Lean Startup, Agile Methodologies and Customer Development for business model innovation

A systematic review and research agenda

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Abstract

Purpose – Startups have attracted increased attention over the past years. While entrepreneurs develop startups to capture new business opportunities, also large companies are turning to these fast-growing organizations in efforts to become more agile. However, managing business model innovation and validation is challenging. A number of methodologies, like the Lean Startup (LS), emerged to reduce uncertainties concerning innovation-based projects, and to contribute to business model validation. Despite its popularity, the literature on the LS and its key underpinnings (Agile Methodologies and Customer Development) is sparse, lacking an integrated and structured analysis of their impacts and potentialities. The paper aims to discuss this issue.
Design/methodology/approach – The authors conducted a comprehensive systematic literature review on the topic fully analyzing a final set of 71 papers.
Findings – There is a turning point in the research stream's maturity with publications in conferences and major journals, with the predominance of empirical investigations in the European region. Articles on the topic are on the rise in several technology fields. However, the literature on the subject falls short on providing guidance to assist practitioners and scholars on the adoption and investigation of these methodologies.
Practical implications – The paper provides guidance for practice by presenting a staircase roadmap for the LS implementation drawing from the final set of papers reviewed.
Originality/value – The study categorizes the current literature through a concept map, and offers a structured research agenda beyond the categories from the thematic analysis.

Keywords Experimentation, New venture creation, Business model innovation,
Technology entrepreneurship, Lean Startup approaches, Minimum viable product
Paper type Literature review

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1. Introduction

Entrepreneurs face critical obstacles in the early stages of new ventures creation and development, such as prospecting investors and raising capital, transforming an idea into a product/service, validating the business model built around the product and scaling their business. New businesses are always immersed in risky environments, whether in the form of a technology-driven business model with an all-new customer approach, or a franchise company with a solid business plan being implemented in a new location. Although all new businesses entail complexities and risks, technology new ventures, or startups, are usually faced with more challenging environments, as they are designed to create a new product or service under conditions of extreme uncertainty (Blank, 2013; Clarysse and Bruneel, 2007; Hillemane *et al.*, 2019; Innocenti and Zampi, 2019; Ries, 2011; Rippa *et al.*, 2019).

Interest in technology entrepreneurship and the startup movement has increased in a moment in which there is also growing debate and research regarding business models and, more specifically, business model innovation (BMI) (Carayannis *et al.*, 2015; Cortimiglia *et al.*, 2016; Kraus *et al.*, 2019; Spieth *et al.*, 2014; Trimi and Berbegal-Mirabent, 2012). According to Ricciardi *et al.* (2016), the business model construct addresses characteristics of the interaction between the firm and its environment that are key to the firm's revenue, and as the environment continuously changes, business models must also be dynamic. The critical role BMI plays in a company's success has been advocated by both executives (Amit and Zott, 2012; Johnson *et al.*, 2008) and scholars (DaSilva and Trkman, 2014; Spieth *et al.*, 2014; Teece, 2018) alike. BMI does not necessarily entail product or disruptive innovations, but it rather generates changes in the value creation, value appropriation or value delivery functions, resulting in improvements in the value proposition (Sorescu, 2017). Additionally, BMI may refer to both design of novel business models for new organizations (startups), and the reconfiguration of existing business models (Massa and Tucci, 2014), regardless the field, whether in sustainability- or social-oriented business models (Margiono *et al.*, 2018; Todeschini *et al.*, 2017; Zebryte and Jorquera, 2017) or technology-based industries (García-Gutiérrez and Martínez-Borreguero, 2016; Hillemane *et al.*, 2019; Rippa *et al.*, 2019).

The challenge of envisioning and running a startup, however, goes beyond the BMI. In a recent study investigating 54 countries, researchers found a moderate increase in the fear of failure (preventing starting up a business) among adult entrepreneurs when comparing reports of 2016 and 2017 (Global Entrepreneurship Monitor, 2017). Similar findings have been reported by scholars. Staniewski and Awruk (2015) indicated "risk of failure (the loss of the invested capital)" as one of the main perceived hurdles in starting businesses. Finally, Kollmann *et al.* (2017) demonstrated the mediating role that fear of failure plays in the transition from perception of obstacles to opportunity exploitation in entrepreneurial activities.

More recently, several tools and practices have emerged to support technology new ventures to overcome recurrent barriers, mainly during the early stages of development. One of the most prominent methodologies that aim at assisting entrepreneurs in innovation-oriented ventures is the Lean Startup (LS) (Ries, 2008, 2011). The LS, introduced by Ries (2011), gained popularity and interest among entrepreneurs and scholars (Blank, 2013; De Cock *et al.*, 2019; Ladd and Kendall, 2017), and also rapidly gained momentum in large companies from the most varied fields, like General Electric and Goodyear Tire & Rubber (Ganguly and Euchner, 2018; Power, 2014). The methodology focuses on learning from failure and recommends a set of generic practices to validate business model elements using continuous fast iteration processes. According to Ries (2008), the LS movement is strongly supported by two previous approaches: Agile Methodologies (AM) and Customer Development (CD). AM seek to eliminate wasted time and resources by focusing on iterative and incremental product development. CD, by contrast, seeks to identify and understand customers, their needs and the appropriate solutions to satisfy them, reducing business risks by testing hypothesis (Alvarez, 2014; Blank, 2013).

Academic literature on LS and its underpinnings matured in the past few years. Bortolini *et al.* (2018) conducted a comprehensive historical review to identify academic antecedents of LS, positioning the methodology in the Learning School of strategic management and the effectuation approach to entrepreneurship. Additionally, recent studies have investigated entrepreneurial cognitions behind the methodology (Ladd and Kendall, 2017; Mansoori and Lackéus, 2019; Yang *et al.*, 2019). However, despite its popularity, literature exploring LS, AM and CD is still sparse, lacking integrated understanding and analysis of the effects and potentialities of the methodologies, as well as practical guidelines for is implementations for both startups and large organizations. As a consequence, LS academic relevance and soundness is still met with skepticism by scholars (Ghezzi and Cavallo, 2018). Thus, this paper sheds light on current knowledge, identifying relevant issues, and advancing theory and practice by conducting a systematic literature review (SLR) of the implementation of LS, also covering AM and CD, addressing the following research questions:

RQ1. What is the existing research covering LS, AM and CD related to BMI in entrepreneurial environments?

RQ2. What practices and tools have been used complementarily with LS?

RQ3. What are the organizational impacts of implementing LS practices?

RQ4. What are the critical success factors (CSFs) for LS implementation?

The present paper provides a systematic review with descriptive and thematic analyses based on a final set of 71 papers. The research objectives are threefold: map and categorize the current literature; identify key managerial aspects of implementing LS, such as CSFs and organizational impacts; and provide paths for practice and research. First, the authors present the theoretical background and the methodological procedures, thoroughly describing the planning and selection stages conducted during the systematic review. Then, the findings and research streams are outlined. Finally, the authors discuss gaps and weaknesses of current literature, present the conclusions and summarize opportunities for further research.

2. Setting the stage for the review: Lean Startup, Agile Methodologies and Customer Development

Entrepreneurial literature discussing the startup development has recently turned its attention to the framing and systematization of the entrepreneurial act of startup's business model design and subsequent validation (Ghezzi, 2018; McDonald and Eisenhardt, 2019), so as to equip entrepreneurs with a quasi-scientific process for launching their ventures (Camuffo *et al.*, 2019).

A startup community-led movement to go "back to the basics" of entrepreneurial action in a startup's early stages of development proposed to conceive startups as the atomic unit of analysis they are built around: a business idea to develop a product, service or solution addressing a complex market need (Blank, 2007, 2013; Blank and Dorf, 2012; Ries, 2011). Following this simple though effective equation, startup development could be paralleled to new product development; and the evolution of new product development processes, methods and practices could provide an alternative lens to interpret and inform startup development. In this sense, Eric Ries (2011) draws from principles originated in the Japanese Lean philosophy to propose a set of processes to systematize entrepreneurship and startups development, termed Lean Startup (LS).

The Lean Manufacturing, coined from the Toyota Production System, is grounded in the idea of maximizing customer value, while minimizing waste (Lean Enterprise Institute, 2019; Womack and Jones, 1997). Likewise, LS advocates that planning for conventional

businesses and technology new ventures should be differentiated, since these non-traditional ventures are surrounded in more volatile environments, searching for scalable and repeatable business models. Thus, LS would assist such entrepreneurs at validating assumptions and ceasing waste activities with no value creation, i.e. activities customers do not ask for (Blank, 2013; Frederiksen and Brem, 2017).

In order to understand where waste lies, LS is centered in a learning process for BMI, dubbed as "validated learning," in which the entrepreneur must engage in a Build-Measure-Learn (BML) loop (Ries, 2011, 2017). In this loop, LS puts forward a systematic process made of falsifiable hypotheses to test through early versions of the product (commonly known as "Minimum Viable Products", or MVPs), quasi-scientific experiments where customer-originated feedback helps entrepreneurs understand if they should persevere with the business model, drop it altogether, or "pivot" it – by keeping features that customers approved, while tweaking elements customers rejected (Eisenmann *et al.*, 2011). The premise underneath the methodology is that the entrepreneur must "fail fast," learn from it as soon as possible, and avoid stubbornly persevering in a wrong idea that may consume valuable resources (Eisenmann *et al.*, 2011; Ries, 2011). Although it may sound simple, LS draws from the scientific method and uses performance indicators and metrics to measure continuous business development (Maurya, 2012) so that startups can benefit from early interactions with customers, increasing the chances of success without necessarily investing large amounts of capital to launch their products (Stayton and Mangematin, 2018; Trimi and Berbegal-Mirabent, 2012).

Besides the clear inspiration in the Lean philosophy (incorporated in the name of the methodology), Eric Ries (2008), in his personal blog, also mentions two other key underpinnings of LS: Agile Methodologies (AM) and Customer Development (CD). In the agile manifesto, Beck *et al.* (2001) define agile development as a set of software development methods based on iterative and incremental development, which promotes adaptive planning, evolutionary development and delivery, and encourages rapid and flexible response to change. AM have the merit of promoting customer involvement since the early stages of product development, thus making it more customer-centric (Cram and Newell, 2016; Nerur *et al.*, 2005; Rigby *et al.*, 2016), which is also in line with the Lean philosophy. Notwithstanding their merits, there are limitations impairing the use of AM, especially when considering them as a possible way to help entrepreneurs develop a startup. In this sense, while AM deem important to build products with customer involvement, they leave the issue of how to identify and engage with such customers virtually unsolved. Moreover, they only implicitly account for the need startups have to develop an outside-in, rather than an inside-out stance, meaning that entrepreneurs should anticipate interaction with customers as early as possible, in order to tackle customer problems or pains and adjust the business idea accordingly.

This paradigmatic change in product – and startup – development mindset is embodied in the last (but not least) inspiration of LS: Customer Development (Alvarez, 2014; Blank, 2007, 2013; Blank and Dorf, 2012). Customer Development (CD) tweaks AM and the Lean philosophy to focus on customers upfront, since startups in their seed and early stages have to develop customers rather than products (Alvarez, 2014). So startups are advised to "search" for the right customers to test their business idea assumptions on, thus obtaining validation or refutation of the overall business model. Only after experimentation confirms all business model assumptions, startups can develop a company and a mass market (Blank, 2007). In CD, the first product is not designed to satisfy mainstream customers, but to be tested on a small group of early and visionary customers called "evangelists," in order to obtain informed feedbacks about the proposed solution (Blank, 2013; Blank and Dorf, 2012). Although CD constitutes an evolution of the traditional product development approach, its processes and tools depart from the traditional focus, underscoring how startups should develop not only a product, but a whole business model, and test all business model-related assumptions in the market to assess for viability.

Due to the significant overlap in scope, objective and key steps, recent contributions (Ghezzi and Cavallo, 2018) couple LS and CD under the umbrella name "Lean Startup Approaches." LS gained significant momentum within the entrepreneurial community at a global level, and to date, it is by far the most widespread approach to pragmatically support startup development (de Aguiar *et al.*, 2019; Frederiksen and Brem, 2017; Ghezzi, 2018; Mollick, 2019). However, such diffusion was not matched by a concurrent theoretical development backing the approach; and even from a practitioner standpoint, several implementation issues remain obscure (Cooper, 2019; Lindgren and Münch, 2016), with specific reference to CSFs, boundaries and opportunity of integration with other approaches and related tools.

Recently, Bortolini *et al.* (2018) conducted a historical review, identifying antecedents of the LS methodology, like principles of the Learning School of management and other concepts, such as the theory of discovery-driven planning (McGrath and MacMillan, 1995), effectuation (Sarasvathy, 2001), entrepreneurial bricolage (Baker and Nelson, 2005) and the probe-and-learn approach (Lynn *et al.*, 1996). Even though there is an increase in the number of contributions attempting to frame and generalize LS, AM and CD as startup development processes, these contributions are still scattered and fragmented. The entrepreneurship literature lacks a systematic review connecting and organizing this body of knowledge, which leaves a significant gap for both theory and practice this study aims at addressing.

3. Methodology

As the main purpose of the paper is to advance understanding regarding the implementation stage of LS, AM and CD tools in the context of startups and BMI, the authors conducted an SLR focusing on research related to these methodologies within entrepreneurial environments. Literature reviews are traditionally descriptive and adopt narrative approaches, often criticized due to lack of soundness concerning methodological rigor and inherent bias (Denyer and Neely, 2004; Paré *et al.*, 2015). As a consequence, scholars have turned to systematic reviews (De Luca *et al.*, 2019; Pret and Cogan, 2019; Tranfield *et al.*, 2003), since SLR helps to minimize bias and has explicit, reproducible criteria and transparent process when compared to approaches like survey or traditional general reviews (Cerchione and Esposito, 2016; Cook *et al.*, 1997; Petticrew and Roberts, 2006). As defined by Petticrew and Roberts (2006, p. 2), "systematic literature reviews are a method of mapping out areas of uncertainty, and identifying where little or no relevant research has been done, but where new studies are needed."

To ensure reliability and validity of the findings, the study adopted the stages suggested by Tranfield *et al.* (2003), namely: planning the review; conducting a review; and reporting and dissemination. Following the authors' recommendations, the authors organized the stages into the following topics:

(1) Planning: formation of a review panel, definition of research questions, identification of keywords, construction of search strings and selection of databases.

(2) Selection: definition of inclusion/exclusion criteria, selection process based on the criteria and cross-checking of articles by the review panel.

(3) Descriptive analysis: categorization of the literature, and a summary view of the selected articles.

(4) Thematic analysis: in-depth review of articles, highlighting the strengths and weaknesses of literature, identifying emerging themes and questions for future research.

The planning and selection stages comprise the first two stages suggested by Tranfield *et al.* (2003), planning the review and conducting the review, and are presented in Subsections 3.1

and 3.2. Finally, to better address the emerging themes and recommendations, the reporting and dissemination stage was divided into two sections of descriptive analysis (Section 4) and thematic analysis (Section 5).

3.1 Planning

During the planning stage, a review panel was formed consisting of three researchers (all authors of the paper). Each researcher had previous experience related to entrepreneurship and/or innovative methodologies; as recommended by Tranfield *et al.* (2003), the panel should include a range of experts in the field of study.

The search was conducted using three databases: ScienceDirect, Web of Science and Scopus. The inclusion of only three databases can be seen as a limitation. However, the databases were chosen due to their relevance within the fields of business and management, covering main publishers, including Elsevier, Emerald, Springer and Wiley, among others. ScienceDirect covers more than 14m publications from over 3,800 journals (Kolajo *et al.*, 2019). From one perspective, although Web of Science best retrieves older materials (Bauer and Bakkalbasi, 2005) and includes well-recognized content (Scaringella and Radziwon, 2018), Scopus' wider array of international outlets can represent better receptiveness to dynamic and growing topics (Ghezzi *et al.*, 2018) such as LS. Also, recent SLRs covering emerging subjects in major management and organization journals adopted this set of databases (e.g. de Oliveira and Cortimiglia, 2017; Subtil de Oliveira *et al.*, 2018; Todeschini *et al.*, 2017). Although the choice of three databases created an overlap, their selection served as a validation to ensure that relevant articles within the search criteria were included.

Prior to the definition of the review focus, the authors adopted an inductive approach (Miles and Huberman, 1994) and followed the guidelines of Popay *et al.* (2006) to conduct a pilot mapping of available relevant evidence (using the three databases) in order to refine the research strategy. This mapping exercise supported the elaboration of the research questions (*RQ1–RQ4*) to be both answerable and relevant for theory and practice, and to subsequently guide the descriptive and thematic analyses of the review.

As the main purpose of the study was to investigate the implementation of emerging methodologies in the context of new ventures, strings related to entrepreneurship, startups, and SMEs were included. However, the authors did not exclude articles reporting or analyzing such practices in large companies, as these organizations are increasingly turning to startups and agile players to bolster innovation and foster entrepreneurial mindsets among their employees (Euchner, 2016; Thornberry, 2001). The search strings and the number of articles obtained in each database can be seen in Table I.

Due to recent and fast growth of the literature on LS, the study included articles (written in English) published in both academic journals and international conference proceedings, as similarly conducted in SLRs covering emerging topics (e.g. Adams *et al.*, 2016; Garza-Reyes, 2015; Ghezzi *et al.*, 2018) and recommended by Saunders *et al.* (2016) as the most useful and reliable sources for literature reviews. In dynamic and emerging fields, such as LS, the inclusion of "gray literature," i.e. heterogeneous material available outside traditional academic peer-review processes, can provide positive contributions, such as incorporating relevant contemporary material in dynamic topic areas where scholarship lags, and exploring novel fields of inquiry (Adams *et al.*, 2017). Books, reviews and editorial materials were excluded (see Table II).

LS proposes iterative business model validation drawing from AM and CD (Ries, 2008) and stems from previous management theories (Bortolini *et al.*, 2018). Hence, the authors decided to not establish a time constraint. The timespan is limited to the most time-comprehensive database adopted (Web of Science). The study included articles investigating the use of LS, AM and/or CD related to BMI, development and experimentation of MVPs or prototypes, regardless the size of the organization. Both the

Search String	Database: Web of Science	Scopus	ScienceDirect
("Agile" AND "develop*" AND ("entrepr*" OR "startup*" OR "SME*"))	157	323	20
("Agile" AND "method*" AND ("entrepr*" OR "startup*" OR "SME*"))	124	231	12
("Agile" AND "techn*" AND ("entrepr*" OR "startup*" OR "SME*"))	85	194	11
("Agile" AND "Management" AND ("entrepr*" OR "startup*" OR "SME*"))	78	190	5
("Agile" AND "tool*" AND ("entrepr*" OR "startup*" OR "SME*"))	39	122	4
"Agile" AND "SME*"	58	95	17
"Agile" AND "entrepr*"	30	35	7
"Agile" AND "startup*"	15	10	7
"Agile Management"	22	29	6
"Customer Development"	25	81	19
"Lean Startup"	48	87	34
"Lean" AND "Startup*"	73	139	53

Table I. Search strings and number of papers obtained per researched database

Inclusive criteria	
Language	English
Timespan	1945–April/2019
Document types	Journal articles and proceedings
Research focus	Adoption of Lean Startup, customer development or agile methodologies for business model innovation; adoption of Lean Startup, Customer Development or Agile Methodologies for startup development
Exclusive criteria	
Document types	Books, newspapers, magazines and editorial materials
Research focus	Strict application of Lean Manufacturing tools, such as value stream mapping, Kanban, single-minute exchange of die (SMED), Poka-Yoke or the like; Adoption of Agile Methodologies for software development/programming or software architecture validation

Table II. Inclusive and exclusive criteria for the review

LS and AM emerged in the software industry, but have gained momentum in several technology-based fields (Eisenmann *et al.*, 2011; Ries, 2011, 2017). Thus, papers reporting the adoption of these practices with implications for BMI (regardless the field) were selected. The review panel excluded research covering exclusive Lean and/or agile manufacturing settings, i.e. elimination of waste in a facility process or limited to the application of Lean Manufacturing tools, such as value stream mapping, Kanban, 5S or the like. The authors also excluded articles related only to agile software development/programming or studies on software architecture.

3.2 Selection

During the selection stage, the review panel conducted searches on databases using the search strings previously defined; overlapping results were eliminated, resulting in 514 articles. Articles were cross-checked to filter results based on the aforementioned inclusion/exclusion criteria.

The titles, abstracts and keywords of the 514 papers were examined by all researchers from the review panel in accordance with the inclusion/exclusion criteria. The review panel

assigned a score on a scale of 1 to 4 for each paper, where: 1 (certainly not accepted); 2 (possibly not accepted); 3 (possibly accepted); and 4 (certainly accepted). The evaluation of the panel members was subjected to analysis of variance (ANOVA) and correlation, in order to verify significant differences between the answers, and to validate whether the understanding of the inclusion and exclusion criteria was clear. Table III presents the ANOVA.

There was no statistically significant differences in the review panel scores ($p > 0.05$). Additionally, Table IV provides data from the correlation analysis by the review panel. Small differences were observed between the researchers, which is expected, since the panel members have different trajectories and perceptions; however, values higher than 0.5 show convergence in the decisions, supporting the clarity in the definition of the selection criteria of the articles and the understanding by the review panel.

After the evaluation, papers that obtained a mean score equals to or greater than 3 were selected, which resulted in a final sample of 79 papers. However, eight papers were excluded from review after verification of exclusion criteria during full readings, such as addressing methodologies in contexts different from the research focus (e.g. Duc *et al.*, 2016; Khalil and Khalil, 2019; Oliva and Kotabe, 2019). Finally, the review was based on 71 papers. Figure 1 summarizes the planning process, with the selection of articles in the different stages.

After completing the planning and selection stages, the 71 papers were reviewed and uploaded to the QSR NVivo software for analysis, since this software is used and suggested by researchers as an effective tool in the codification of data extracted from articles (Thomas and Harden, 2008; Thorpe *et al.*, 2005). Based on the recommendation of Tranfield *et al.* (2003)

Table III.
Analysis of variance (ANOVA) of the evaluations by the review panel

Source of variation	SS	df	MS	*F*	*p*-value	*F* crit
Between groups	0.354085603	2	0.177042802	0.180886473	0.834547835	3.001571175
Within groups	1,506.297665	1,539	0.97875092			
Total	1,506.651751	1,541				

Table IV.
Correlation analysis of the evaluations by the review panel

	Reviewer 1	Reviewer 2	Reviewer 3
Reviewer 1	1		
Reviewer 2	0.813669616	1	
Reviewer 3	0.64591168	0.628213908	1

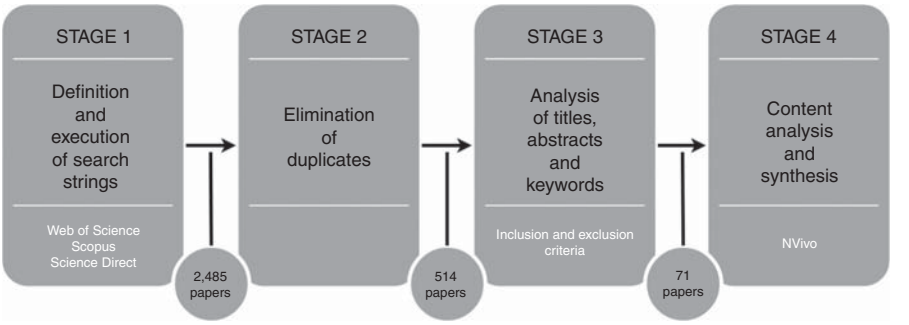

Figure 1.
Stages of the planning and selection steps

adopted in similar systematic reviews (Garza-Reyes, 2015; Hu *et al.*, 2015), the report presentation is divided into two parts: a descriptive analysis, with bibliographical categories, and a thematic analysis, including an interpretation of the degree to which there is a consensus regarding key themes, along with an identification of emerging themes for the development of future research.

4. Descriptive analysis

To answer *RQ1*, this section covers the descriptive analysis of the literature about LS, AM and CD related to BMI in entrepreneurial environments.

4.1 Publications per year, type of source and research methods

The attention over LS practices, as well as AM and CD, has been prominent in recent years. Interest in the topic as a source of research is also increasing, as shown in Figure 2, with a growing number of publications in the period between 2002 and April/2019.

Along with the increase of publications about the topic over the past few years, a few studies were initially presented in conferences, and later on, more mature, published in journals. For instance, Bajwa *et al.* (2016) presented a study at the International Conference of Software Business investigating the process of pivoting (i.e. changing business model elements) in European software startups; one year later, Bajwa *et al.* (2017) published a more complete research on software ventures' pivots in the *Empirical Software Engineering* journal. This represents a natural turning point in the maturity of a topic. From the sample of papers reviewed, publications in journals represent 57.14 percent, against 42.86 percent of conferences, signaling the topic is still emergent.

Research on the topic was published in journals of different fields, covering related areas of entrepreneurship, innovation, business and management (e.g. *Small Business Economics, International Journal of Entrepreneurial Behavior & Research, Technovation* and *Industrial Marketing Management*), as well as in areas less related to the topic (e.g. *Journal of Cleaner Production* and *Translational Materials Research*). Appendix 1 presents the publications per journal and conference.

The most prominent method employed was the multiple-case study, corresponding to 30 percent of the publications, which can be considered another evidence of the topic's emergent nature, as case studies are frequently used to draw a first exploratory light in the early stages of understanding novel phenomenon, and building and developing theory (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Voss *et al.*, 2002). Similarly, conceptual

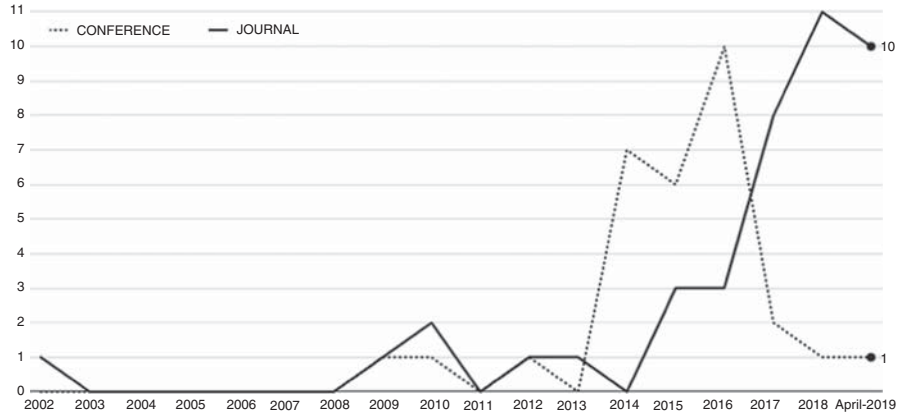

Figure 2.
Representation of the number of publications per year in the analyzed sources

and single-case studies are also fairly frequent (27 and 17 percent, respectively). Less commonly used methods were labeled as others, including action research (Marcinkowski and Gawin, 2019; Xu and Koivumäki, 2019), survey (Lindgren and Münch, 2016) and mixed methods (Bottani, 2010). The frequency of each method among the reviewed papers is listed in Figure 3.

Considering the emergent nature of the topic, ten studies aim at developing theoretical frameworks, as well as proposing models with the improvement of the practices being studied. From this group of studies, five papers conducted purely descriptive discussions (Ahmed *et al.*, 2019; Edison, 2015; Girgenti *et al.*, 2016; Mansoori and Lackéus, 2019; Overall and Wise, 2015), three proposed new frameworks and conducted multiple-case studies (Bessant *et al.*, 2002; Edison *et al.*, 2018; Fagerholm *et al.*, 2017) and two studies developed models and conducted single-case studies (Pease *et al.*, 2014; Still, 2017). The field still lacks mixed methods with multiple sources of evidence, an approach that improves the validity and reliability of the findings (Bhasin, 2012). An exception is the work of Kumar *et al.* (2018), who propose a framework for CD in the context of the sharing economy based on literature and interviews with customers, service providers and service enablers in three major American cities.

4.2 Geographic areas and industry sectors

Of the 71 articles reviewed, 34 indicated the geographic area covered (Figure 4). Empirical investigations were predominantly developed within organizations (both large enterprises and startups/SMEs) in Finland: ten studies were entirely held in Finland (Fagerholm *et al.*, 2017; Hokkanen *et al.*, 2015; Hokkanen and Leppänen, 2015; Järvinen *et al.*, 2014; Lindgren and Münch, 2016; Raatikainen *et al.*, 2016; Still, 2017; Terho *et al.*, 2015; Xu and Koivumäki, 2019; Yaman *et al.*, 2017), while two studies conducted investigations in Finland and Switzerland in a cross-country research (Eloranta, 2014; Leppänen, 2014).

Finland's preponderance and the emergence of Switzerland in the development of studies linking AM to BMI are in line with a recent ranking where Finland emerges among the seven leading innovation countries in the European region, along with Switzerland, Sweden, Denmark, the Netherlands, the UK and Germany (Hollanders and Es-Sadki, 2017). Additionally, Finland ranked second, and six other European countries (Sweden, Norway, Netherlands, Switzerland, UK and Luxembourg) were in the Top 9 (out of 139 nations) in the Networked Readiness Index

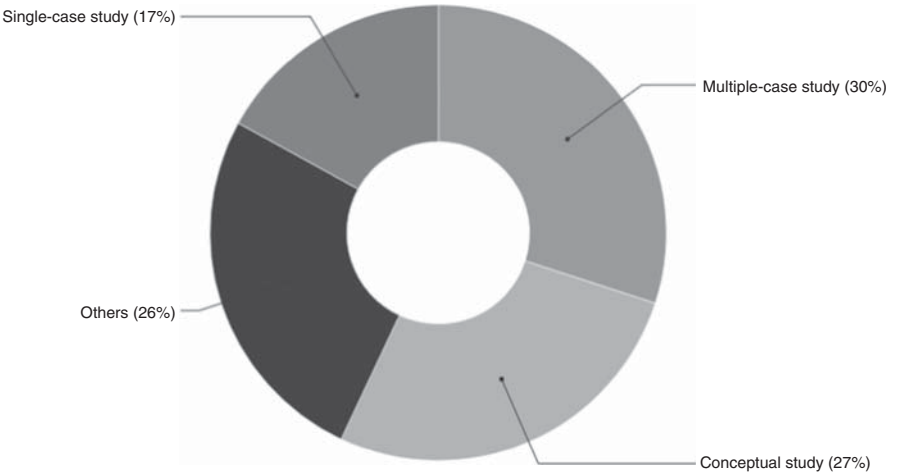

Figure 3.
Percentage of papers according to the research method

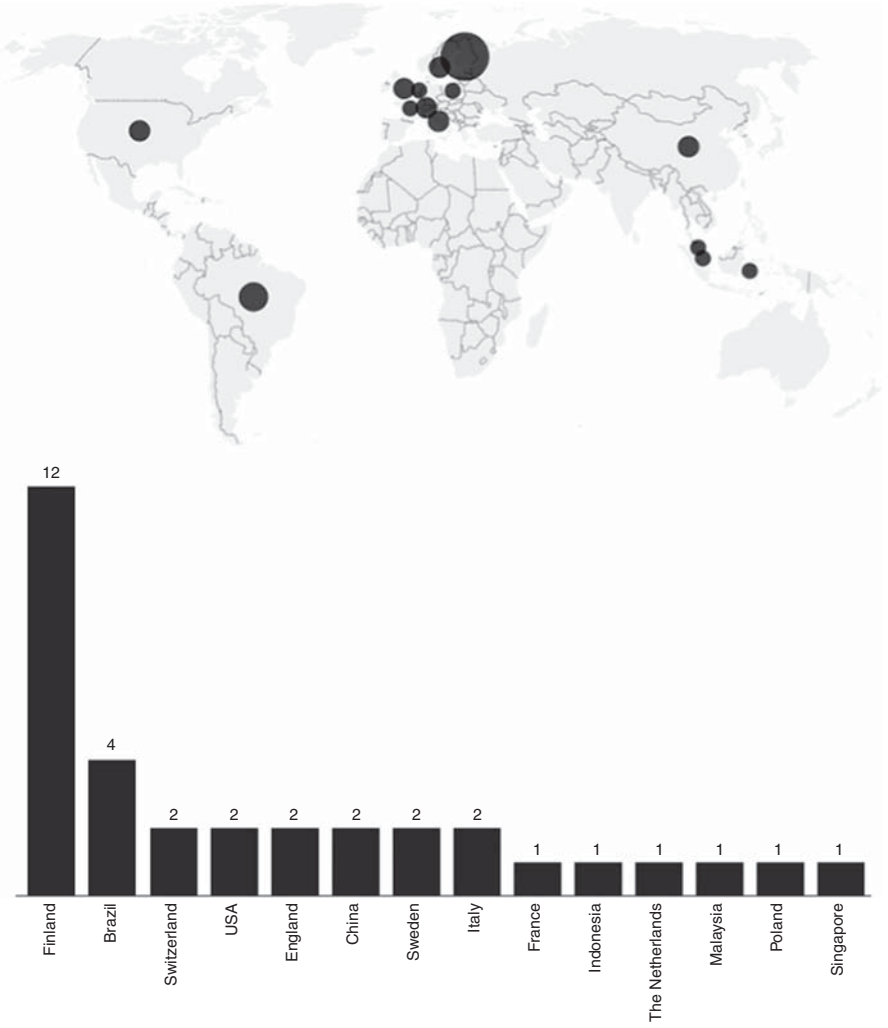

Figure 4.
Number of studies per country

of the Global Information Technology Report (World Economic Forum, 2016). This annual report assesses digital network readiness according to indicators regarding regulatory and business environment, information and communication technology (ICT) affordability and infrastructure, usage and socio-economic impacts. According to World Economic Forum (2016), Finland has good access to latest technologies and venture capital, and its businesses are highly connected; such attributes confer the Finnish country a better-quality digital environment and businesses, a characteristic that both prompts and facilitates empirical studies on LS and AM.

In addition to Europe, a number of papers report research conducted in other locations, with a small representation of Brazil (Melegati *et al.*, 2019; de Paula and Araujo, 2016; Tolfo *et al.*, 2018; Ximenes *et al.*, 2015), the USA (Kumar *et al.*, 2018; May, 2012), China (Li *et al.*, 2014; Yang *et al.*, 2019), Indonesia (Nirwan and Dhewanto, 2015), Singapore (Chan *et al.*, 2019) and Malaysia (Ekpe *et al.*, 2017). The small number of investigations outside Europe highlights the lack of research and opportunities in other continents, especially in developing countries.

In total, 53 papers reported specific industry sectors investigated. Not surprisingly, considering the origin of LS and AM in the software industry, 42 papers (79 percent of the total) focused on the ICT sector (Figure 5).

In spite of the high concentration of articles in ICT, there are studies in unconventional segments, such as library management (Bieraugel, 2015) or the promotion of entrepreneurship focused on social development (Traube *et al.*, 2017). The emergence of studies in sectors other than ICT fits the proposal of Ries (2011), which advocates the use of the methodology in innovation projects, regardless of the field; however, the low number of studies reveals the need for future research investigating the applicability of the methodology in different sectors, especially in engineering and materials sciences (Harms *et al.*, 2015; Werwath, 2019).

5. Thematic analysis

Although all selected papers address LS, AM and/or CD, the studies focused on different aspects, with some overlap. For this reason, the authors used QSR NVivo software to construct a concept map to help visualize the categorization and structure of the revision. QSR NVivo has been recommended as an effective computer-assisted qualitative data analysis software for coding data from full articles to thematic analysis in systematic reviews (Bryman and Bell, 2011; Thomas and Harden, 2008; Thorpe *et al.*, 2005).

Following similar SLRs (Bembom and Schwens, 2018; Garza-Reyes, 2015), the study presents a concept map (Figure 6) displaying the current state of research, with the centralized topic on LS, CD and AM, from which the main identified categories emerged, including investigation: benefits, limitations, difficulties; integration with another methodology or proposition of a new model/framework; size of the organization; industry sector; and location. For each category and subcategory, the articles were identified according to their focus and content and based on the assigned numbering (Appendix 2). For example, in the article number 55, "Digital startups and the adoption and implementation of Lean Startup Approaches: Effectuation, Bricolage and Opportunity Creation in practice," by Antonio

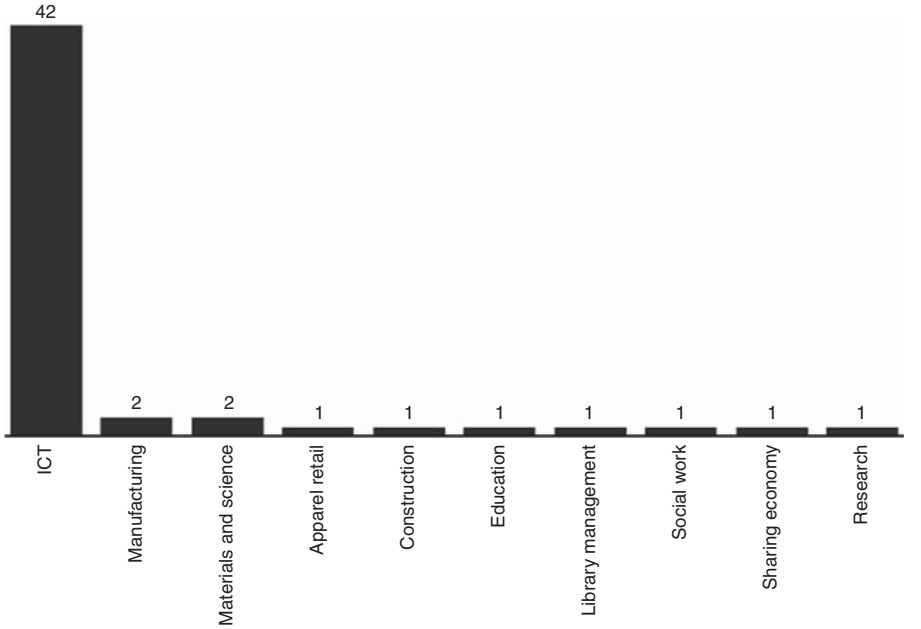

Figure 5.
Number of articles per sector

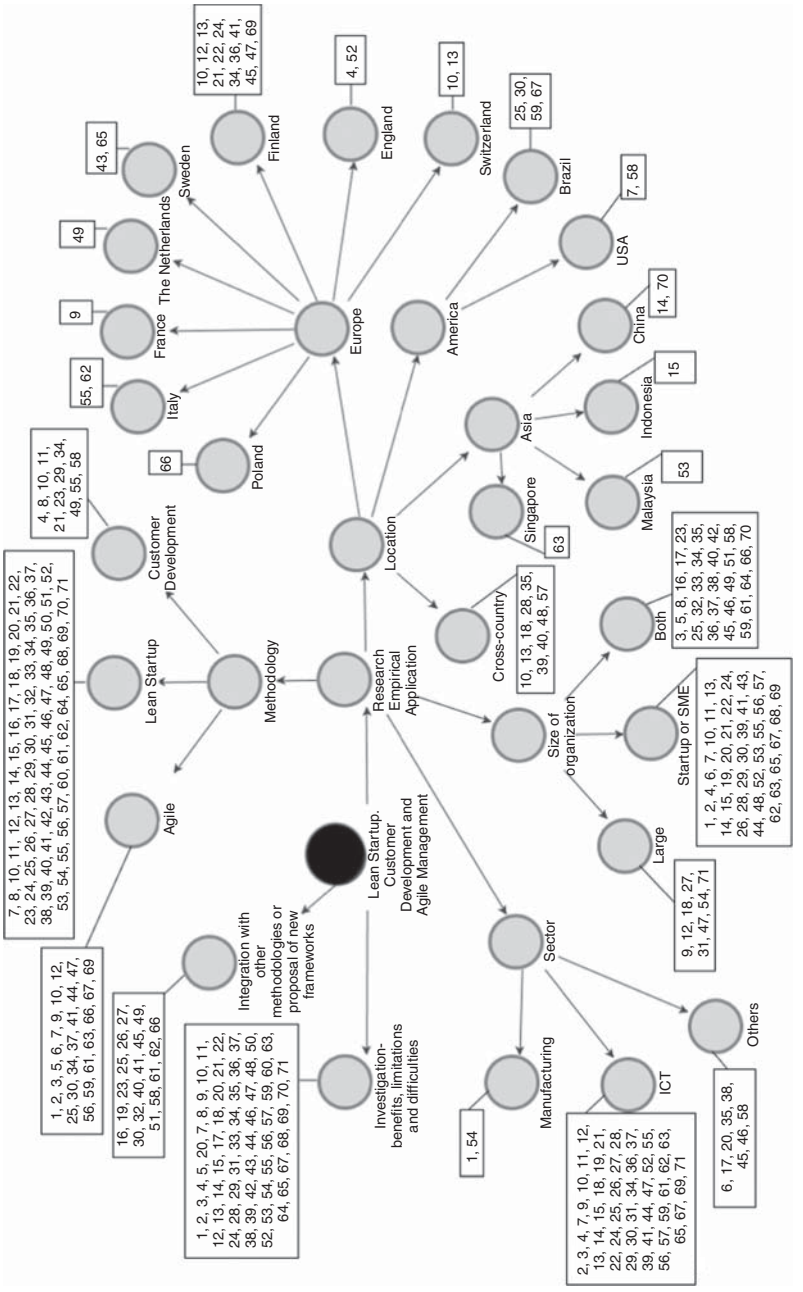

Figure 6.
Concept map of the systematic review

Ghezzi on the *Technological Forecasting and Social Change*, the size of the organization is identified as "startup/SME," with industry sector "ICT," "Italy" as the location of the study, investigating "Lean Startup" and "Customer Development" practices, exploring "benefits, difficulties and limitations."

The study followed the suggestions of Tranfield *et al.* (2003) and included a thematic section with the identification of emerging key themes, as well as the discussion on the extent to which there is consensus in the literature regarding the topic. The authors employed a rationale of recursive and cyclical interpretative-oriented content analysis explicitly stating the research concerns and research questions, and selecting relevant text for further analysis (Auerbach and Silverstein, 2003). Following the guidelines by Saunders *et al.* (2016), inductive coding was employed to group similar findings regarding the impacts of LS, AM and CD on organizations, as well as CSFs for their implementation and avenues for future research.

Data from the 71 papers reviewed were coded to move methodically to a higher conceptual level, enabling to later sort topics from different sources in different ways, examining related features and gaining insights (Yin, 2011). Based on the content analysis and synthesis, three main themes address the remaining research questions (*RQ2–RQ4*). All themes are individually discussed next:

- Theme 1: integration with other methodologies and a new model/framework proposal.
- Theme 2: impacts on organizations.
- Theme 3: CSFs for implementation.

5.1 Integration with other methodologies and a new model/framework proposal

Despite the novelty of the topic, 15 papers seek to integrate LS with other methodologies, or propose new models recommending rapid hypothesis testing (Figure 6). Some articles discussed the implementation of LS with strategic tools, such as business model design (Ghezzi *et al.*, 2015), with the development of the business model using business model canvas, or internal corporate venturing (Edison, 2015), representing a set of activities used to generate innovation within an organization. Although all the methodologies and tools have great potential for integration, they were very little explored in the studies, and lacked explanations about how the startups being studied used the methodologies, or how they should be adjusted for different types of companies.

Similarly, there seems to be special attention given to combining LS with design thinking in software project management and process improvements (Ahmed *et al.*, 2019; Edison *et al.*, 2018; de Paula and Araujo, 2016; Risku and Abrahamsson, 2015; Ximenes *et al.*, 2015) for further problem exploration. Design thinking is a methodology proposed by Brown (2009) that – differently from LS, which starts with a business idea – is triggered from a problem or question and is highly recognized in literature by its appeal to creativity, problem solving and user centeredness (Micheli *et al.*, 2019). In their studies, the researchers converged when observing that design thinking supports LS with moments of empathy and user understanding to better comprehend their real needs. Despite its benefits, Risku and Abrahamsson (2015) criticize what they perceive is little inclusion of design thinking in academic programs outside design courses.

Balocco *et al.* (2019) developed an interesting framework for companies operating in dynamic sectors. The authors recognized the roots of LS in the Japanese philosophy and integrated single-minute exchange of die, a tool from Lean Manufacturing, in the business model change process. According to the authors, the framework is suitable for any process of business model change, regardless of the stage of the venture.

Finally, other authors proposed new models and/or frameworks with approaches that combined LS with other AM (Fagerholm *et al.*, 2017), axiomatic design (Girgenti *et al.*, 2016), CD (Overall and Wise, 2015), or even considering less explored areas, such as the

development of products aimed at underdeveloped countries (Pease *et al.*, 2014), to support employee-driven innovation in the context of green product development (Buhl, 2018), or aiming at understanding the applicability and use of the LS paradigm within the research context (Still, 2017). Again, despite the potential for exploration, most of the studies were purely descriptive, with little or no empirical application; few papers also involved case studies for further exploration (Bessant *et al.*, 2002; Fagerholm *et al.*, 2017; Kumar *et al.*, 2018; Pease *et al.*, 2014; Still, 2017). In this line, Kumar *et al.* (2018) proposed a strategic framework for CD in the sharing economy based on literature, press and several interviews, addressing threats and opportunities; Marcinkowski and Gawin (2019), by contrast, conducted an in-depth canonical action research study and proposed an architecture integrating agile methods with business process management, considering multi-scenario business processes. Some researchers attempted to complement LS, AM and CD shortcomings, such as interpreting customer feedback, or identifying and prioritizing critical assumptions to be tested; nevertheless, these papers lacked results, examples, guidelines and sometimes theoretical lenses to support the research and further its contributions.

5.2 Impacts on organizations

In his book, Ries (2011) advocated fast experimentation instead of long business plans within the startup context, a theme that has been discussed in some of the reviewed papers. Xu and Koivumäki (2019) revealed that LS and effectuation approaches produce more realistic business models when compared to causation/prediction approaches. More specifically, the authors claim Sarasvathy's (2001) effectuation can better benefit entrepreneurs with an advantage in personal and professional networks, whereas LS is better suited for those with stronger technical skills, especially in high-tech fields. Clutterbuck *et al.* (2009) presented the implementation of AM with results that reveal costs involving constant adaptation changes proposed by the experimentation; however, these costs are smaller when compared to management based on traditional business plans. Similarly, Edison *et al.* (2015) stated that the BML loop from the LS – in which the entrepreneur develops and tests hypotheses using MVP – assists with the development of the right product, but it requires resources (whether human, financial or time) in the measure stage that must be considered. Lindgren and Münch (2016) showed that very few organizations use experimentation in a continuous and systematic way, lacking awareness about such practices.

According to Ghezzi and Cavallo (2018), mainly during the early stages, digital startups adopting LS benefit from orchestrating tensions arising from concurrently managing the startup's existing use of scarce resources and recombining them into new and original resources. Furthermore, based on a large-scale survey, Ghezzi (2018) reports that digital startups adopting LS benefited from: reducing time and costs to test the startup; aligning the business idea to customer needs; verifying and pivoting business model parameters; receiving rounds of financing; and offering alternatives to traditional intellectual property protection.

In an ethnographic study, Mansoori *et al.* (2019) investigated the impact of LS in entrepreneur–coach relationships in a university-based accelerator. The authors revealed interesting findings, observing that introducing LS in accelerators changes the authority of coaches, rendering them less assertive. According to Mansoori *et al.* (2019), coaches' advice (in line with LS) mitigated team conflict by resolving intra-team deadlocks; however, entrepreneur–coach relationships were eventually at odds when hypotheses should be tested with empirical data, rather than having coach authority as a key principle guiding action. As a conclusion, the authors suggest coaches should aim to formulate advice and opinions as hypotheses to be validated, rather than unquestionable facts.

According to Ganguly and Euchner (2018), large manufacturing companies can benefit from experimentation, since the learning from such experiments, and customers, in

particular, is very powerful in building internal support for the business. Moreover, Yaman *et al.* (2017) conducted a study with software product and service development companies participating in a Finnish research program and observed that some of the benefits gained by introducing continuous experimentation include improved understanding of the need for user involvement in the development process and getting rapid feedback, in addition to forming new insights and understandings about their product and services, users and development processes. Likewise, Chan *et al.* (2019) reported that, by being agile in responding to disruptive digital innovations, SMEs develop innovative capability through organizational adaptability, which is an important component, since not all innovative capability leads to agility.

In a combination of sustainable business model and user-driven innovation, Baldassarre *et al.* (2017) conducted a study on a European innovation project addressing the challenge of climate change and observed that iterating the value proposition with an extended range of stakeholders creates more acceptance, commitment and support for sustainable innovations. Similarly, Bocken *et al.* (2018) revealed that experimentation could provide internal and external traction for sustainability transitions and create a more entrepreneurial atmosphere within organizations, mitigating resistance to transitions with the aid of learning loops and limiting negative exposure due to the low-resource and small-scale nature of experiments.

Finally, regarding the impact of emerging methodologies on entrepreneurship and innovation, Bieraugel (2015) stated that the use of LS can contribute to the reduction of uncertainties and fears about innovation, and Tolfo *et al.* (2018) showed that industry practitioners and scholars have positive perceptions to AM enhancing entrepreneurial skills. The studies of Ladd and Kendall (2017) and Ekpe *et al.* (2017) reported increased entrepreneurial intention to start new business and self-confidence in the ability to search for an idea in individuals exposed to LS. Bessant *et al.* (2002) revealed that AM strengthen internal capabilities of organizations concerning the ability to change rapidly and continuously, while Trimi and Berbegal-Mirabent (2012) stated that the logic behind rapid iterations drives innovation and fosters product generation in a shorter period, wherein the value of such methodologies lies.

Some authors have employed efforts toward understanding pivots in business model elements and failures in the early stages of new ventures (e.g. Bajwa *et al.*, 2016, 2017; Pantiuchina *et al.*, 2017; Terho *et al.*, 2015); however, the studies are more focused on the occurrence of such pivots and less on the relationship among them. For instance, Bajwa *et al.* (2017) identified that the most common pivots among software startups regard the understanding of customer needs, revealing the importance of properly identifying the customers' problem, and Terho *et al.* (2015) observed that unrefined key metrics might lead to wide multiple pivots; although these are relevant findings, there is a dearth of investigation as to the relation among such multiple pivots, whether sequential or in parallel, and how pivots may impact the new venture.

At last, Yordanova (2018) argues that LS and the principle of user involvement hinder the development of breakthrough innovation. Additionally, the author states that companies tend to adopt the methodology blindly without fully understanding its advantages and disadvantages. The study surveyed professionals working in areas of product development, R&D, project management and innovation management, and captured their perceptions regarding LS principles and premises. Quantitative analysis revealing actual results to support such claims lay outside the scope of the study; however, the research addresses compelling arguments and calls for further investigations.

5.3 Critical success factors for implementation

Surprisingly, none of the selected studies focused exclusively on identifying CSFs for implementing LS, AM and/or CD. However, several articles dealt directly or indirectly with

important aspects when conducting a project using precepts from such methodologies. Thus, the present study was able to identify key factors based on the results of some of the papers.

LS and its key underpinnings advocate interaction with customers since early moments of the venture; this principle was reinforced and complemented by researchers. Nirwan and Dhewanto (2015) state that, in addition to the early stage interaction, entrepreneurs must assess market segmentation after each round of hypothesis testing, since the target segment can "pivot," as well as other characteristics of the product/service. Hokkanen and Leppänen (2015) emphasize that the focus of the interaction should be on potential users, declaring that any effort in gathering feedback from another type of user is a waste of time and resources. Additionally, according to Ribeiro and Fernandes (2010), entrepreneurs must foster reliable relationships early on, not only with the end user, but also with suppliers, promoting alliances and partnerships.

Concerning the feedback-seeking stage, de Paula and Araujo (2016) and Hokkanen *et al.* (2015) address the interface as a relevant element, which should be as close to the final product as possible; according to them, a good UX (user experience) provides more meaningful feedback. Bajwa *et al.* (2017) observe that it may not be easy for entrepreneurs to identify which valuable feature to build first, so it may be beneficial to use MVPs to decide the candidate features to include in product offerings. Fagerholm *et al.* (2017) state that some skills are critical to experimentation and that entrepreneurs must know how to collect and analyze data, having in mind what is being tested and for what reason.

Terho *et al.* (2016) affirm that entrepreneurs must divide the MVP into different learning objectives, developing shorter experiments. In this line, according to Ganguly and Euchner (2018), a well-designed business experiment has four attributes: it should be designed to examine in isolation just a few critical factors that are crucial to the business model, it tests a measurable assumption, it should be inexpensive and it should be quick, generating enough information to validate (or invalidate) the hypothesis. Ghezzi (2018) notes that entrepreneurs must accurately formulate falsifiable hypotheses and comprehensively adopt LS, rather than randomly pick steps and elements they perceive as most useful.

Yaman *et al.* (2017) conclude that companies need to take some aspects into consideration when selecting experiments, which include: availability of resources, current technologies being used and the status of current development activities. Additionally, Ganguly and Euchner (2018) provide insights from the experience of a global manufacturer with business experiments, revealing that, occasionally, concerns may arise that an experiment could damage the brand image; the organization can avoid such risk by not using the brand or logo in the experiment.

Baldassarre *et al.* (2017) reveal that co-creation sessions with users allow gaining a multifaceted stakeholder perspective and, consequently, identifying a stakeholder network. In sustainability-oriented projects, it is important to track progress against sustainability goals in each step of the experimentation process, because it may become unclear as the focus may shift to different business elements (Bocken *et al.*, 2018).

In order to successful implement LS, some of the reviewed papers advocate a need for a flexible organizational structure with few interconnected departments to enable cooperation and communication, as well as a culture open to experimentation that recognizes failure as a learning method, with full support from top management (Edison *et al.*, 2015, 2018; Lindgren and Münch, 2016; Ribeiro and Fernandes, 2010; Terho *et al.*, 2016). Specifically addressing LS within internal startups in large organizations, Edison *et al.* (2018) revealed that having a cross-functional team, empowering such team and having top management support speed up the development and learning processes, as well as increase collaboration, while reducing communication overhead. By contrast, the authors also reported that when internal startups should balance the long-term and short-term issues, they often suffer from dilemmas to satisfy current customers, or focus on long-term goals.

Finally, De Cock *et al.* (2019) conducted a longitudinal multiple-case study and revealed LS is constrained by the entrepreneurs' level of prior market knowledge. According to the authors, entrepreneurs with no prior market knowledge struggle to interpret market information collected through experimentation. Such finding relates to results presented by Khanna *et al.* (2018), in which the authors reveal entrepreneurs learn from hypotheses testing and MVP creation; however, the amount of learning possessed by the entrepreneur also depends on user involvement and previous existing knowledge about the market.

6. Conclusions, implications and research directions

In this study, the authors conducted an SLR with an in-depth analysis of 71 papers selected from three main databases (Web of Science, Scopus and ScienceDirect), and provided a categorization of the current literature. Like any qualitative research, this study is not free of limitations. During selection, the criteria did not take into account the quality of sources; nevertheless, all papers were evaluated by researchers who verified their adherence to the research objectives. Also, the authors used three databases of academic papers; although these databases contain the main publishers, the authors acknowledge the search process may have omitted relevant research. Content analysis can also be criticized by its subjectivity, but it may be impossible to avoid a certain level of subjectivity when dealing with the interpretative synthesis of the literature.

Despite the study presenting pertinent results and information from the review, there are still many gaps concerning the topic. The literature on the subject lacks clear guidelines to assist practitioners and scholars on the adoption and investigation of LS. To contribute to this dearth of practical guidance, and stimulate future research, the following subsection presents structured insights based on the review.

6.1 Managerial implications and avenues for future research

The present study provides direct implications for practitioners. Similar to the SLR conducted by Hu *et al.* (2015), the authors developed a preliminary roadmap (Figure 7) to guide entrepreneurs and managers on applying LS, considering the thematic analysis from the review. The construction of the staircase followed the guidelines of Miles and Huberman (1994), and the authors structured a time-ordered matrix with columns corresponding to LS sequential stages of building an MVP, measuring the tests and learning. The BML process was broken down into specific activities drawn from coded data, using the rows of the matrix.

The inner area of the *y*-axis constitutes the BML stages and the "staircase" serves as their related activities. The separation between stages is purposely blurry to represent the fact that, in the real world, positioning the steps can be somewhat fuzzy. This roadmap represents an initial attempt to provide practical guidance based on extant literature on the topic. Future research should further explore the staircase sequence, revising the proposed steps and/or incorporating new steps.

Particularly in the context of early digital startups, LS can support in the orchestration of tensions between concurrently managing the startup's existing endowment of resources and recombining them into new and original resources (Ghezzi and Cavallo, 2018). Nonetheless, irrespective of the field of the startup, after validating the initial MVP and reaching the stage in which the venture has the right product for the market (product-market fit), entrepreneurs should continue to adopt the BML approach; in this case, LS draws on the Japanese spirit of Kaizen (continuous improvement) from the Lean philosophy, and "the purpose of these tests shifts from business model *validation* to business model *optimization*" (Eisenmann *et al.*, 2011, p. 11).

Figure 7.
The Lean Startup staircase roadmap

Although the results provided light on the topic, there are still several gaps and opportunities in the current literature on LS, AM and CD toward BMI. The present study posits several questions as avenues for future research, as similarly proposed by Dorn *et al.* (2016) and Pret and Cogan (2019) in their SLRs, and recommended as an effective strategy to guide future research (Bryman and Bell, 2011; Garza-Reyes, 2015). Thus, based on the analysis and synthesis of the papers reviewed, Table V presents research questions formulated to provide potential research agenda, with questions categorized according to the themes derived from the content analysis.

Additionally, relevant matters emerged beyond the three thematic topics. MOS literature is not consensual as to relating LS as an Effectuation process (Sarasvathy, 2001). Bortolini *et al.* (2018) and Ghezzi (2018) claim LS can be positioned as an operational and scientific approach to the behavioral theory of effectuation; Xu and Koivumäki (2019), by contrast, state that the main focus of effectuating for LS is built on the rationale that the driver of developing network and partnership is through the identification of a real problem-solution fit, whereas Sarasvathy's (2001) effectuation emphasizes effectuating knowledge, resource and network. Mansoori and Lackéus (2019) conduct a thorough comparison and highlighted core underpinnings among effectuation, discovery-driven planning, prescriptive entrepreneurship, business planning, LS and design thinking. However, the positioning of such practices lay outside their scope and aim. Future research could further this discussion and debate.

Theme	Research questions
Integration with other methodologies and a new model/framework proposal	Are the frameworks/models suitable to all industries?
	Are the frameworks/models suitable to both large organizations and startups/SMEs?
	How can sustainability tools support Lean Startup to address social and environmental issues?
Impacts on organizations	How can different sorts of pivots impact the business' strategy? Should multiple pivots occur sequentially or in parallel? Is there a relationship between them?
	What are the implications of Lean Startup for corporate entrepreneurship? Does Lean Startup enhance entrepreneurial mindsets within established organizations?
	What is the impact of Lean Startup on breakthrough innovations?
	What are the implications for (large and small) businesses to conduct experimentation using their brand or going incognito? What should they consider beforehand?
Critical success factors	Which adjustments are necessary for Lean Startup to be implemented in large companies?
	Which are the most common inhibiting factors practitioners face when attempting to implement Lean Startup, Agile Methodologies and Customer Development?
	What are the most frequent errors practitioners make when implementing the methodologies?
	Is Lean Startup applicable to technology-based ventures beyond software?
	How can entrepreneurs better interpret customers' feedback and incorporate validated learning without bias?
	How to best define metrics to assess MVPs?
	How to best execute the Build-Measure-Learn loop when the organization has intermediaries and doesn't interact directly with end users?

Table V.
Research questions for future agenda

In their recent research, Melegati *et al.* (2019) conducted a multiple-case study with Brazilian software ventures and revealed that the startups do not systematically adopt LS and AM, but rather ponder the adoption based on a set of influences, such as the founders, market, business model and the startup ecosystem. Future research could further investigate reasons for the limited adoption of such practices among digital ventures, considering that these practices emerged in the software industry. The authors also observed that most of the empirical papers concerning the topic took place in the European region, more precisely, in European countries top ranked in innovation and digital-quality reports. Thus, future research may also investigate whether there is a relationship between digital affordances of a location and the usage of LS and other emerging managerial practices.

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Appendix 1

Title of journal	Count
Journal of Systems and Software	3
Information and Software Technology	2
International Entrepreneurship and Management Journal	
Journal of Cleaner Production	
Small Business Economics	
Business Process Management Journal	1
Computers in Human Behavior	
Empirical Software Engineering	
Environmental Innovation and Societal Transitions	
IEEE Engineering Management Review	
Industrial Marketing Management	
Information Systems Journal	
Information Technology & People	
International Journal of Entrepreneurial Behavior & Research	
International Journal of Entrepreneurship and Innovation Management	
International Journal of Innovation and Technology Management	
International Journal of Management in Education	
International Journal of Production Economics	
International Journal of Technology Management	
Journal of Business Research	
Journal of Enterprise Information Management	
Journal of Entrepreneurship Education	
Journal of Modern Project Management	
Journal of Small Business Management	
Journal of Software: Evolution and Process	
Library Management	
Management Decision	
Research on Social Work Practice	
Research-Technology Management	
Technological Forecasting and Social Change	
Technology Innovation Management Review	
Technovation	
The Electronic Journal Information Systems Evaluation	
The Journal of Private Equity	
Translational Materials Research	

Table AI.
Journals that sourced publications for content analysis

Title of conference	Count
International Conference on Product-Focused Software Process Improvement	7
International Conference of Software Business	4
European Conference on Pattern Languages of Programs	2
International Conference on Agile Software Development	
Academy of Management Annual Meeting	1
Agile Conference	
Computer Science and Electronic Engineering	
Euromicro Conference on Software Engineering and Advanced Applications	
European Conference on Pattern Languages of Programs	
IEEE International Conference on Industrial Eng. and Eng. Management	
IEEE International Professional Communication Conference	
Indonesia International Conference on Innovation, Entrepreneurship and Small Business	
Information Systems – Creativity and Innovation in Small and Medium-Sized Enterprises	
International Conference of Design, User Experience, and Usability	
International Conference on Axiomatic Design	
International Conference on Enterprise Information Systems	
International Conference on Human Interface and the Management of Information	
International Conference on Human-Computer Interaction	
International Design Engineering Technical Conferences & Computers and Information in Engineering Conference	

Table AII.
Conferences that sourced publications for content analysis

Appendix 2

Article	Author/year	Title
1	Bessant *et al.* (2002)	Developing the agile enterprise
2	Clutterbuck *et al.* (2009)	A case study of SME web application development via agile methods
3	Conboy *et al.* (2009)	Creativity in agile systems development: a literature review
4	Adebanjo (2010)	Challenges and approaches to customer development in co-located high-tech start-ups
5	Bottani (2010)	Profile and enablers of agile companies: an empirical investigation
6	Ribeiro and Fernandes (2010)	Exploring agile methods in construction small and medium enterprises: a case study
7	May (2012)	Applying Lean Startup: an experience report – Lean & Lean UX by a UX veteran: lessons learned in creating & launching a complex consumer app
8	Trimi and Berbegal-Mirabent (2012)	Business model innovation in entrepreneurship
9	Khalil and Fernandez (2013)	Agile management practices in a "Lightweight" organization: a case study analysis
10	Eloranta (2014)	Towards a pattern language for software start-ups
11	Giardino *et al.* (2014)	Why early-stage software startups fail: a behavioral framework
12	Järvinen *et al.* (2014)	From agile software development to mercury business
13	Leppänen (2014)	Patterns for starting up a software startup company
14	Li *et al.* (2014)	Collaborative innovation research on co-working platform based on Lean Startup model
15	Nirwan and Dhewanto (2015)	Barriers in implementing the Lean Startup methodology in Indonesia – case study of B2B startup
16	Pease *et al.* (2014)	Toward a market-based Lean Startup product design method for the developing world
17	Bieraugel (2015)	Managing library innovation using the Lean Startup method
18	Edison *et al.* (2015)	Lean Startup: why large software companies should care
19	Ghezzi *et al.* (2015)	A comparative study on the impact of business model design & Lean Startup approach versus traditional business plan on mobile startups performance
20	Harms *et al.* (2015)	Lean Startup for materials ventures and other science-based ventures: under what conditions is it useful?
21	Hokkanen *et al.* (2015)	Early product design in startups: towards a UX strategy
22	Hokkanen and Leppänen (2015)	Three patterns for user involvement in startups
23	Overall and Wise (2015)	An S-curve model of the start-up life cycle through the lens of customer development
24	Terho *et al.* (2015)	Ways to cross the Rubicon: pivoting in software startups
25	Ximenes *et al.* (2015)	Software project management combining agile, Lean Startup and design thinking
26	Risku and Abrahamsson (2015)	What can software startuppers learn from the artistic design flow? Experiences, reflections and future avenues
27	Edison (2015)	A conceptual framework of lean Startup enabled internal corporate venture
28	Bajwa *et al.* (2016)	How do software startups pivot? Empirical results from a multiple case study
29	Batova *et al.* (2016)	Challenges of Lean customer discovery as invention
30	de Paula and Araujo (2016)	Pet empires: combining design thinking, Lean Startup and agile to learn from failure and develop a successful game in an undergraduate environment
31	Edison (2016)	Software product innovation through startup experimentation in large companies

Table AIII.
Articles selected for the systematic review

(*continued*)

Article	Author/year	Title
32	Girgenti *et al.* (2016)	An axiomatic design approach for customer satisfaction through a Lean Start-up framework
33	Lenarduzzi *et al.* (2016)	MVP explained: a systematic mapping study on the definitions of minimal viable product
34	Lindgren and Münch (2016)	Raising the odds of success: the current state of experimentation in product development
35	Paço *et al.* (2016)	Development of entrepreneurship education programmes for HEI students: the Lean Start-up approach
36	Raatikainen *et al.* (2016)	Eight paths of innovations in a Lean Startup manner: a case study
37	Terho *et al.* (2016)	The developers dilemma: perfect product development or fast business validation?
38	Traube *et al.* (2017)	Beta testing in social work
39	Bajwa *et al.* (2017)	"Failures" to be celebrated: an analysis of major pivots of software startups
40	Baldassarre *et al.* (2017)	Bridging sustainable business model innovation and user-driven innovation: a process for sustainable value proposition design
41	Fagerholm *et al.* (2017)	The RIGHT model for continuous experimentation
42	Frederiksen and Brem (2017)	How do entrepreneurs think they create value? A scientific reflection of Eric Ries' Lean Startup approach
43	Mansoori (2017)	Enacting the Lean Startup methodology: the role of vicarious and experiential learning processes
44	Pantiuchina *et al.* (2017)	Are software startups applying agile practices? The state of the practice from a large survey
45	Still (2017)	Accelerating research innovation by adopting the Lean Startup paradigm
46	Weissbrod and Bocken (2017)	Developing sustainable business experimentation capability – a case study
47	Yaman *et al.* (2017)	Introducing continuous experimentation in large software-intensive product and service organisations
48	Ladd and Kendall (2017)	Entrepreneurial cognition in the Lean Startup method
49	Bocken *et al.* (2018)	Experimenting with a circular business model: lessons from eight cases
50	Bortolini *et al.* (2018)	Lean Startup: a comprehensive historical review
51	Buhl (2018)	Do it yourself – a Lean Startup toolbox for employee-driven green product innovation
52	De Cock *et al.* (2019)	Making the Lean Start-up method work: the role of prior market knowledge
53	Ekpe *et al.* (2017)	Lean Start-up awareness and effect on entrepreneurial intentions among Malaysian youths
54	Ganguly and Euchner (2018)	Conducting business experiments: validating new business models: well-designed business experiments can help validate assumptions and reduce risk associated with new business models
55	Ghezzi (2018)	Digital startups and the adoption and implementation of Lean Startup approaches: effectuation, bricolage and opportunity creation in practice
56	Ghezzi and Cavallo (2018)	Agile business model innovation in digital entrepreneurship: Lean Startup approaches
57	Khanna *et al.* (2018)	From MVPs to pivots: a hypothesis-driven journey of two software startups
58	Kumar *et al.* (2018)	A strategic framework for a profitable business model in the sharing economy
59	Tolfo *et al.* (2018)	Agile practices and the promotion of entrepreneurial skills in software development
60	Yordanova (2018)	Lean Startup method hampers breakthrough innovations and company's innovativeness
61	Ahmed *et al.* (2019)	A Lean design thinking methodology (LDTM) for machine learning and modern data projects
62	Balocco *et al.* (2019)	Lean business models change process in digital entrepreneurship
63	Chan *et al.* (2019)	Agility in responding to disruptive digital innovation: case study of an SME

(*continued*)

Table AIII.

Article	Author/year	Title
64	Mansoori and Lackéus (2019)	Comparing effectuation to discovery-driven planning, prescriptive entrepreneurship, business planning, Lean Startup, and design thinking
65	Mansoori *et al.* (2019)	The influence of the Lean Startup methodology on entrepreneur-coach relationships in the context of a startup accelerator
66	Marcinkowski and Gawin (2019)	A study on the adaptive approach to technology-driven enhancement of multi-scenario business processes
67	Melegati *et al.* (2019)	A model of requirements engineering in software startups
68	Werwath (2019)	Lean Startup and the challenges with "hard tech" startups
69	Xu and Koivumäki (2019)	Digital business model effectuation: an agile approach
70	Yang *et al.* (2019)	Search and execution: examining the entrepreneurial cognitions behind the Lean Startup model
71	Edison *et al.* (2018)	Lean internal startups for software product innovation in large companies: enablers and inhibitors

Table AIII.

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