Research Article

Setting the P-Start for digital entrepreneurship: an idea-to-company process model integrated with innovation management tools

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Abstract

The relevance of Digital Entrepreneurship is increasingly growing, especially in the context of Innovation Ecosystems. However, little attention has been paid to product/service and business levels of analysis, despite the complex managerial and technological skills required in startup generation processes. Based on technology entrepreneurship and innovation management perspectives, we propose the P-Start approach: an idea-to-company process model integrated with innovation management tools that combines agile methods and stage-gate systems to support the generation of digital startups. The model has been developed for more than six years following an action-research program that involved 12 startups, two universities, and three startup accelerators. Besides proposing the process, this article discusses theoretical and practical implications such as how the process and tools actually helped digital startups; how were they created and adapted throughout the research; and, finally, future studies on processes/tools in the Digital Entrepreneurship context are then proposed.

Keywords: digital entrepreneurship, innovation process, innovation tools, agile methods, technology entrepreneurship.

1. Introduction

Digital Entrepreneurship (DE) has attracted growing interest since its effect in the whole world – from the rising of big tech companies such as Google, Microsoft, Alibaba, and Apple to the very way we communicate, work, live, as DE is increasingly being associated with economic growth and innovation (Shen et al., 2018; Zaheer et al., 2019). We will adopt the following definition: Digital Entrepreneurship is the process of creating a digital startup as a new business or within an established firm (Zaheer et al., 2019). And digital startups are firms or organizations within established firms, in their early stages of development and growth, in which digital technologies enable at least one component of a business model in a vital way to the firm (Zaheer et al., 2019). These startups face several challenges related to technology, product development, human resources, finance, and others. Uncertainty, limited resources, information, and time add another layer of complexity to these challenges. This study was designed to help entrepreneurial teams in overcoming these challenges.

To do so, we propose P-Start: an idea-to-company agile stage-gate-like process model integrated with innovation management tools to support entrepreneurs in the context of startup development. It was built over an action research program that involved 12 startups, two universities, and three accelerators through more than six years.

Therefore, we intend to contribute to the more recent phase of studies related to Digital Entrepreneurship. Zaheer, Breyer & Dumay (2019) offer a literature review of the field and state that the current phase of research in DE must focus on *"prescriptive outputs"* to bridge the distance between research and practice in digital entrepreneurship, in line with other studies of the field (e.g.: Nambisan, 2017; Shen et al., 2018). Our study and its empirically tested agile stage-gate model help to fill a gap in DE research related to the scarcity of empirically tested venture lifecycle or integrative frameworks (Zaheer et al., 2019). Indeed, after reviewing 25 years of research on strategy tools, Vuorinen et al. (2018) found that less than a third of articles on tools provide evidence of value based on real-world experience. We also intend to contribute to the discussion of agile stage-gate models (Cooper, 2014, 2017; Cooper & Sommer, 2016), typical of large companies, by proposing an approach built under a different and relevant context.

The main contribution of this study is, however, placed in the broad discussion of managerial tools for entrepreneurship and innovation. Tools are an important lever for practitioners in their strategy efforts (Jarzabkowski & Wilson, 2006; Vaara

& Whittington, 2012) as they shape the mental models of strategies and affect both the content and process of strategy work (Vuorinen et al., 2018). They help to focus on what is important to analyze (Jarzabkowski & Kaplan, 2015; Jarzabkowski & Spee, 2009) and foster interactions among practitioners engaged in challenging sensemaking efforts (Jarzabkowski & Wilson, 2006; Vaara & Whittington, 2012); which is particularly important under DE constraints.

However, as Jarzabkowski & Kaplan (2015) stated, research on strategy tools *per se* is limited. If we narrow the focus on tools adapted to the Digital Entrepreneurship context, this limitation is even more prominent, as perceived by Blank (2013). On the other hand, Pereira et al. (2018) found statistical evidence that the use of tools is a success factor in information and communication (ICT) startups while Vuorinen et al. (2018) ask for the development of new tools to support companies in their need for rapid adaptation and changing in turbulent environments.

Theoretically, our study is built over the literature of New Product Development and Innovation. The connection between these strands and the technology entrepreneurship field is recognized by literature (*e.g.* Ratinho et al., 2015; Spiegel & Marxt, 2011). New Product Development involves engaging in several activities, including managing and transforming resources, gathering expertise and information on specifications, and creating products that meet (or create) market demand (Wheelwright & Clark, 1992). From the innovation literature, we know that the use of well-suited tools strengthens the innovation process (D'Alvano & Hidalgo, 2012; Hidalgo & Albors, 2008; Phaal et al., 2006). Once technology entrepreneurship deals with innovation in a multi-agent process, huge information asymmetry, and a great need for skills (Garud & Karnøe, 2003; Harms & Walsh, 2015), tools that have been successfully applied in the context of innovation and technology-based innovation in the past, represent opportunities to enrich the DE field.

2. Theoretical overview

Following Nambisan (2017), our study focuses on digital entrepreneurship as a novel and relevant focus of research. It is different from other Technological Entrepreneurship efforts such as hard-tech academic spinoffs (Giones & Brem, 2017), although some general insights from the TE field can be shared with DE. This theoretical review starts with some TE and DE process-based perspectives. Then, it focuses on typical challenges that startups face. Finally, it presents some tools and frameworks over which P-Start was built.

2.1. Technology and Digital Entrepreneurship process-based perspectives

The entrepreneurship phenomenon is fundamentally based on action and involves a highly interrelated set of creative, strategic, and organizational processes (Moroz & Hindle, 2012). There is a need to deal with entrepreneurship from a process perspective, since change, action, and newness are central characteristics of entrepreneurship and process-based perspectives, and process-based views are useful in understanding TE and DE (Shane & Venkataraman, 2000).

Spiegel & Marxt (2011) offer a three-stage definition of TE (Figure 1), each phase comprising different levels of analysis, viz, product/service level, business/firm level, and system level. In each of these levels, there are some research topics of interest, with many issues and challenges in the levels of product/service and business/firm, such as strategy, business model creation, project management, product and service design, prototyping and testing.
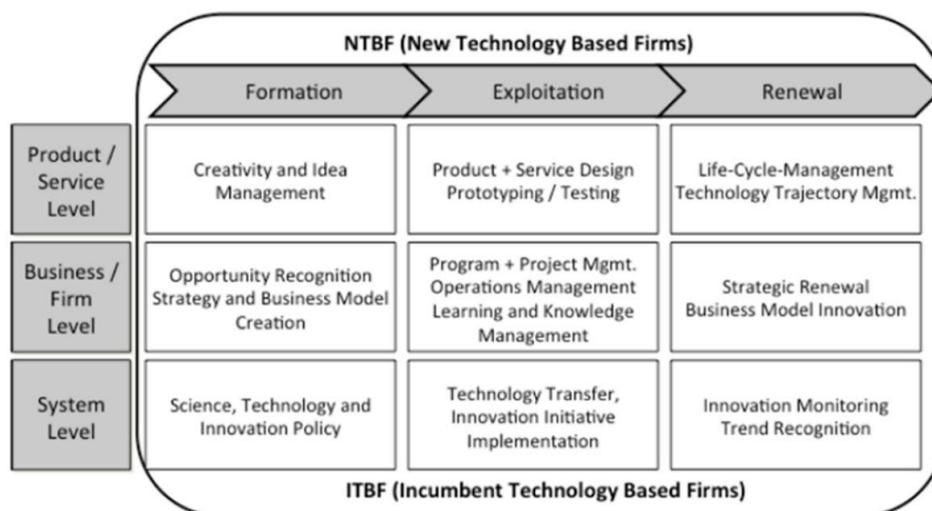
NTBF (New Technology Based Firms)		
Formation	**Exploitation**	**Renewal**
Product / Service Level		
Creativity and Idea Management	Product + Service Design Prototyping / Testing	Life-Cycle-Management Technology Trajectory Mgmt.
Business / Firm Level		
Opportunity Recognition Strategy and Business Model Creation	Program + Project Mgmt. Operations Management Learning and Knowledge Management	Strategic Renewal Business Model Innovation
System Level		
Science, Technology and Innovation Policy	Technology Transfer, Innovation Initiative Implementation	Innovation Monitoring Trend Recognition
ITBF (Incumbent Technology Based Firms)		

Figure 1. Elements of TE framework with research topics. Source: Spiegel & Marxt (2011).

Another process-based perspective was proposed by Vohora et al. (2004). Studying the academic spin-off (ASO) stream of TE research, the authors identified milestones/critical junctures through which ASOs should walk through along their development. A five-phase nonlinear process is then proposed, encompassing the possibility of ASO's team to move backward or forward throughout it (Vohora et al., 2004).

Another process-based representation was proposed by Picken (2017), who presents the life-cycle of an entrepreneurial firm in four stages: startup, transition, scaling, and exit (Figure 2). It is also a nonlinear perspective, in which the "boundaries between adjacent stages are fuzzy and frequently overlapping" (Picken, 2017, p. 588).

Picken (2017) found that during the startup phase the key challenges are to define and validate the business concept, with a narrow focus and limited resources. The organization at this stage is typically informal and fluid. Transition is the most critical period in the life cycle of a new venture and usually lasts between 18 and 36 months, involving the transition from a nascent startup into a disciplined business. Transition implies overcoming the challenges of preparing fertile ground for rapid growth, acquiring resources, and establishing credibility and legitimacy (Picken, 2017).
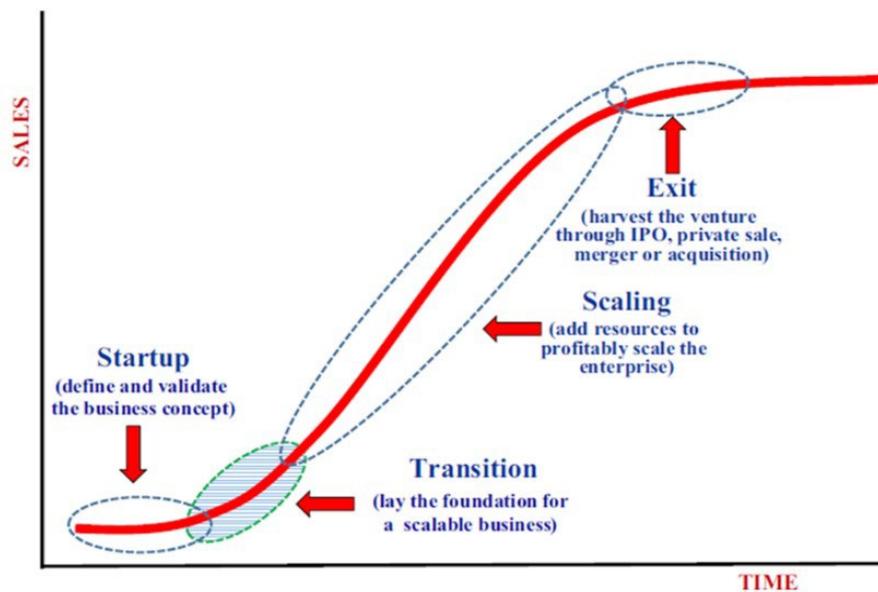

Figure 2. Four stages in the life cycle of an entrepreneurial firm. Source: (Picken, 2017).

The transition period begins at about the time when the new venture starts to gain traction in the marketplace, moving towards a structured and disciplined form, required for rapid scaling. To do so, additional resources are required, and new capabilities must be developed (Picken, 2017).

2.2. From methods to hurdles and the challenges of digital entrepreneurship

Several approaches and tools designed to support digital entrepreneurship efforts are growing in reach and importance in the context of *"The Lean revolution"* (Zaheer et al., 2019). For instance, Lean Startup (Ries, 2011), Business Model Canvas (Osterwalder & Pigneur, 2010), Design Thinking (Brown, 2009) are central approaches of such a context. Frederiksen & Brem (2017) noted that these methods are often limited to a single industry or company type, based only on subjective experiences and anecdotal evidence. To avoid risks from using these methods without considering Fredriksen and Brem's advice, this study starts from the problems digital startups face in their development.

Picken (2017) explains eight common hurdles that startups usually face in the transition phase - a moment poorly approached by Lean Startup (LS) and other similar proposals (Table 1) since they are focused on the initial steps of digital startups. By knowing these hurdles, the task of choosing appropriate methods and tools may be conducted more properly.

As Table 1 shows, the hurdles of the transition phase are different from those faced in the startup phase according to LS, which are: to develop and validate hypotheses regarding consumer/market problems and product assumptions in order to find a business model (Blank, 2013; Ries, 2011). After finding a business model in the LS perspective, the hurdles of the transition phase exposed by Picken (2017) begin.

**Table 1.** The eight hurdles of the transition period. Source: Picken (2017).

	Hurdle
1	Setting a direction and mantaining focus
2	Positioning products/services in an expanded market
3	Maintaining a cutomer/market focus
4	Building an organization and management team
5	Developing effective processes and infrastructures
6	Building financial capability
7	Developing and nurturing a culture
8	Managing risks and vulnerabilities

2.3. Approaches and methods used as support for this study

Well-chosen, well-designed, and well-adapted tools can help digital entrepreneurship efforts to thrive. Similarly, innovation and management tools help technology innovation efforts (D'Alvano & Hidalgo, 2012; Phaal et al., 2006). Of course, any good tool cannot fit all problems in a one-size-fits-all way (Salerno et al., 2015), but it needs to go through cycles of design and adaptation to specific problems and contexts.

The "Lean Startup" was selected not only due to its diffusion but also because of some scientific evidence that supports it (*e.g.* Bortolini et al., 2018; Frederiksen & Brem, 2017; Ghezzi, 2019). The Lean Startup results from a combination of agile practices with a process-based view, the so-called Customer Development (Blank, 2013).

Customer Development is a four-step nonlinear approach (Figure 3) that offers guidance to hypothesis testing with an emphasis on agility. The Lean Startup is usually associated with Customer Development and was created to help organizations carry out experiments and iterate when looking for a sustainable business model (Bortolini et al., 2018; Ries, 2011).
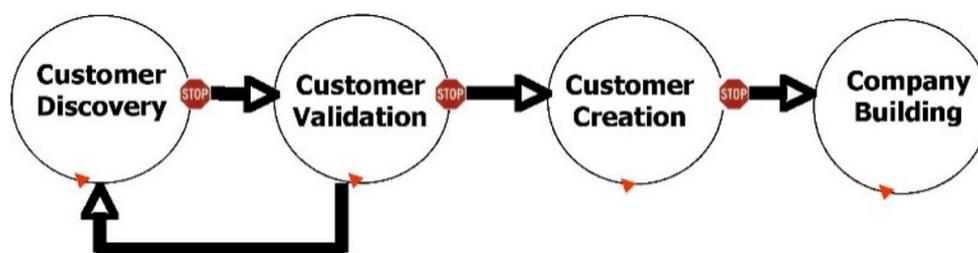
Figure 3. Customer Development four steps. Source: Blank (2006).

The Lean Startup is based on four principles: Validated learning; Build-measure-learn (B-M-L) cycle; Minimum Viable Product (MVP); and pivot or preserve. Like other agile methods, Lean Startup and Customer Development are helpful to provide higher-level orientation to entrepreneurs but fail to specify more tangible and lower-level orientation. They provide orientation about "what", but not about "how". This is helpful to foster some structured thinking while also leaving room for improvisation, characteristics that Bingham & Eisenhardt (2011) noted as necessary under uncertain and complex environments.

However, literature on innovation management has long been discussing tools and processes to help in both "what" and "how" questions with the potential to help mainly the first, but also the third, fifth, and eighth hurdles approached by Picken (2017). Our study combines the strength of these two perspectives to build the P-Start in a way to keep the strength of both: Lean Startup / Customer Development and Innovation Management Tools.

Such a connection is, however, not new. For instance, problem-solving through cycles of experimentation and early testing of critical issues is a quite similar idea to that found in the debate of the new product development cycles proposed by Thomke & Fujimoto (2000).

Finally, from the Innovation Management literature, we took the stage-gate systems as initially proposed by Cooper (1990) with the vision of agile and flexible processes following the more recent trends on stage-gate literature (Cooper, 2014, 2017; Cooper & Sommer, 2016). Agile stage-gates systems maintain the central idea of a process comprised of (i) stages in which the work gets done and (ii) gates that follow each of the stages and represent decision-taking points. However, Agile stage-gates also incorporate elements of agility, dynamism, and flexibility to become leaner, faster, and more adaptative (Cooper, 2014, 2017).

3. Method

In order to be robust and useful, processes, approaches, and methods must be developed in an iterative and controlled fashion, underpinned by appropriate theoretical frameworks, typically following three phases: early utility testing to ensure that key dimensions of the problem were captured; refinement in practice along with continuous utility assessment; ensure the stability of the model proposed by assessing its value in a variety of contexts without significant changes (Phaal et al., 2006). These guidelines led to the choice of action research as a methodological approach to guide this study through these three phases.

Action research (AR) is a research method (Checkland & Holwell, 1998; Coughlan & Coghlan, 2002) distinguished from others once it implies a social change or transformational action in one real issue (Checkland & Holwell, 1998; Coughlan & Coghlan, 2002). In this sense, AR is "research in action, rather than research about action" (Coughlan & Coghlan, 2002, p. 222).

AR was considered appropriate to reach this research objective for the following reasons: (i) it aims to address real-world problems, as in the case of designing a process-based model to help entrepreneurs and accelerators to manage their startups. This was the practical trigger, or rationale for action (Coughlan & Coghlan, 2002; Eden & Ackermann, 2018) of this research, presented by an Accelerator to the research team; and (ii) unless the researchers attempted to engage in startup development themselves, they would be unable to devise processes, approaches, and methods to tackle this kind of problem.

Table 2 presents the action research cycles as applied in the present study, detailing (i) the objective of each cycle according to the three phases of tool development (Phaal et al., 2006); (ii) the main theoretical root and other data related to the team involved in the cycles; and (iii) major changes expected to occur at each cycle.

Table 2 - Action-research cycles. Source: the authors.

	First Cycle	Second Cycle	Third Cycle	Fourth Cycle	Fifth Cycle
Time Period	Oct/2015 to Mar/2017	Mar/2017 to Jun/2017	Jul/2017 to Dec/2017	May/2018 to Jun/2020	May/2019 to Dec/2021
Objective following Phaal et al. (2006)	Early utility testing to capture key problem dimensions	Refinement in practice along with continuous utility assessment		Usefulness test in other contexts to ensure stability	
Major Theoretical Influence	Stage-gate Systems	Customer Development	Agile Stage-Gates and Customer Development	Hurdles exposed by Picken (2017)	--//--
Outcome	First version of P-Start	Second version of P-Start	Third version of P-Start	Third version of P-Start	Refined and final P-Start version
Level of involvment of researchers	Highly intense	Highly intense	Only when requested by entrepreneurs	Small: to collect data about P-Start but without involvment in the daily activities	
Startup Cases	Seja Direto and HurryApp	Seja Direto and Amor&Horta	SejaDireto and Amor&Horta	StartLog, Swampum, LIGO, Pleever, BeeMaster, and Evaluator*	Swampum, LIGO, CoinNation, MarketEasy*, and InnoPlat*
Context	Aceleradora d.E. and UFMG		SEED, UFMG, and PUC	Two startup studios, UFMG, and PUC	

*Names that don't match the real ones as requested by the entrepreneurs or in cases in which the startup still had no name defined.

The research team was comprised of members of UFMG, a top-ranked public university in Brazil, PUC-MG, a large-sized private university in Brazil. Acel and d20 are independent startup accelerators founded and managed by some of the researchers. Professors, post-graduate and graduate students were involved in different phases, totaling more than 20 researchers.

The digital startup cases were:

- *Seja Direto.* A B2B software startup. In this period, it received three rounds of angel investment, won a batch of a public acceleration program, and was later incorporated by a larger company (TIGE - a startup studio) in March/2018.

- *Hurry App.* This project was started in Dec/2016 by two IT developers, a business manager, and some angel investors. Although the narrative of this case is shorter (the founding team decided to end it a few months later), it brought important insights to the design of P-Start.

- *Amor e Horta* was a B2C software startup and participated in the research from May/2017 to Dec/2017. It received two rounds of angel investment during this study.

- *StartLog*, *CoinNation*, and *MarketEasy* were B2C startups created by PUC-MG students. One of them failed in the initial tests and two were still running by the time this article was under elaboration.

- *Swampum* (B2C), *Beemaster* (B2C), *LIGO* (B2B), and *InnoPlat* (B2B) were nascent businesses supported by d20. By Dec/2021, one had already failed, other was in its first steps, another was in the final steps to launch in the market, and the last one was in a growing stage, focusing on attracting new customers.

- *Pleever* and *Evaluator* (both B2B) were businesses supported by the startup studio TIGE and, along with HurryApp, were the only startups that were not nurtured by P-Start from the beginning. Both were paused by the end of this research.

Finally, a first study (Souza et al., 2020a) was conducted with the majority of the startups involved in the first four AR cycles using interviews and questionnaires to evaluate P-Start usefulness and support some of the conclusions here exposed.

4. The idea-to-company process model with associated tools: P-Start

The AR program resulted in a process model integrated with innovation management tools to support DE efforts. This section will present the process model (P-Start, Figure 4), and the tools associated with it.
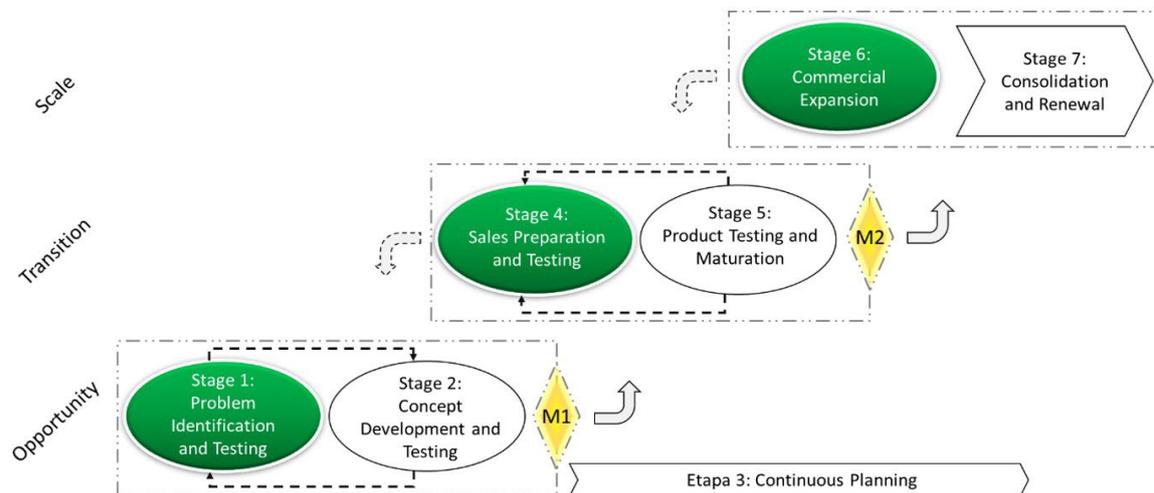

Figure 4. The final idea-to-company process model: P-Start. Source: the authors.

P-Start is focused (Figure 4, left) in the three macro-stages (opportunity, transition, and scale), similar to startup, transition, and scaling phases of Picken's startup lifecycle (see Figure 4). It is a process structured in seven steps and two milestones. We call "milestones" because they represent evaluation points – or gates – but with more flexibility in their dynamics than the traditional gates of new product development. Each stage is comprised of substages that propose toolls and/or activities geared to overcome challenges and hurdles of startup development. Table 3 shows the tools/substages associated with each P-Start stage. Following, we offer a brief description of stages and substages (see Souza et al. 2020b for a more detailed description).

P-Start's first stage has six substages that focus on obtaining and consolidating knowledge regarding the problem addressed by the startup, deeply digging into the reality of the customer. Substage 1.1 (Table 3) is designed to build the "customer-side" – customer profile – of VPD (Value Proposition Design) proposed by Osterwalder et al. (2014). Substage 2.2 relates to customer journey mapping, as suggested by the Design Thinking approach (Brown, 2009). Here, the focus is on understanding the world before working on the startup design itself, to gain insight into the real problems faced by the customer when they don't have any information about the startup intended solutions (if any). 2.3 consists of testing the findings of substages 1.1 and 1.2. Finally, substages 1.4, 1.5, and 1.6 are focused on the analysis of the external environment, when needed. The framework proposed by Osterwalder & Pigneur (2010, p. 200) may help especially in substages 1.4 to 1.6.

Table 3. P-Start substages and associated tools. Source: the authors.

1	Problem identification and testing		
1.1	Value Proposition Design (VPD) / Customer Profile		
1.2	Customer Journey (previous to the startup)	5	Product Testing and Maturation
1.3	Problem Testing and Validation	5.1	SCRUM artifacts
1.4	Analysis of competitors, benchmarks and substitutes	5.2	Design of new features
1.5	Target market definition and sizing	5.3	Design of interface (UI) and experience (UX) improvements
1.6	Environmental and value chain analysis	5.4	Quality assurance and technical debt management
2	Concept development and testing	5.5	Customer service
2.1	Value Proposition Design (VPD) / Value Map	5.6	Supply chain management
2.2	User stories design (journey or cases from the real use)	6	Commercial Expansion
2.3	MVP building	6.1	Sales model improvement
2.4	Real value evaluation	6.2	System of metrics and Key Performance Indicators (KPIs)
2.5	Competitive analysis and market positioning	6.3	Marketing expansion
3	Continuous Planning	6.4	Sales expansion
3.1	Business Model Generation Canvas	6.5	Customer service expansion
3.2	Financial analysis and investment-related ones	7	Consolidation and Renewal
3.3	Agile Roadmapping	7.1	Improvement of metrics / KPIs
3.4	Team planning and structuration	7.2	Monitoring of competitors, benchmarks and substitutes
4	Sales Preparation and Testing	7.3	New products/services and platform planning
4.1	Sales journey and sales funnel design	7.4	Analysis of new tendencies and opportunities
4.2	Sales model definition and design		
4.3	Marketing / sales testing		
4.4	Monetization and pricing decisions		
4.5	Branding and propaganda		

The second stage of P-Start (Concept development and testing) aims to create, develop and test the startup concept to achieve a product-market fit that may justify further investment and/or at least continuity of the investment previously planned. Several prototyping techniques might help at this point. Substage 2.1 (Table 3) is designed to build the "solution-side" – value map – of VPD (Value Proposition Design) proposed by Osterwalder et al. (2014). Substage 2.2 relates to designing user stories or their real cases to gain validated knowledge about how the customer would apply the solution. 2.3 relates to prototyping, creating minimum viable products able to run the build-measure-learn cycle of Lean Startup (Ries, 2011). 2.4, one of the most fundamental substages, involves the evaluation of the value offered based on the comparison between the pre and post-startup customer reality. If the difference is huge, so is the value. 2.5 focuses on competitive analysis to help market positioning.

P-Start incorporates the agile vision of the exact level of planning required – not too much, not too little. The third stage (continuous planning) focuses on it. Substage 3.1 concerns the completion of the Business Model Canvas (BMC) proposed by Osterwalder & Pigneur (2010). We found more value to the startups by first focusing on two blocks of BMC – value proposition and customer segment – using the Value Proposition Design (1.1 and 2.1). Therefore, the filling of the entire BMC occurs in a living and iterative way. 3.2 relates to finance-related analysis, a point required with more intensity in negotiations with investors. 3.3 relates to the application of an agile long-term planning method, the Agile Roadmapping (Souza et al., 2020c). Finally, 3.4 involves the fundamental activities of building, maintaining, and evolving the new venture team.

After these first stages, the first macro-stage (opportunity stage) is finished and gate M1 is set to happen (details of the gates will be given below). Stage 4 begins (sales preparation and testing) with a focus on developing a robust and efficient sales model. This stage leads to creating an initial version of the sales model (substages 4.1 and 4.2) to be submitted to test at a small/medium scale (4.3). The desired outcome is to prove the potential of startup sales expansion and justify further investment in larger sales operations. Monetization and pricing decisions must take place (4.4), as well as activities related to branding and propaganda (4.5).

It is usual to overcome the third stage with some level of technical debt. Besides solving these accumulated problems, this stage looks to other preparations that must be made to reach a product mature enough to be marketed at a real scale, according to growth expectancy at the sixth P-Start stage. Substage 5.1 focuses on agile artifacts, like product backlog/kanban and the necessary software documentation. 5.2 focuses on adding features to the product/service, while 5.3 is focused on experience and interface (UX/UI) improvements. 5.4 focuses on quality assurance and technical debt management. Customer service (5.5) may be needed, as well as supply chain management (5.6) if the startup has some part of its business model that is not digital.

The Sixth P-Start stage relates to commercial expansion at scale and begins with substage 6.1, focused on gaining efficiency in the sales model. 6.2 relates to designing a robust metric system to cover previously uncovered areas, while 6.3, 6.4, and 6.5 focus respectively on marketing, sales, and customer success expansion to support scale.

The final P-Start stage is Consolidation and Renewal, comprising the improvement of metrics (7.1) that were designed in 6.2, and the continuous monitoring of competitors, benchmarks, and substitutes (7.2). One key challenge of the studied startups that positioned one successful innovation in the market is to position the second product, reason why product platform planning may take place (7.3). Finally, and to support 7.3 or other startup activities, it is recommended to conduct continuous analysis of new tendencies and opportunities (7.4) in parallel with 7.2.

4.1. Milestones associated to P-Start

P-start also presented evaluation points associated with each macro-stage transition in a soft stage-gate-like system. Each milestone has the objective of demonstrating the critical challenges that a startup needs to overcome before moving to other development stages. There were two evaluation points (gates), called M1 and M2 (Figure 4). M1 was placed between the opportunity and transition phases while M2 was placed between transition and scale phases.

M1 aimed to verify if the startup reached its product-market fit and, at this maturity level, if it found a minimum viable prototype/product that has been proved in terms of the value proposition and price. Here, early users are supposed to be excited about using the solution. It is expected from the entrepreneurs, at this point, a clear and solid vision of how to achieve growth in the creation phase. M2 aims to verify if the startup shows constant revenues growth and both product and marketing models are ready to start a significant gain of scale. It is expected that the team has already started to structure other organizational processes (*e.g.*, customer service, customer success, and so forth) and has successfully hired the first non-founder employees.

5. Implications for theory and practice

This section discusses the main inferences and considerations that can be drawn from the study, as well as their implications for related theory and practice.

5.1. Contributions to Digital Entrepreneurship literature

Given the multidisciplinary and specificity of DE, AR proved to be important for adapting the methods and guiding their application. P-Start was perceived as valuable to help complex problem solving, improve communication and focus, help in collective decision making, and integrate strategic decisions into operational activities. The impact of this last benefit was realized when the startups began to present more than about 5 people in the team.

The benefits of P-Start can be also seen because it helps to solve, in different intensity levels, four of the eight hurdles that a startup faces in the transition phase according to Picken (2017). It helped to set and maintain direction (*e.g.*, substage 3.3 – Agile Roadmapping, and stages 5 and 6), stimulating startup to focus on small goals at each stage; maintaining a customer/market focus - *e.g.*, multiple substages in stages 1, 2, 4, 6, and 7 and the influence of the *"get out of the building"* principle proposed by Blank (2006); developing effective processes and infrastructure, and; managing risks and vulnerabilities using advising entrepreneurial teams on strategic topics through different moments.

Finally, P-Start was more appreciated by inexperienced entrepreneurs and new members of entrepreneurial teams than by the experts. The novice ones said that P-Start helped to create a common language to discuss strategic issues and provided guidance about how and when managerial tools should be used or which topics should be discussed at each moment. They also usually stated that the content of tools used in previous P-Start substages helped them to gain access to information built by the founders, facilitating training. The more experienced entrepreneurs involved in this research found value in P-Start as a means to make the coordination of their teams more easily and to facilitate their training.

5.2. Tools, stages, gates, and linearity in an entrepreneurial context

Digital entrepreneurs used P-Start as a means to focus attention on one strategic topic at each moment, as commonly suggested in the literature (*c.f.,* Jarzabkowski & Kaplan, 2015; Jarzabkowski & Spee, 2009). Also according to this literature stream (Jarzabkowski & Wilson, 2006; Vaara & Whittington, 2012), P-Start helped to structure information and to foster interaction between practitioners engaged in challenging sensemaking efforts. So, this study delivered a positive perception regarding a process model associated with tools even in an uncertain and complex entrepreneurial context.

However, it is noteworthy to say that linear representations with milestones and stages tend to be not helpful in the context of Digital Entrepreneurship. In this study, linearity has been diminished if compared to more classical stage-gate systems (*e.g.*, Cooper, 1990) and milestones were also more flexible, acting not as go/kill criteria, but as points to support decision-making.

For instance, milestone M2 helped in decision-making in critical moments of *Seja Direto* and *Amor & Horta* startup development. After stages 2 and 3, the good results of these startups generated excitement in its investors. Soon after the test of the first concept, they wanted to direct all startup's resources to start sales at scale (stage 6). At that moment, however, such an investment could lead to high risks since the products were almost artisanal and teams were still working inefficiently. M2 milestone helped to keep the focus on the 4th and 5th stages before investing in commercialization.

An example of M1 help was HurryApp case. This startup had a particularity when started to be helped by the research team of this project. HurryApp team, comprised mainly of engineers, wished to gain scale on sales with an already functional prototype but they had scarce knowledge about their value proposition, market, and customers. Using P-Start, the research team convinced them to focus on stages 2 and 3, even against their initial will. While dealing with stages 2 and 3, HurryApp team realized that some hypotheses of the business model would generate an unsustainable startup, leading to failure. So, they decided to finish HurryApp operations. P-Start, in this case, helped to make good decisions, reducing risks and the waste of resources, as expected.

6. Conclusions

The contemporary context of Digital Innovation Ecosystems tends to emphasize the higher levels of innovation and value generation by focusing on connections, partnerships, networks, and complementary competences among agents. Little attention has been paid to an important piece of this puzzle and a somewhat neglected level of analysis – the granular efforts employed to create new successful companies. The Action Research conducted in this study reached the goal of designing an idea-to-company process model for supporting Digital Entrepreneurship, associated with management tools. This result contributes to scholars and practitioners by addressing the need of startup teams for practical orientation in early and late life-cycle stages that precede a structured company, building over approaches like Lean Startup that tend to focus only on the early stages of the startup life-cycle (Picken, 2017).

It can be also said that the so-called entrepreneurship gurus often write books with a sensationalistic approach (Frederiksen & Brem, 2017) that tends to discard all prior knowledge in favor of demonstrating their work as the ultimate holy grail of entrepreneurship practice. This study seeks a different perspective, by incorporating benefits both from old and new approaches to innovation. So, the P-Start provides a balance between prescriptive and traditional stage-gate-like models (Cooper, 1990) with more agile approaches (Blank, 2006, 2013; Ries, 2011). We advocate that integration between process models and other innovation support tools has the potential to foster innovation and DE. Finally, this study contributed to unveiling a yet underexplored potential that innovation management literature possesses to help entrepreneurial efforts not only in the "whys" but also in the "hows" of entrepreneurship, whether in nascent businesses or even inside established organizations (*c.f.,* Oliveira et al., 2019; Morais et al., 2020; Bagno et al., 2020; Melo Filho et al., 2021).

Future research should investigate if an approach like P-Start can provide the same positive outcomes on entrepreneurial realities other than digital settings. We argue that uncertain settings in big companies can also benefit from approaches like P-Start, however, future studies are needed to strengthen the approach in this direction. Finally, additional efforts of designing simpler and less extensive ways of adapting and applying innovation tools originally proposed in big companies to digital startups are desirable to foster new entrepreneurial teams.

7. References

Bagno, R. B., Salerno, M. S., Souza Junior, W. C., & O'Connor, G. C. (2020). Corporate engagements with startups: antecedents, models, and open questions for innovation management. *Product: Management & Development*, *18*(1), 39-52.

Bingham, C. B., & Eisenhardt, K. M. (2011). Rational heuristics: the 'simple rules' that strategists learn from process experience. *Strategic Management Journal*, *32*(13), 1437-1464. http://dx.doi.org/10.1002/smj.965.

Blank, S. (2006). *The four steps to the epiphany: successful strategies for products that win.* Hoboken: John Wiley & Sons.

Blank, S. (2013). Why the lean start-up changes everything. *Harvard Business Review*, *91*(5), 63-72.

Bortolini, R. F., Nogueira Cortimiglia, M., Danilevicz, A. M. F., & Ghezzi, A. (2018). Lean startup: a comprehensive historical review. *Management Decision*, *59*(8), 1765-1783. https://doi.org/10.1108/MD-07-2017-0663

Brown, T. (2009). *Change by design: how design thinking transforms organizations and inspires innovation.* New York: HarperCollins.

Checkland, P., & Holwell, S. (1998). Action research: its nature and validity. *Systemic Practice and Action Research*, *11*(1), 9-21.

Cooper, R. (1990). Stage-gate systems: a new tool for managing new products. *Business Horizons*, *33*(3), 44-54.

Cooper, R. (2014). What's next? After stage-gate. *Research Technology Management*, *57*(1), 20-31. http://dx.doi.org/10.5437/08956308X5606963.

Cooper, R. (2017). Idea-to-launch gating systems: better, faster, and more agile. *Research Technology Management*, *60*(1), 48-52. http://dx.doi.org/10.1080/08956308.2017.1255057.

Cooper, R., & Sommer, A. F. (2016). The agile-stage-gate hybrid model: a promising new approach and a new research opportunity. *Journal of Product Innovation Management*, *33*(5), 513-526. http://dx.doi.org/10.1111/jpim.12314.

Coughlan, P., & Coghlan, D. (2002). Action research for operations management. *International Journal of Operations & Production Management*, *22*(2), 220-240. http://dx.doi.org/10.1108/01443570210417515.

D'Alvano, L., & Hidalgo, A. (2012). Innovation management techniques and development degree of innovation process in service organizations. *R & D Management*, *42*(1), 60-70. http://dx.doi.org/10.1111/j.1467-9310.2011.00663.x.

Eden, C., & Ackermann, F. (2018). Theory into practice, practice to theory: action research in method development. *European Journal of Operational Research*, *271*(3), 1145-1155. http://dx.doi.org/10.1016/j.ejor.2018.05.061.

Frederiksen, D. L., & Brem, A. (2017). How do entrepreneurs think they create value? A scientific reflection of Eric Ries' Lean Startup approach. *The International Entrepreneurship and Management Journal*, *13*(1), 169-189. http://dx.doi.org/10.1007/s11365-016-0411-x.

Garud, R., & Karnøe, P. (2003). Bricolage versus breakthrough: distributed and embedded agency in technology entrepreneurship. *Research Policy*, *32*(2), 277-300. http://dx.doi.org/10.1016/S0048-7333(02)00100-2.

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*, *146*, 945-960. http://dx.doi.org/10.1016/j.techfore.2018.09.017.

Giones, F., & Brem, A. (2017). Digital technology entrepreneurship: a definition and research agenda. *Technology Innovation Management Review*, *7*(5), 8.

Harms, R., & Walsh, S. T. (2015). An introduction to the field of technology entrepreneurship: editorial to the special issue: introduction to the field of technology entrepreneurship. *Creativity and Innovation Management*, *24*(4), 552-557. http://dx.doi.org/10.1111/caim.12159.

Hidalgo, A., & Albors, J. (2008). Innovation management techniques and tools: a review from theory and practice. *R & D Management*, *38*(2), 113-127. http://dx.doi.org/10.1111/j.1467-9310.2008.00503.x.

Jarzabkowski, P., & Kaplan, S. (2015). Strategy tools-in-use: a framework for understanding "technologies of rationality" in practice. *Strategic Management Journal*, *36*(4), 537-558. http://dx.doi.org/10.1002/smj.2270.

Jarzabkowski, P., & Spee, A. (2009). Strategy-as-practice: a review and future directions for the field. *International Journal of Management Reviews*, *11*(1), 69-95. http://dx.doi.org/10.1111/j.1468-2370.2008.00250.x.

Jarzabkowski, P., & Wilson, D. C. (2006). Actionable strategy knowledge: a practice perspective. *European Management Journal*, *24*(5), 348-367.

Melo Filho, L. D. R., Bagno, R. B., Barroso, M. B. C., & Costa, M. D. D. (2021). BM-QFD: an approach to technology entrepreneurship in creating academic spin-offs. *Product: Management & Development*, *19*(2), e20210014.

Morais, V. H. F., Vieira, D. M., Bagno, R. B., & Freitas, J. S. (2020). Past, present, and future of Product Management and Development: a bibliometric study on the contribution and challenges of PMD journal. *Product: Management & Development*, *18*(2), 111-121.

Moroz, P. W., & Hindle, K. (2012). Entrepreneurship as a process: toward harmonizing multiple perspectives. *Entrepreneurship Theory and Practice*, *36*(4), 781-818. http://dx.doi.org/10.1111/j.1540-6520.2011.00452.x.

Nambisan, S. (2017). Digital entrepreneurship: toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, *41*(6), 1029-1055. http://dx.doi.org/10.1111/etap.12254.

Oliveira, M. G., Bagno, R. B., Sousa Mendes, G. H., Rozenfeld, H., & Souza Nascimento, P. T. (2019). The front-hub of innovation: updating the classic fuzzy front-end to the new approaches of innovation management. *Product: Management & Development*, *16*(2), 81-91.

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

Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2014). *Value proposition design: how to create products and services customers want.* Hoboken: John Wiley & Sons.

Pereira, J. H. S., Lopes, J. E. F., & Porto, G. S. (2018). Success factors to improve the life cycle of information and communication technology start-ups in Brazil. In D. F. Kocaoglu (Ed.), *Portland International Conference on Management of Engineering and Technology*. Portland: IEEE. https://doi.org/10.23919/PICMET.2018.8481902

Phaal, R., Farrukh, C. J. P., & Probert, D. R. (2006). Technology management tools: concept, development and application. *Technovation*, *26*(3), 336-344. http://dx.doi.org/10.1016/j.technovation.2005.02.001.

Picken, J. C. (2017). From startup to scalable enterprise: laying the foundation. *Business Horizons*, *60*(5), 587-595. http://dx.doi.org/10.1016/j.bushor.2017.05.002.

Ratinho, T., Harms, R., & Walsh, S. (2015). Structuring the technology entrepreneurship publication landscape: making sense out of chaos. *Technological Forecasting and Social Change*, *100*, 168-175. http://dx.doi.org/10.1016/j.techfore.2015.05.004.

Ries, E. (2011). *The lean startup: how today's entrepreneurs use continuous innovation to create radically successful businesses.* New York: Crown Business.

Salerno, M. S., Gomes, L. A. de V., da Silva, D. O., Bagno, R. B., & Freitas, S. L. T. U. (2015). Innovation processes: which process for which project? *Technovation*, *35*, 59-70. http://dx.doi.org/10.1016/j.technovation.2014.07.012.

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, http://dx.doi.org/10.5465/amr.2000.2791611.

Shen, K. N., Lindsay, V., & Xu, Y. C. (2018). Digital entrepreneurship. *Information Systems Journal*, *28*(6), 1125-1128. http://dx.doi.org/10.1111/isj.12219.

Souza, M., Guerra, R., Vilela, A., & Dias, L. (2020a). Análise da adaptação, utilidade e processo de design de um novo método proposto para o auxílio à geração de startups. *Percurso Acadêmico, 10*(20), 57-72.

Souza, M., Melo Filho, L., & Cheng, L. C. (2020b). P-Start: processo para geração de startups e kit de ferramentas. In R. Bagno, M. Souza, & L. Cheng (Eds.), *Perspectivas sobre o empreendedorismo tecnológico: da ação empreendedora aos programas de apoio e dinâmica do ecossistema* (pp. 111–160). Curitiba: Brazil Publishing.

Souza, M., Souza, W. C., Freitas, J. S., Melo Filho, L. D. R., & Bagno, R. B. (2020c). Agile roadmapping: a management tool for digital entrepreneurship. *IEEE Transactions on Engineering Management*, *69*(1), 1-15. http://dx.doi.org/10.1109/TEM.2020.3027918.

Spiegel, M., & Marxt, C. (2011). Defining technology entrepreneurship. In *IEEE International Conference on Industrial Engineerng and Engineering Management (IEEM)* (pp. 1623-1627). Singapore: IEEE.

Thomke, S., & Fujimoto, T. (2000). The effect of "front-loading" problem-solving on product development performance. *Journal of Product Innovation Management*, *17*(2), 128-142. http://dx.doi.org/10.1111/1540-5885.1720128.

Vaara, E., & Whittington, R. (2012). Strategy-as-practice: taking social practices seriously. *The Academy of Management Annals*, *6*(1), 285-336. http://dx.doi.org/10.1080/19416520.2012.672039.

Vohora, A., Wright, M., & Lockett, A. (2004). Critical junctures in the development of university high-tech spinout companies. *Research Policy*, *33*(1), 147-175. http://dx.doi.org/10.1016/S0048-7333(03)00107-0.

Vuorinen, T., Hakala, H., Kohtamäki, M., & Uusitalo, K. (2018). Mapping the landscape of strategy tools: A review on strategy tools published in leading journals within the past 25 years. *Long Range Planning*, *51*(4), 586-605. http://dx.doi.org/10.1016/j.lrp.2017.06.005.

Wheelwright, S. C., & Clark, K. B. (1992). *Revolutionizing product development: quantum leaps in speed, efficiency, and quality.* New York: Simon and Schuster.

Zaheer, H., Breyer, Y., & Dumay, J. (2019). Digital entrepreneurship: an interdisciplinary structured literature review and research agenda. *Technological Forecasting and Social Change*, *148*, 119735. http://dx.doi.org/10.1016/j.techfore.2019.119735.