, 2019; Windheim and Myers, 2014)	X	-	X	-	-	-	-	-	-
Stage-gate	product development with technology-driven gates (e.g. Cooper and Sommer, 2016)	-	-	-	-	-	X	-	-	-

Table 2. Validation tools and practices adopted by the startups

The findings are organized into four subsections comprising the three technology fields in which the investigated startups are based and one subsection disclosing commonalities in their opportunity exploitation. In each subsection, the authors present the context of the technology new ventures and briefly detail the strategies adopted by the entrepreneurs to exploit opportunities, also whether they made use of LS practices during their business development.

Biotechnology startups

During the investigation, the authors identified particularities constraining the biotechnology startups from adopting experimentation and gathering financial resources: “it is much harder to attract investments when you do not have the resources to produce an MVP or high numbers of customer traction, as in software businesses” (B3). The biotechnology startups investigated commercialized products with long development cycles and, although B2 was able to occasionally execute usability tests, none of the ventures fully adopted LS practices; nevertheless, the entrepreneurs pursued alternative strategies to raise investments, such as participating and gaining prizes in international fairs, which afforded some sort of recognition from the market and gave confidence to investors.

Other major issues faced by biotechnology startups relate to legal and technological uncertainties. The former refers to the lack of a solid legislation, and it was particularly latent when investigating the case of B1, which works with biodiversity molecules; according to the entrepreneurs, “the government still relies on existing provisional measures” (B1). Such a legal uncertainty directly entails fear on investors and subsequent difficulties in building and testing MVPs. To countervail this uncertainty, the startup resorted to exploiting alternative opportunities. Thus, while their product was under development, B1 made use of their biotechnology database to commercialize their knowledge to other organizations.

Finally, technological uncertainties also entailed concerns during the opportunity exploitation as they make the product development process more challenging. The statement retrieved from one of the interviews with B3 offers a compelling argument on this matter: “if you put 5 people in a room and 500 people in a gymnasium, you cannot foresee that the latter group is going to have the same behavior as the former one; there is no proportional rule, the behavior is not linear, and neither is our production.” Thus, this hurdle calls for extra risks regarding production and business model scalability.

Engineering startups

Similar to the biotechnology startups, the engineering startups also face challenges regarding long development cycles in their product development process; nevertheless, the investigation of the cases revealed additional concerns related to this matter and, consequently, to the stage of opportunity exploitation. In the case of the engineering-based ventures, the entrepreneurs struggle with delays between identifying the customers’ needs and designing and manufacturing products to meet those needs. Furthermore, E3 revealed that incremental updates are not well-received by their clients because they commercialize expensive machinery assets: “digital applications are allowed to have quick updates, but machines are not. If I try to sell a second updated version of a machine in a short period, my client will ask me why I previously delivered a version without the improvements.”

The market segmentation in which the entrepreneurial opportunity is pursued also brings further implications on the strategies adopted to exploit it. E1 and E3 have the heavy industry as a major client and the entrepreneurs had difficulties in conducting experiments with initial versions of the products. “I cannot conduct experiments in production lines without a minimum level of reliability so that my product will not compromise my clients’ performance. If I fail in the middle of the client’s production line, I’m doomed” (E3). This

requirement for a greater level of reliability was made explicit by E3, but also shared by the other engineering startups, which entailed in resistance from clients to conduct experiments, and led the entrepreneurs to adopt a process for product development that resembles the stage-gate approach, with in-between steps of technical assessments.

During the investigation, the authors observed a regulatory requirement obstructing the process of opportunity exploitation. Although some biotechnology startups shared this obstacle, it was more explicit in the cases of the engineering startups. These technology new ventures must make sure their tests and products are approved by not only the market, but also by ANVISA (Brazilian Health Regulatory Agency) and INMETRO (National Institute of Metrology, Quality and Technology), Brazilian agencies responsible for the observance of metrology and compliance policies, as well as sanitary control of products and services subject to health regulation and related environments. These obligatory approvals slow down the process of product development and the validation of business model elements: “to install a photovoltaic system in a residence, I have to formally request the electric utility to allow the installation, and I must obtain a technical responsibility note of the project signed by an engineer” (E2). Thus, bureaucracy and the need to comply with excessive regulation may also reduce the velocity of experimentation in technology new ventures.

Finally, the entrepreneurs revealed a different strategy adopted in the early stages of E1: the entrepreneurs structured a traditional business plan and applied in several calls for grants. E1 was selected to receive subvention investments, which supported the development of a new technology and, according to the entrepreneurs, served as a validation of their product.

Software startups

Contrary to the biotechnology and engineering startups, the investigated software startups did not face idiosyncratic constraints hindering the adoption of experimentation during their opportunity exploitation processes. Nevertheless, these particular technology new ventures demonstrated scattered adoption of LS or any other experimentation-driven practice (Table 2). More specifically, the entrepreneurs often adopted A/B testing and usability assessments when designing adjustments in their products, or to evaluate their market segmentation; however, none of these practices were adopted systematically or in a structured manner.

One of the reasons for the scattered adoption of the tools was explained by one of the entrepreneurs: “the software industry provides way too many agile tools, so we use a few (interchangeably) when we believe it is needed” (S2). By contrast, the entrepreneurs leading S1 did acknowledge the value of testing with customers beforehand and adopting agile practices; according to the entrepreneurs, the rationale underneath such practices and tools support the team in mitigating bias from initial assumptions; nevertheless, the startup does not implement the tools systematically.

In the investigation, S3 stood out by adopting a more comprehensive mentality towards hypothesis-driven experimentation, which was evident during validations of their business model elements. Nonetheless, according to the entrepreneurs, during the initial stages of their startup, the initial features of their product were built based on what the team believed was the best, and they barely performed experiments; then, during their incubation process, they became aware of LS practices: “we used to release features and observe what happened. Many things happened, and we could not trace the reasons [...] we built lots of things and we did not know what to measure, which feature was being effective and which was responsible for increases in the retention of users” (S3). During planning meetings, the

entrepreneurs still struggled to establish accurate metrics; even so, all the team emphasized their evolution and the importance of adhering to such an approach.

Heuristics in technology new ventures

Despite the startup S3 making use of hypotheses and experiments to develop their products, the entrepreneurs did not adopt the tools comprehensively (as depicted in Ries, 2011; Silva *et al.*, 2019). Six out of the nine startups revealed making use of casual situations to obtain feedback from customers (Table 2); that is, the entrepreneurs took advantage of personal networks and obtained feedback informally in occasional private gatherings. Finally, throughout the analysis of documents, the authors observed several pivots throughout the existence the startups; during the interviews, most of the respondents described executing these pivots *intuitively*, i.e., without explicit metrics to strongly support decisions.

Discussion

Lean Startup within different technology fields

Startups are generally conceived from an idea or problem observed by the entrepreneur, and then the business model designed around the idea is validated and structured as the technology venture matures; moreover, as startups are in continuous search for the best business model fit with their target market, it is natural that changes in its dimensions occur over time. The right business model rarely appears in early stages of ventures (Teece, 2010) and pivoting is neither a target, nor something to be feared and avoided, but entrepreneurs should have in mind that the most successful ventures are not the ones with a perfect business model, but those with flexibility that allows changes and readjustments (Eisenmann et al., 2011; Teece, 2018). Although pivots are not mandatory, they represent an evolution from the startup perception over its environment, since these shifts are obtained through strategic

learning resulting from opportunity exploration and exploitation (Hitt *et al.*, 2011; Sirén *et al.*, 2012).

Most of the investigated startups were not systematically adopting LS or other experimentation-driven practices; rather, they were relying on heuristics (i.e., intuition, unclear paths and casual attempts to problem-solving). By doing so, these technology ventures disregard the importance of building KPIs (Key Performance Indicators) and metrics to keep track of their startups' development. One risk of such attitude refers to premature scaling. LS assists entrepreneurs in *failing fast* (Ries, 2011), thus saving up scarce resources while learning from their own mistakes. Without such experimental business model validation, entrepreneurs run the risk of getting caught in their own overly positive vision about their startup future, and decide to start scaling up too early - by investing to make the startup grow in terms of people, organizational units, operations, and marketing spending. Any time the growth in CAPEX and OPEX is not matched by a superior growth in sales, resulting in a positive margin, the conditions for failure due to the condition known as "premature scaling" are created (Marmer *et al.*, 2012).

Despite the strategic literature underscores how business model experimentation is critical for technology new ventures survival under high levels of uncertainty (Andries *et al.*, 2013; Dyer *et al.*, 2008; Patel *et al.*, 2015), some startups still rely on informal interactions and investigations based on market research developed without real contact with customers. Entrepreneurs can reduce uncertainty to some extent by employing a research technique, but the benefits from testing products and searching for real feedbacks are far more reliable (Andries *et al.*, 2013; Eisenmann *et al.*, 2011).

Networking is fundamental in every business, and it may be crucial in the early stages. Global changes towards digitization and rapid-pace responses have forced organizations to invest time understanding customers (Euchner, 2017; Ganguly and Euchner, 2018; Power,

2014). However, entrepreneurs must be aware of the risk of biased feedback and take into consideration the effects of social influence on opportunity recognition (McAllister *et al.*, 2018). In this sense, Customer Development (Alvarez, 2014; Blank, 2007) or similar systematic customer-centric approaches can assist entrepreneurs in properly collecting and interpreting reliable feedbacks.

Technological contexts impose different challenges for the startups and may entail obstacles to the opportunity exploitation. Drawing on the findings, Figure 2 represents the constraints hindering LS adoption experienced by the startups in the study, namely: (i) regulation requirements; (ii) technology/legal uncertainty; (iii) contexts with low tolerance to failures; (iv) long-cycle product development; (v) manufacturing/development costs; and (vi) markets with low acceptance to incremental updates.

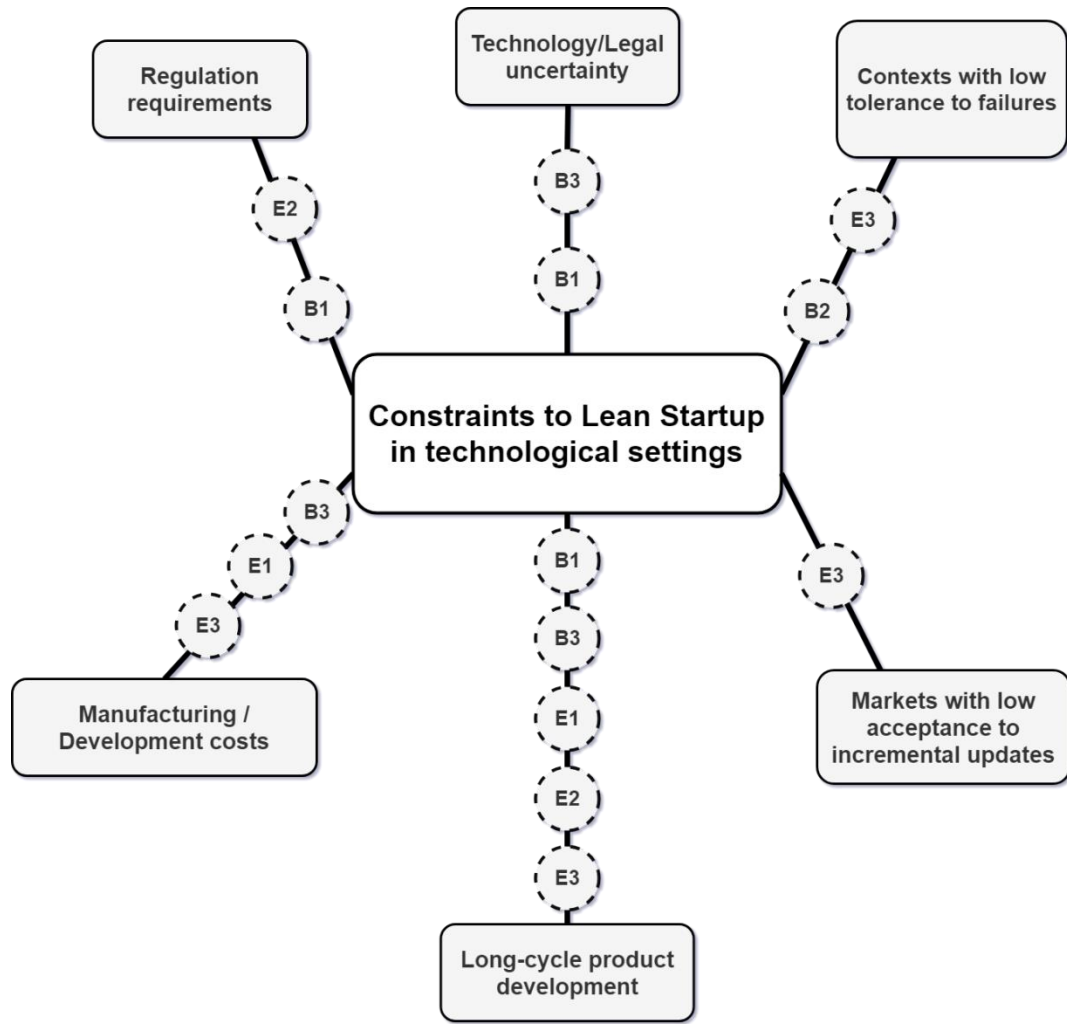


Figure 2 Constraints hindering Lean Startup adoption by startups.

Startups may face technology uncertainties leading to product development taking longer than expected or producing unpredicted results, also increasing scalability risks (Harms *et al.*, 2015; Holahan *et al.*, 2014; Kim and Vonortas, 2014). This obstacle was mostly perceived by the biotechnology startups and explicitly stated by B3, claiming their product development and scalability has “no proportional rule.” Furthermore, commercialization of emerging technologies calls for different regulations (Roca *et al.*, 2017). B1 and E3 reported difficulties concerning regulation requirements, legal uncertainty, and excessive bureaucracy, slowing the business model validation process and restricting LS adoption.

The investigation revealed two main hurdles that set the biotechnology and engineering startups apart from the software ventures: long-cycle product development and manufacturing costs. These obstacles have direct implications in MVP building and testing. Engineering breakthroughs or massive infrastructure deployment may pose a problem in highly-innovative entrepreneurial activities, as it diminishes the possibility of launching products early and often (Eisenmann *et al.*, 2011). Moreover, both biotechnology and engineering contexts entail more-expensive components when compared to software startups. This may represent a financial constraint, resulting in a lack of funds for innovation, and causing forego of technology purchase (Kaufmann and Tödtling, 2002; Staniewski *et al.*, 2016).

Technology new ventures often operate in volatile environments, as they typically offer innovative products and services. The constraints were experienced by one or more of the investigated startups from different backgrounds. The software startups investigated did not mention any contextual constraint that could hinder LS adoption; however, depending on the case, they can also be susceptible to some constraints. For instance, software startups operating in fields with low tolerance to mistakes (e.g., healthcare) may have to develop more refined MVPs or deal with limited experimentations. Hence, though these constraints emerged in non-digital technology ventures, we posit that such obstacles are not exclusive of biotechnology and engineering fields.

Cross-case analysis and propositions

The cross-case analysis among the ventures from different technology fields offered an overall view of the findings. Table 3 depicts the ventures' usage of the tools and the contribution of such tools in their particular processes of opportunity exploitation (Kuckertz *et al.*, 2017): (i) developing a product or service based on a perceived entrepreneurial

opportunity (e.g., Marion *et al.*, 2012); (ii) structuring a start-up team (Aldrich and Martinez, 2001); (iii) approaching investors, building networks and gathering financial resources from personal or external funding (Gartner *et al.*, 2012); and (iv) setting up formal organizational structures (Gartner *et al.*, 2010).

Validation tools/practices	Opportunity Exploitation				
		Developing a product or service	Structuring a start-up team	Gathering financial resources	Setting up the organization
	A/B testing	S1, S3		S1, S3	
	Usability testing	B2, E2, S2, S3		S2, S3	
	Structured surveys	E2, S1, S3			
	Informal interactions	B1, B2, E2, E3, S2, S3		B1, E2, E3, S2, S3	
	Market research	B3, E1, E2	B3, E2		
	Business Plan		B3	E1	B3, E1, S3
	Lab-to-market	B1, B3		B1, B3	B1, B3
	Stage-gate	E3	E3		

Table 3. Opportunity exploitation and validation tools and practices in technology new ventures

Our critical insight is that technology entrepreneurs adopt diverse practices to exploit opportunities. LS-related tools and practices—in the present cases, usability and A/B tests—primarily support developing a product or a service and gathering financial resources; by contrast, the other tools and practices supplement LS by supporting the remaining activities in the opportunity exploitation process. The empirics from the study afford additional contributions in the form of propositions and research agenda.

Literature reveals the major role of the economic and institutional context for boosting or hindering regional entrepreneurship (Del Giudice *et al.*, 2019; Stam, 2015). Despite different types of incubators/accelerators with specific *modus operandi* and strategies to foster new ventures exist (c.f., Bergek and Norrman, 2008; Hillemane *et al.*, 2019), there is growing evidence of their pivotal role in LS adoption. Ghezzi (2019) revealed that most

digital startups adopting LS mentioned incubators/accelerators, workshops, universities, and investors as their sources of information and training on the methodology. On this matter, the cross-case analysis revealed a pattern concerning the extent to which the entrepreneurs were aware of experimentation and its importance in their technology new ventures performances, regardless of the founders' backgrounds.

S3 revealed being exposed to business model validation methodologies for the first time during their first startup competition. Next, S3 founders also reported receiving training courses on LS practices in the subsequent incubation process, which assisted the team in systematizing its business model development. S1 and S2, by contrast, adopted validation practices interchangeably. Despite its limited adoption, S1 acknowledged benefits from the methodology. As to S2, the lack of comprehensive adoption is due to a large number of tools offered to digital startups; however, the startup does not implement any of the proposed methodologies systematically.

The study identified several (technological and institutional) constraints limiting LS adoption among technology new ventures (Figure 2). Despite not experiencing any of the previous contextual constraints, two out of the three investigated software startups disregard the systematic adoption of LS practices or other validation tools, which leads to the following proposition:

Proposition 1. Institutional and contextual constraints may hinder LS adoption among technology new ventures.

Strategy and entrepreneurship literature have long addressed the cognitive benefits of organizational learning (Bingham *et al.*, 2007; Bingham and Eisenhardt, 2011). Drawing on the psychology research developed by Ericsson *et al.* (1993), scholars have underscored the importance of structured and intense activities focused on the improvement of current performance, known as *deliberate practice*. In this sense, the engagement in such structured

efforts affords entrepreneurs enhanced capacity to assimilate new information with current knowledge and skills (Corbett, 2005), thus relating to entrepreneurial learning and venture performance (Baron and Henry, 2010).

Despite deliberate practice generating better performance in more predictable environments, “efforts to reduce ambiguity, such as obtaining accurate feedback (from oneself or others) or being socially astute enough to recognize which decisions/choices were responsible for their successful (or unsuccessful) selection and execution of influence behaviors may increase performance” (McAllister *et al.*, 2018, pp. 1942–1943). LS strongly advocates learning from failure, which provides higher-level outcomes, with revitalized awareness of the entrepreneurs' abilities and more sophisticated knowledge base (Cope, 2011). Additionally, LS offers structured and systematic means to iteratively validate business model elements and enhance the learning process directly from the market, dubbed by Ries (2011) as *validated learning*.

Drawing on the cases, most of the investigated technology new ventures rely on making decisions based on heuristics, intuition, and biased feedback. These startups have poor systematization of metrics and superficially use their data. B1, for instance, does not make use of structured metrics and costs. The entrepreneurs leading B2 admitted “occasionally” developing products based on the team members’ intuitions, and failing.

The software startups reported benefits from experimentation. Though randomly adopting LS practices, S1 and S2 admitted experimentation assisted the team in mitigating bias from their initial assumptions. S3, by contrast, adopts LS practices more comprehensively when compared to the other software startups, and the entrepreneurs confirmed that developing hypotheses and testing helped the team ending decisions based on beliefs and running the startup more assertively. The startup analyzes the user experience and systematizes the analysis of feedbacks.

Finally, the entrepreneurs running E2 reported that experimentation and usability tests increased their interpretation abilities to distinguish more reliable feedbacks. Based on these rationales, we introduce the following propositions:

Proposition 2. The systematic and comprehensive adoption of LS enhances the acquisition and development of entrepreneurial experimental capability to assist opportunity exploitation in technology new ventures.

Proposition 3. LS practices specifically support technology new ventures in the opportunity exploitation phases of developing a product or service and gathering financial resources in the pre-seed, seed and early stages of development.

LS has its origins in the software industry and has been largely studied within digital startups, with little attention to other technology-based ventures. Contextual constraints may hinder the comprehensive adoption of LS by different sorts of technology new ventures. Thus, startups experiencing contextual constraints may benefit from merging LS adoption with the traditional business planning (Delmar and Shane, 2003), the stage-gate approach (Cooper, 1990), simulations (when it is suited), or similar alternative approaches.

The investigated biotechnology and engineering startups provided relevant insights regarding their contexts. The authors observed issues concerning MVP construction, as well as business and production scalabilities due to technology uncertainty in the cases of B1 and B3. Moreover, the case of B1 disclosed great legal uncertainty regarding its collection and treatment of material from the Brazilian biodiversity, which slowed product development and business model validation processes. To overcome such hurdles, both B1 and B3 concentrated efforts in further developing their academic research and benefiting from it later on. As to B3, winning prizes and participating in international fairs were critical in catching the attention of investors. E3, by contrast, simultaneously collected feedbacks and adopted a process similar to the stage-gate approach. These strategies share similarities with the lab-to-

market roadmap for technology translation in university- based ventures (Bazan, 2019; Windheim and Myers, 2014), and stage-gate adaptations for technology developments (Cooper, 2006; Cooper and Sommer, 2016), in which companies develop technologies while observing market needs.

Finally, E1 developed a traditional business plan to apply for calls for grants, which they also considered as an approval of their business model validation. Based on these findings, we present the final propositions:

Proposition 4. Startups can develop entrepreneurial capabilities and undertake entrepreneurial activities by adopting approaches that integrate or substitute Lean Startup, depending on the constraints encountered.

Proposition 4 (a). Startups benefit in integrating the adoption of Lean Startup with adaptations of the lab-to-market or the stage-gate approach to counter the constraints of technology uncertainty, long-cycle product development, and contexts with low tolerance to failures.

Proposition 4 (b). Startups benefit in integrating the adoption of Lean Startup with business planning to attract investments and counter higher manufacturing/development costs.

Concluding remarks

This study originally explores how LS practices can support technology-based new ventures in exploiting opportunities notwithstanding contextual constraints that may arise. The authors conducted a multiple-case study with nine Brazilian ventures and identified contextual constraints that might hinder LS adoption among three different technology fields, namely: biotechnology, engineering and software.

The main theoretical contribution of the study, organized in a set of propositions, concerns the exploration of LS for the process of opportunity exploitation, in its main phases of developing a product or service, acquiring human resources, gathering financial resources and setting up the organization (Kuckertz *et al.*, 2017). This is particularly important as entrepreneurship research overly focus on addressing matters of “how much?” rather than “how?” when investigating new venture growth, and “addressing the how is critical because doing so can provide ventures a roadmap of the actions necessary to expand their operations quickly” (Shepherd and Patzelt, 2020, p. 1).

The findings showed how traditional LS tools and practices (Ries, 2011, Blank, 2013) mostly focus on supporting the development of new products and services as well as the gathering of financial resources phases of opportunity exploitation. However, contextual constraints hinder the adoption of LS, depending on the industry the technology new ventures operate in.

In order to cope with contextual constraints, our study reveals how startups integrate LS with complementary tools and practices, like market research, business planning, as well as variants of lab-to-market and the stage-gate approaches, which help them developing products and services, gathering financial resources, as well as setting up the organization in opportunity exploitation endeavors. Our findings did not reveal explicit links between LS adoption and the acquisition of human resources, which leaves room to further investigation of how startups may effectively and experimentally attract human capital.

Additionally, the study revealed that the comprehensive adoption of LS can assist entrepreneurs in the development of entrepreneurial experimental capabilities, since LS provides a systematic set of practices similar to the concept of deliberate practice, in which entrepreneurs benefit from structured efforts to enhance cognitive resources, and, hence, improve the overall venture performance.

Moreover, the study also offered practical results. The authors revealed how LS adoption may be limited among different sorts of technology fields due to the presence of contextual constraints inherent to some settings. The study identified six constraints hindering the systematic adoption of Lean Startup by the investigated technology new ventures, and revealed several strategies conducted by the startups to overcome barriers in their early-stages.

The study is not free of limitations, like any research striving to frame reality in a model. The authors adopted an exploratory qualitative approach, which has limitations regarding generalization. In an attempt to reduce this limitation, the authors collected data from ventures in similar fields, but in different STPs, which affords replication logic (Eisenhardt, 1989; Yin, 2014). Additionally, by adopting a multiple-case study, the study augmented the external validity and reduced the observer bias (Voss *et al.*, 2002). The qualitative nature of the research limits generalization of populations, but affords generalization of theoretical propositions (Yin, 2014). Nevertheless, the findings presented in the paper may be useful for technology new ventures (beyond the digital domain) pursuing repeatable and scalable business models. Also, entrepreneurial institutions (e.g. incubators, accelerators) may be aware of the critical role of disseminating Lean Startup practices for startups and entrepreneurial individuals.

The Brazilian emerging economy served as an underlying setting for the study. Two of the identified constraints to LS in technology new ventures relate to regulation and legal uncertainty. Previous research discussed excessive regulatory compliance acting as institutional barrier and leading to exit hazards for new entrants in emerging economies (Chang and Wu, 2014). Additionally, institutional support and environmental turbulence are closed linked to product innovation strategies in technology new ventures within transitional economies (Li and Atuahene-Gima, 2014). Thus, legal inefficiency can be seen as a type of

institutional uncertainty (Bylund and McCaffrey, 2017) and may hamper LS adoption among technology startups. Future research could explore additional strategies to overcome such constraints under environmental uncertainties in emerging economies (e.g., Bao *et al.*, 2020).

The study investigated LS adoption by Brazilian technology new ventures, responding to a recent call on the topic (c.f. Silva *et al.*, 2019) and shedding light on context influencing startup development (Amankwah-Amoah and Hinson, 2019; Tripathi *et al.*, 2019). Future studies should try to replicate the research on different and more mature settings, also employing quantitative approaches to generate statistical validation to the propositions.

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REFERENCES

- Abdelgawad, S.G., Zahra, S.A., Svejenova, S. and Sapienza, H.J. (2013), "Strategic leadership and entrepreneurial capability for game change", *Journal of Leadership and Organizational Studies*, Vol. 20 No. 4, pp. 394–407.
- Acs, Z.J., Audretsch, D.B. and Lehmann, E.E. (2013), "The knowledge spillover theory of entrepreneurship", *Small Business Economics*, Vol. 41 No. 4, pp. 757–774.
- Agarwal, R., Audretsch, D. and Sarkar, M.B. (2007), "The process of creative construction: knowledge spillovers, entrepreneurship, and economic growth", *Strategic Entrepreneurship Journal*, Vol. 1 No. 3–4, pp. 263–286.
- Agarwal, R., Audretsch, D. and Sarkar, M.B. (2010), "Knowledge spillovers and strategic entrepreneurship", *Strategic Entrepreneurship Journal*, Vol. 4 No. 4, pp. 271–283.
- Aldrich, H.E. and Martinez, M.A. (2001), "Many are Called, but Few are Chosen: An Evolutionary Perspective for the Study of Entrepreneurship", *Entrepreneurship Theory and Practice*, Vol. 25 No. 4, pp. 41–56.
- Alvarez, C. (2014), *Lean Customer Development*, O'Reilly Media, Sebastopol.
- Alvarez, S.A. and Barney, J.B. (2007), "Discovery and creation: alternative theories of entrepreneurial action", *Strategic Entrepreneurship Journal*, Vol. 1 No. 1–2, pp. 11–26.
- Amankwah-Amoah, J. and Hinson, R.E. (2019), "Contextual influences on new technology ventures: A study of domestic firms in Ghana", *Technological Forecasting and Social Change*, Vol. 143 No. June, pp. 289–296.
- Amankwah-Amoah, J. and Wang, X. (2019), "Business Failures around the World: Emerging Trends and New Research Agenda", *Journal of Business Research*, Vol. 98 No. May, pp. 367–369.
- Andries, P., Debackere, K. and Looy, B. Van. (2013), "Simultaneous experimentation as a learning strategy: business model development under uncertainty", *Strategic Entrepreneurship Journal*, Vol. 7, pp. 288–310.
- Bailetti, T. (2012), "Technology Entrepreneurship: Overview, Definition, and Distinctive Aspects", *Technology Innovation Management Review*, Vol. 2 No. 2, pp. 5–12.
- Bao, Y., Wei, Z. and Di Benedetto, A. (2020), "Identifying the Tacit Entrepreneurial Opportunity of Latent Customer Needs in an Emerging Economy: The Effects of Experiential Market Learning versus Vicarious Market Learning", *Strategic Entrepreneurship Journal*, available at: <https://doi.org/10.1002/sej.1350>.
- Baron, R.A. and Henry, R.A. (2010), "How entrepreneurs acquire the capacity to excel: insights from research on expert performance", *Strategic Entrepreneurship Journal*, Vol. 4, pp. 49–65.
- Bazan, C. (2019), "'From lab bench to store shelves': A translational research & development framework for linking university science and engineering research to commercial outcomes", *Journal of Engineering and Technology Management - JET-M*, Vol. 53, pp. 1–18.
- Beckman, C.M., Eisenhardt, K., Kotha, S., Meyer, A. and Rajagopalan, N. (2012a), "Technology Entrepreneurship", *Strategic Entrepreneurship Journal*, Vol. 6, pp. 89–93.
- Beckman, C.M., Eisenhardt, K., Kotha, S., Meyer, A. and Rajagopalan, N. (2012b), "The role of the entrepreneur in technology entrepreneurship", *Strategic Entrepreneurship Journal*, Vol. 6 No. 3, pp. 203–206.
- Bergek, A. and Norrman, C. (2008), "Incubator best practice: a framework", *Technovation*, Vol. 28 No. 1–2, pp. 20–28.
- Bingham, C.B. and Eisenhardt, K.M. (2011), "Rational heuristics: the 'simple rules' that strategists learn from process experience", *Strategic Management Journal*, Vol. 32 No. 13, pp. 1437–1464.

- Bingham, C.B., Eisenhardt, K.M. and Furr, N.R. (2007), "What makes a process a capability? Heuristics, strategy, and effective capture of opportunities", *Strategic Entrepreneurship Journal*, Vol. 1 No. 1–2, pp. 27–47.
- Blank, S.G. (2007), *The Four Steps to the Epiphany*, 2nd ed., Cafepress.com, San Francisco.
- Blank, S.G. (2013), "Why the Lean Start Up Changes Everything", *Harvard Business Review*, Vol. 91 No. 5, p. 64.
- Bortolini, R.F., Cortimiglia, M.N., Danilevicz, A.D.M.F. and Ghezzi, A. (2018), "Lean Startup : a comprehensive historical review", *Management Decision*, available at: <https://doi.org/10.1108/MD-07-2017-0663>.
- Boso, N., Story, V.M. and Cadogan, J.W. (2013), "Entrepreneurial orientation, market orientation, network ties, and performance: Study of entrepreneurial firms in a developing economy", *Journal of Business Venturing*, Vol. 28 No. 6, pp. 708–727.
- Brown, R. and Mason, C. (2014), "Inside the high-tech black box: A critique of technology entrepreneurship policy", *Technovation*, Vol. 34 No. 12, pp. 773–784.
- Bruton, G.D., Ahlstrom, D. and Obloj, K. (2008), "Entrepreneurship in emerging economies: where are we today and where should the research go in the future", *Entrepreneurship Theory and Practice*, No. January, pp. 1–14.
- Bylund, P.L. and McCaffrey, M. (2017), "A theory of entrepreneurship and institutional uncertainty", *Journal of Business Venturing*, Vol. 32 No. 5, pp. 461–475.
- CDT/UnB. (2014), *Estudo de Projetos de Alta Complexidade: Indicadores de Parques Tecnológicos*, available at: http://www.cdt.unb.br/pdf/programaseprojetos/parquetecnologico/Estudo_PNI_Completo.pdf.
- Chacar, A. and Vissa, B. (2005), "Are emerging economies less efficient? Performance persistence and the impact of business group affiliation", *Strategic Management Journal*, Vol. 26 No. 10, pp. 933–946.
- Chang, S. and Wu, B. (2014), "Institutional barriers and industry dynamics", *Strategic Management Journal*, Vol. 35 No. 8, pp. 1103–1123.
- Clark, S.M., Gioia, D.A., Ketchen, D.J. and Thomas, J.B. (2010), "Transitional identity as a facilitator of organizational identity change during a merger", *Administrative Science Quarterly*, Vol. 55 No. 3, pp. 397–438.
- Clarysse, B. and Bruneel, J. (2007), "Nurturing and growing innovative start-ups: the role of policy as integrator", *R&D Management*, Vol. 37 No. 2, pp. 139–149.
- Contigiani, A. and Levinthal, D. (2019), "Situating the construct of lean start-up: adjacent conversations and possible future directions", *Industrial and Corporate Change*, Vol. 28 No. 3, pp. 551–564.
- Cooper, R.G. (1990), "Stage-gate systems: a new tool for managing new products", *Business Horizons*, Vol. 33 No. 3, pp. 44–54.
- Cooper, R.G. (2006), "Managing technology development projects", *Research-Technology Management*, Vol. 49 No. 6, pp. 23–31.
- Cooper, R.G. and Sommer, A.F. (2016), "The Agile–Stage-Gate hybrid model: a promising new approach and a new research opportunity", *Journal of Product Innovation Management*, Vol. 33 No. 5, pp. 513–526.
- Cooper, S.Y. and Park, J.S. (2008), "The impact of 'incubator' organizations on opportunity recognition and technology innovation in new, entrepreneurial high-technology ventures", *International Small Business Journal*, Vol. 26 No. 1, pp. 27–56.
- Cope, J. (2011), "Entrepreneurial learning from failure: an interpretative phenomenological analysis", *Journal of Business Venturing*, Vol. 26 No. 6, pp. 604–623.
- Corbett, A.C. (2005), "Experiential Learning within the Process of Opportunity Identification and Exploitation", *Entrepreneurship Theory and Practice*, Vol. 29 No. 4, pp. 473–491.

- Cortimiglia, M.N., Ghezzi, A. and Frank, A.G. (2016), "Business model innovation and strategy making nexus: Evidence from a cross-industry mixed-methods study", *R and D Management*, Vol. 46 No. 3, pp. 414–432.
- Dalmarco, G., Hulsink, W. and Blois, G. V. (2018), "Creating entrepreneurial universities in an emerging economy: Evidence from Brazil", *Technological Forecasting and Social Change*, Vol. 135 No. March, pp. 99–111.
- Delmar, F. and Shane, S. (2003), "Does business planning facilitate the development of new ventures?", *Strategic Management Journal*, Vol. 24 No. 12, pp. 1165–1185.
- Dyer, J.H., Gregersen, H.B. and Christensen, C. (2008), "Entrepreneur behaviors, opportunity recognition, and the origins of innovative ventures", *Strategic Entrepreneurship Journal*, Vol. 2 No. 4, pp. 317–338.
- Eisenhardt, K.M. (1989), "Building Theories from Case Research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532–550.
- Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25–32.
- Eisenmann, T., Ries, E. and Dillard, S. (2011), "Hypothesis-Driven Entrepreneurship: The Lean Startup", *Harvard Business School Background Note 812-095*.
- Endeavor. (2015), *Índice de Cidades Empreendedoras, Endeavor Brasil*, available at: <http://info.endeavor.org.br/ice2015>.
- Ericsson, K.A., Krampe, R.T. and Tesch-Römer, C. (1993), "The role of deliberate practice in the acquisition of expert performance.", *Psychological Review*, Vol. 100 No. 3, pp. 363–406.
- Espinoza-Benavides, J. and Díaz, D. (2019), "The entrepreneurial profile after failure", *International Journal of Entrepreneurial Behavior & Research*, available at: <https://doi.org/10.1108/IJEER-04-2018-0242>.
- Euchner, J. (2017), "Advancing the state of the practice", *Research-Technology Management*, Vol. 60 No. 1, pp. 9–10.
- Fernandes, J., Mason, K. and Chakrabarti, R. (2019), "Managing to make market agencements: The temporally bound elements of stigma in favelas", *Journal of Business Research*, Elsevier, Vol. 95 No. February, pp. 128–142.
- Frank, A.G., Cortimiglia, M.N., Ribeiro, J.L.D. and Oliveira, L.S. de. (2016), "The effect of innovation activities on innovation outputs in the Brazilian industry: Market-orientation vs. technology-acquisition strategies", *Research Policy*, Vol. 45 No. 3, pp. 577–592.
- Frederiksen, D.L. and Brem, A. (2017), "How do entrepreneurs think they create value? A scientific reflection of Eric Ries' Lean Startup approach", *International Entrepreneurship and Management Journal*, Vol. 13 No. 1, pp. 169–189.
- Ganguly, A. and Euchner, J. (2018), "Conducting Business Experiments", *Research-Technology Management*, Vol. 61 No. 2, pp. 27–36.
- Gartner, W.B. (1985), "A conceptual framework for describing the phenomenon of new venture creation.", *Academy of Management Review*, Vol. 10 No. 4, pp. 696–706.
- Gartner, W.B., Carter, N.M. and Reynolds, P.D. (2010), "Entrepreneurial Behavior: Firm Organizing Processes", in Acs, Z.J. and Audretsch, D.B. (Eds.), *Handbook of Entrepreneurship Research*, 2nd ed., Springer, New York, NY, pp. 99–127.
- Gartner, W.B., Frid, C.J. and Alexander, J.C. (2012), "Financing the emerging firm", *Small Business Economics*, Vol. 39, pp. 745–761.
- Ghezzi, A. (2019), "Digital startups and the adoption and implementation of Lean Startup Approaches: Effectuation, Bricolage and Opportunity Creation in practice", *Technological Forecasting and Social Change*, Vol. 146 No. September, pp. 945–960.
- Ghezzi, A. (2020), "How Entrepreneurs make sense of Lean Startup Approaches: Business Models as cognitive lenses to generate fast and frugal Heuristics", *Technological*

- Forecasting and Social Change*, Vol. 161, available at: <https://doi.org/10.1016/j.techfore.2020.120324>.
- Del Giudice, M., Garcia-Perez, A., Scuotto, V. and Orlando, B. (2019), "Are social enterprises technological innovative? A quantitative analysis on social entrepreneurs in emerging countries", *Technological Forecasting and Social Change*, Vol. 148 No. November, available at: <https://doi.org/10.1016/j.techfore.2019.07.010>.
- Glaser, B.G. and Strauss, A.L. (1967), *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Aldine Transaction, New Brunswick.
- Gomes, L.A. de V., Salerno, M.S., Phaal, R. and Probert, D.R. (2018), "How entrepreneurs manage collective uncertainties in innovation ecosystems", *Technological Forecasting and Social Change*, Vol. 128 No. March, pp. 164–185.
- Graebner, M.E., Martin, J.A. and Roundy, P.T. (2012), "Qualitative data: Cooking without a recipe", *Strategic Organization*, Vol. 10 No. 3, pp. 276–284.
- Harms, R., Marinakis, Y. and Walsh, S.T. (2015), "Lean startup for materials ventures and other science-based ventures: under what conditions is it useful?", *Translational Materials Research*, Vol. 2 No. 3, pp. 1–8.
- Hillemane, B.S.M., Satyanarayana, K. and Chandrashekar, D. (2019), "Technology business incubation for start-up generation", *International Journal of Entrepreneurial Behavior & Research*, Vol. 25 No. 7, pp. 1471–1493.
- Hitt, M.A., Ireland, R.D., Camp, S.M. and Sexton, D.L. (2001), "Strategic entrepreneurship: entrepreneurial strategies for wealth creation", *Strategic Management Journal*, Vol. 22, pp. 479–491.
- Hitt, M.A., Ireland, R.D., Sirmon, D.G. and Trahms, C.A. (2011), "Strategic entrepreneurship: creating value for individuals, organizations, and society", *Academy of Management Perspectives*, Vol. 25 No. 2, pp. 57–75.
- Holahan, P.J., Sullivan, Z.Z. and Markham, S.K. (2014), "Product development as core competence: how formal product development practices differ for radical, more innovative, and incremental product innovations", *Journal of Product Innovation Management*, Vol. 31 No. 2, pp. 329–345.
- Hoskisson, R.E., Eden, L., Lau, C.M. and Wright, M. (2000), "Strategy in emerging economies", *Academy of Management Journal*, Vol. 43 No. 3, pp. 249–267.
- Innovation Research Interchange. (2018), "2018 R&D Trends Forecast", *Research-Technology Management*, Vol. 61 No. 1, pp. 23–34.
- Islam, M., Fremeth, A. and Marcus, A. (2018), "Signaling by early stage startups: US government research grants and venture capital funding", *Journal of Business Venturing*, Vol. 33 No. 1, pp. 35–51.
- Jarvis, L.C. (2016), "Identification, intentions and entrepreneurial opportunities: an integrative process model", *International Journal of Entrepreneurial Behavior & Research*, Vol. 22 No. 2, pp. 182–198.
- Kaufmann, A. and Tödtling, F. (2002), "How effective is innovation support for SMEs? An analysis of the region of Upper Austria", *Technovation*, Vol. 22 No. 3, pp. 147–159.
- Kim, D.H. (1993), "The link between individual and organizational learning", *MIT Sloan Management Review*, Vol. 35 No. 1, pp. 37–50.
- Kim, Y. and Vonortas, N.S. (2014), "Managing risk in the formative years: Evidence from young enterprises in Europe", *Technovation*, Vol. 34 No. 8, pp. 454–465.
- Kirzner, I.M. (1973), *Competiton and Entrepreneurship*, The University of Chicago Press, Chicago.
- Kirzner, I.M. (1997), "Entrepreneurial discovery and the competitive market process: An Austrian approach", *Journal of Economic Literature*, Vol. 35 No. 1, pp. 60–85.
- Knott, A.M. and Posen, H.E. (2005), "Is failure good?", *Strategic Management Journal*, Vol.

- 26 No. 7, pp. 617–641.
- Kuckertz, A., Kollmann, T., Krell, P. and Stöckmann, C. (2017), “Understanding, differentiating, and measuring opportunity recognition and opportunity exploitation”, *International Journal of Entrepreneurial Behavior & Research*, Vol. 23 No. 1, pp. 78–97.
- Lamine, W., Mian, S., Fayolle, A., Wright, M., Klofsten, M. and Etzkowitz, H. (2018), “Technology business incubation mechanisms and sustainable regional development”, *Journal of Technology Transfer*, Vol. 43 No. 5, pp. 1121–1141.
- Langley, A. (1999), “Strategies for Theorizing from Process Data”, *The Academy of Management Review*, Vol. 24 No. 4, pp. 691–710.
- Lean Enterprise Institute. (2019), “What is Lean?”, available at: <https://www.lean.org/WhatsLean/>.
- Li, H. and Atuahene-Gima, K. (2014), “Product Innovation Strategy and the Performance of New Technology Ventures in China”, *Academy of Management Journal*, Vol. 44 No. 6, pp. 1123–1134.
- Liao, Y.C. and Phan, P.H. (2016), “Internal capabilities, external structural holes network positions, and knowledge creation”, *The Journal of Technology Transfer*, Vol. 41 No. 5, pp. 1148–1167.
- Van Maanen, J. (1974), “The fact of fiction in organizational ethnography”, *Administrative Science Quarterly*, Vol. 24 No. 4, pp. 539–550.
- Mansoori, Y. (2017), “Enacting the lean startup methodology”, *International Journal of Entrepreneurial Behavior & Research*, Vol. 23 No. 5, pp. 812–838.
- March, J.G. (1991), “Exploration and exploitation in organizational learning”, *Organization Science*, Vol. 2 No. 1, pp. 71–87.
- Marion, T.J., Friar, J.H. and Simpson, T.W. (2012), “New product development practices and early-stage firms: Two in-depth case studies”, *Journal of Product Innovation Management*, Vol. 29 No. 4, pp. 639–654.
- Marmer, M., Herrmann, B.L., Dogrultan, E., Berman, R., Eesley, C. and Blank, S. (2012), *Startup Genome Report Extra on Premature Scaling*, *Startup Genome*, Vol. 1.2.
- Maurya, A. (2012), *Running Lean*, 2nd ed., O’Reilly Media, Sebastopol.
- McAllister, C.P., Ellen, B.P. and Ferris, G.R. (2018), “Social influence opportunity recognition, evaluation, and capitalization: increased theoretical specification through political skill’s dimensional dynamics”, *Journal of Management*, Vol. 44 No. 5, pp. 1926–1952.
- Montgomery, D.C. (2017), *Design and Analysis of Experiments*, 9th ed., John Wiley & Sons, Hoboken, NJ.
- Mosey, S., Guerrero, M. and Greenman, A. (2017), “Technology entrepreneurship research opportunities: insights from across Europe”, *Journal of Technology Transfer*, Vol. 42 No. 1, pp. 1–9.
- Nakata, C. and Weidner, K. (2012), “Enhancing new product adoption at the base of the pyramid: A contextualized model”, *Journal of Product Innovation Management*, Vol. 29 No. 1, pp. 21–32.
- Olavarrieta, S. and Villena, M.G. (2014), “Innovation and business research in Latin America: An overview”, *Journal of Business Research*, Vol. 67 No. 4, pp. 489–497.
- Omoredede, A. (2020), “Managing crisis: a qualitative lens on the aftermath of entrepreneurial failure”, *International Entrepreneurship and Management Journal*, available at: <https://doi.org/10.1007/s11365-020-00655-0>.
- Patel, P.C., Kohtamäki, M., Parida, V. and Wincent, J. (2015), “Entrepreneurial orientation-as-experimentation and firm performance: the enabling role of absorptive capacity”, *Strategic Entrepreneurship Journal*, Vol. 36, pp. 1739–1749.

- Patton, M.Q. (2014), *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*, 4th ed., Sage Publications, Thousand Oaks, CA.
- Picken, J.C. (2017), "From startup to scalable enterprise: Laying the foundation", *Business Horizons*, Vol. 60 No. 5, pp. 587–595.
- Power, B. (2014), "How GE Applies Lean Startup Practices", *Harvard Business Review*, pp. 13–15.
- Prahalad, C.K. and Hamel, G. (1990), "The core competence of the corporation", *Harvard Business Review*, Vol. 68 No. 3, pp. 79–91.
- Pratt, M.G. (2009), "For the lack of a boilerplate: tips on writing up (and reviewing) qualitative research", *Academy of Management Journal*, Vol. 52 No. 5, pp. 856–862.
- Puranam, P., Singh, H. and Zollo, M. (2006), "Organizing for innovation: managing the coordination-autonomy dilemma in technology acquisitions", *Academy of Management Journal*, Vol. 49 No. 2, pp. 263–280.
- Ries, E. (2011), *The Lean Startup*, Crown Business, New York.
- Ries, E. (2017), *The Startup Way: How Modern Companies Use Entrepreneurial Management to Transform Culture and Drive Long-Term Growth*, Currency, New York.
- Roca, J.B., Vaishnav, P., Morgan, M.G., Mendonça, J. and Fuchs, E. (2017), "When risks cannot be seen: Regulating uncertainty in emerging technologies", *Research Policy*, Vol. 46 No. 7, pp. 1215–1233.
- Saldaña, J. (2013), *The Coding Manual for Qualitative Researchers*, 2nd ed., Sage Publications, London.
- Sarasvathy, S.D. (2001), "Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency", *Academy of Management Review*, Vol. 26 No. 2, pp. 243–263.
- Schumpeter, J. (1943), *Capitalization, Socialism and Democracy*, Routledge, New York.
- SEBRAE. (2016), "Mapeamento de startups digitais do Rio Grande do Sul", pp. 1–56.
- Sengupta, S., Sahay, A. and Croce, F. (2018), "Conceptualizing social entrepreneurship in the context of emerging economies: an integrative review of past research from BRIICS", *International Entrepreneurship and Management Journal*, Vol. 14 No. 4, pp. 771–803.
- Shepherd, D.A. and Gruber, M. (2020), "The Lean Startup Framework: Closing the Academic–Practitioner Divide", *Entrepreneurship: Theory and Practice*, pp. 1–31.
- Shepherd, D.A. and Patzelt, H. (2020), "A Call for Research on the Scaling of Organizations and the Scaling of Social Impact", *Entrepreneurship: Theory and Practice*, pp. 1–14.
- Sigglekow, N. (2007), "Persuasion with case studies.", *Academy of Management Journal*, Vol. 50 No. 1, pp. 20–24.
- Silva, D.S., Ghezzi, A., Aguiar, R.B. de, Cortimiglia, M.N. and ten Caten, C.S. (2019), "Lean Startup, Agile Methodologies and Customer Development for business model innovation: A systematic review and research agenda", *International Journal of Entrepreneurial Behavior & Research*, Vol. 26 No. 4, pp. 595–628.
- Sirén, C.A., Kohtamäki, M. and Kuckertz, A. (2012), "Exploration and exploitation strategies, profit performance, and the mediating role of strategic learning: escaping the exploitation trap", *Strategic Entrepreneurship Journal*, Vol. 6 No. 1, pp. 18–41.
- Sosna, M., Treviño-Rodríguez, R.N. and Velamuri, S.R. (2010), "Business model innovation through trial-and-error learning: The naturhouse case", *Long Range Planning*, Vol. 43 No. 2–3, pp. 383–407.
- Stam, E. (2015), "Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique", *European Planning Studies*, Vol. 23 No. 9, pp. 1759–1769.
- Staniewski, M.W., Nowacki, R. and Awruk, K. (2016), "Entrepreneurship and innovativeness of small and medium-sized construction enterprises", *International Entrepreneurship and Management Journal*, Vol. 12 No. 3, pp. 861–877.

- Strauss, A.C. and Corbin, J. (2008), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 3rd ed., Sage Publications, Thousand Oaks, available at: <https://doi.org/10.4135/9781452230153>.
- Suddaby, R. (2006), "From the editors: what grounded theory is not", *Academy of Management Journal*, Vol. 49 No. 4, pp. 633–642.
- Teece, D.J. (2010), "Business models, business strategy and innovation", *Long Range Planning*, Vol. 43 No. 2–3, pp. 172–194.
- Teece, D.J. (2018), "Business models and dynamic capabilities", *Long Range Planning*, Vol. 51 No. 1, pp. 40–49.
- Trimi, S. and Berbegal-Mirabent, J. (2012), "Business model innovation in entrepreneurship", *International Entrepreneurship and Management Journal*, Vol. 8 No. 4, pp. 449–465.
- Tripathi, N., Oivo, M., Liukkunen, K. and Markkula, J. (2019), "Startup ecosystem effect on minimum viable product development in software startups", *Information and Software Technology*, Vol. 114 No. January, pp. 77–91.
- Venkataraman, S. (2004), "Regional transformation through technological entrepreneurship", *Journal of Business Venturing*, Vol. 19 No. 1, pp. 153–167.
- Vissa, B. and Chacar, A.S. (2009), "Leveraging ties: the contingent value of entrepreneurial teams' external advice networks on Indian software venture performance", *Strategic Management Journal*, Vol. 30 No. 11, pp. 1179–1191.
- Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, Vol. 22 No. 2, pp. 195–219.
- Wadson, N. (2013), "Discovery theory of entrepreneurship", in Kessler, E.H. (Ed.), *Encyclopedia of Management Theory*, Sage Publications, Thousand Oaks.
- Walsh, S.T., Kirchhoff, B.A. and Newbert, S. (2002), "Differentiating market strategies for disruptive technologies.", *IEEE Transactions on Engineering Management*, Vol. 49 No. 4, pp. 341–351.
- Windheim, J. von and Myers, B. (2014), "A lab-to-market roadmap for early-stage entrepreneurship", *Translational Materials Research*, Vol. 1 No. 1, available at: <https://doi.org/10.1088/2053-1613/1/1/016001>.
- Womack, J.P. and Jones, D.T. (1997), "Lean Thinking—Banish Waste and Create Wealth in your Corporation", *Journal of the Operational Research Society*, Vol. 48 No. 11, pp. 1148–1148.
- Wright, M., Filatotchev, I., Hoskisson, R.E. and Peng, M. (2005), "Strategic research in emerging markets: challenging the conventional wisdom", *Journal of Management Studies*, Vol. 42 No. 1, pp. 1–33.
- Xu, D. and Meyer, K.E. (2013), "Linking theory and context: 'Strategy research in emerging economies' after Wright et al. (2005)", *Journal of Management Studies*, Vol. 50 No. 7, pp. 1322–1346.
- Yamakawa, Y., Khavul, S., Peng, M.W. and Deeds, D.L. (2013), "Venturing from emerging economies", *Strategic Entrepreneurship Journal*, Vol. 7 No. 3, pp. 181–196.
- Yin, R.K. (2014), *Case Study Research: Design and Methods*, 5th ed., Sage Publications, Thousand Oaks.
- Yu, X., Tao, Y., Tao, X., Xia, F. and Li, Y. (2018), "Managing uncertainty in emerging economies: The interaction effects between causation and effectuation on firm performance", *Technological Forecasting and Social Change*, Vol. 135 No. February, pp. 121–131.
- Yusubova, A., Andries, P. and Clarysse, B. (2020), "Entrepreneurial team formation and evolution in technology ventures: Looking beyond the top management team", *Journal*

- of Small Business Management*, Vol. 58 No. 5, pp. 893–922.
- Zahra, S.A. (1996), “Technology strategy and new venture performance: a study of corporate-sponsored and independent biotechnology ventures”, *Journal of Business Venturing*, Vol. 11, pp. 289–321.
- Zahra, S.A., Abdelgawad, S.G. and Tsang, E.W.K. (2011), “Emerging multinationals venturing into developed economies: Implications for learning, unlearning, and entrepreneurial capability”, *Journal of Management Inquiry*, Vol. 20 No. 3, pp. 323–330.
- Zahra, S.A., Ireland, R.D. and Hitt, M.A. (2000), “International expansion by new venture firms: international diversity, mode of market entry, technological learning, and performance”, *Academy of Management Journal*, Vol. 43 No. 5, pp. 925–950.
- Zouain, D.M. and Plonski, G.A. (2015), “Science and Technology Parks: laboratories of innovation for urban development - an approach from Brazil”, *Triple Helix*, Vol. 2 No. 1, pp. 1–22.