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Lifecycle of technology start-ups and characteristics of individual stages: New Theoretical Framework

Jakub Ulc[a,*]

[a] *Brno University of Technology, Faculty of Business and Management, Kolejní 2906/4, 612 00 Brno, Czech Republic*

Abstract

Purpose of the article To develop a marketing strategy research on technology start-ups depending on their lifecycle, it is necessary to create a theoretical framework for the division of stages of the technology start-up lifecycle. In the professional environment, it is impossible to find a unified idea of the technology start-up lifecycle and therefore it is impossible to observe the differences in the individual stages of the technology start-up lifecycle with respect to other scientific disciplines. The start-up environment is a global phenomenon, yet there is a lack of relevant resources related to lifecycle issues in this research area.

Methodology/methods Based on the research of secondary sources, a theoretical framework of the stages of the technology start-up lifecycle will be developed by evaluating, comparing, and critically assessing different sources and theories. Particular emphasis is placed on tracking the correlated information provided by each source and its application to the newly proposed theoretical framework of the technology start-up lifecycle.

Scientific aim The aim of the article is to propose a theoretical framework of the technology start-up lifecycle as a basis for further research. The individual stages will be divided according to financing sources, risk level, type of customers, product advanceness, output size and others. The output is represented by a graphical representation of a possible approach to the division of stages of the technology start-up lifecycle and their more detailed characteristics.

Findings Based on the analysis of secondary sources, we have defined a possible comprehensive approach to the division of the technology start-up lifecycle. There are five stages divided into the pre-seed / idea stage, seed / launch stage, growing / scaling stage, maturity stage, exit / IPO / acquisition stage. Each stage is defined in more detail and a theoretical framework for a comprehensive conception of the technology start-up lifecycle is developed.

Conclusions The topic of technology start-ups and the lifecycle is under researched. A large part of the publications consists of business literature and online resources. Establishing a comprehensive theoretical framework will help to qualify the individual stages from multiple perspectives and their application in the future. Defining lifecycle stages and creating a new theoretical framework are beneficial for further research, where differences can be observed and possible approaches can be suggested in areas such as marketing or sales depending on the stage in the technology start-up lifecycle.

Keywords: technology start-up, software start-up, start-up lifecycle, start-up funding, start-up stages, start-up development

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* Corresponding author.
E-mail address: jakub.ulc@vutbr.cz.

Introduction

This study examines the start-up phenomenon which continues to grow in importance in today's global economy. Their quick response, growth-oriented strategy, and high flexibility help them to overcome financial crises better than most companies with slower response times and reactions to unexpected events (Marques & Ferreira, 2009). The term start-up is often used in many contexts and aspects. However, this topic is not sufficiently explored in the professional public. For further research on marketing strategy in relation to the technology start-up lifecycle, it is first useful to define the lifecycle per se. A search of available sources reveals that the start-up lifecycle does not have a uniform structure and is often viewed from one perspective, e.g. in terms of investments, customers, size of a start-up, and others. To define a more comprehensive theoretical framework, we need to conduct a search of available secondary sources and then create a lifecycle design of a technology start-up, its stages, and characteristics.

1 Background of start-ups

From a historical perspective, we can trace the concept of start-ups back to the dot.com bubble, where the number of emerging technology companies with high growth rates increased due to the global rise of the Internet phenomenon. The term start-up is not precisely defined by the professional community and its use in this paper shall be specified in more detail. Inconsistent use of the term start-up by different authors prevents the creation of content based on a coherent body of knowledge (Paternoster et al., 2014). From a general perspective, Luger & Koo (2005) addressed this issue in their study, looking for possible evaluations of whether or not a company is considered a start-up. The study was based on 3 criteria - new, active and independent. Simply put, concepts such as innovation, growth, risk, uncertainty, and agility are close to the life of a start-up (Rus et al., 2016). A start-up is often financed from external sources in the form of investments in view of possible future appreciation when a start-up is profitable, when it is sold or when shares are subscribed (Nikiforova, 2018).

The traditional model of the business lifecycle and its stages is different. One of the problems relating to the failure of start-ups and their competitive capabilities is the attempt to apply the same approach as in the case of traditionally conceived, established companies, which often operate in a more stable market environment (Ries, 2011). Start-ups face unique conditions that don´t allow an easy transfer of the concepts defining customer value propositions of established traditional companies to the start-up environment. A start-up is faced with a huge degree of uncertainty when formulating its offer - customer value propositions, due to several factors such as a non-existent customer base, lack of experience in creating the offer, inability to compare with similar products, offers, and markets (Kirchberger et al., 2020). According to the abovementioned, we can therefore conclude that a start-up operates under uncertainty, i.e. in the environment where most start-ups create and consequently offer highly differentiated products and services for specific market segments and where it is difficult to predict and create customer value that is also in demand (Kirchberger et al., 2020). The problems of failed start-ups include lack of finance, lack of business knowledge, staff management problems, lack of technology, bureaucracy in the business environment, marketing and PR communication, outsourcing, innovation and expansion of products / services, logistics, patents, competition, process setup, customer care, etc. (Salamzadeh & Kawamorita Kesim, 2015; Šenkýř et al., 2020). On the other hand, if a start-up successfully manages these problems, it can become a very successful company in the short term.

Start-ups usually focus on creating high-tech innovative products with a high growth rate in highly scalable markets. However, despite a large number of well-known start-up success stories, many start-ups fail in the first two years (Crowne, 2002; Paternoster et al., 2014). What can be considered a successful start-up? When tracking the lifecycle, we can define success in each section based on different indicators such as the number of jobs created, revenue and ROI indicators, a rate of return (ROR), etc. (Schutjens & Wever, 2000). For the sake of simplicity, we can say that a start-up is successful if it passes through all stages of its lifecycle and is subsequently sold, goes public, or generally shows sufficient profit. A start-up can also be sold during its lifecycle, which is considered a success from the founder's point of view. A large number of start-ups fail before they can even reach the exit or maturity stage. In general, however, we can say that a successful start-up must have a good idea, founders and workers must have courage, passion, patience, and also a big dose of luck (Pavlák & Petru, 2018). Start-ups are seen as an important aspect of economic growth, creating jobs and supporting economic development at both regional and national levels. Thanks to start-ups, we have witnessed countless breakthrough innovations and transformations into the world's largest companies. We can therefore conclude that their potential is enormous (Tripathi et al., 2019). Once the success factors during the start-up lifecycle are known and explored, draft

strategies to support the growth and development of start-ups can be refined for global competitiveness and sustainability (Santisteban & Mauricio, 2017).

1.1 Technology start-up

There are several approaches to describe technology-focused start-ups in professional sources. However, the term is often only mentioned without further definition or explanation. Laage-Hellman et al. (2018) in their work focus on a technology-based start-up without further definition. They only mention general features of a start-up such as limited resources or lack of legitimacy. More often we encounter the term technology start-up, high-technology start-up, or high-tech start-up, which are, for instance, synonymous with new technology-based firms (NTBFs) in the work of Colombo et al. (2010) and Bertoni et al. (2011). Despite the abovementioned, even here we do not encounter a more precise definition of what is considered a high-tech start-up, as with W. K. Wong et al. (2005), McAdam & McAdam (2008) or Festel et al. (2013). Stavnsager Rasmussen & Tanev (2015) present a combined concept and introduce the term lean and global technology start-up, which is characterized by lean approach, specific business focus, focus on innovation, minimum viable product, high uncertainty of business, marketing and innovation environment, and global resource allocation process. We may also encounter the term software start-up, which can be characterized as a newly established "young" company, without sufficient resources and time, operating in an extremely dynamic, unpredictable, even chaotic environment, with multiple influences from investors, customers, partners, and competitors, and often operating in a target market with high potential (Sutton, 2000; Blank, 2013; Paternoster et al., 2014; Wang et al., 2016). In this paper, technology start-ups will be regarded as new companies that are characterized by a high degree of innovativeness, the purpose of which is not only creating breakthrough technologies but also possible innovative combinations of already existing available technologies to gain a competitive advantage in an environment of great uncertainty, producing a product or offering a service with a significant impact on society and driven by a vision of future rapid growth potential (Ries, 2011; Rode et al., 2016). In professional sources, focused on the issue of start-ups, we often encounter the absence of their definition. However, a technology start-up defined in this paper can generally be described as a subset of start-ups and therefore we take the information obtained from these professional sources as relevant. If the term start-up is used in the text, it is conceived from the perspective of start-ups in general in accordance with the source from which the information was obtained.

2 Scientific aim and methodology

The aim of this paper is to propose a theoretical framework of the technology start-up lifecycle as a basis for further research. This objective is conceived as follows due to the lack of a comprehensive conception of the technology start-up lifecycle in the available materials presented by the selected authors. The different stages will be divided according to the area of primary interest of a technology start-up according to sources of financing, risk level, type of customers, product level, output size, and others. The output is represented by a graphical representation of a possible approach to the division of stages of the technology start-up lifecycle based on the findings.

The data collection will be done through a search of secondary professional sources as well as business literature. Based on the research of secondary sources, a theoretical framework of the particular stages of the technology start-up lifecycle will be developed by evaluating, comparing, and critically assessing different sources and theories. Particular emphasis is placed on tracking the correlated information provided in the individual sources and its possible application to the newly proposed theoretical framework of the technology start-up lifecycle. First of all, we will present some general approaches to the start-up lifecycle. Based on this breakdown, we will propose a theoretical division of different stages of a technology start-up. Finally, we will present the characteristic features of these stages obtained through the analysis and critical assessment of selected sources.

3 Start-up lifecycle

The division of different stages of the start-up lifecycle according to activities and focus may differ significantly across start-ups (Salamzadeh & Kawamorita Kesim, 2015). The authors of this paper agree with Santisteban & Mauricio (2017) statement that an entrepreneur / founder needs to know the opportunities a start-up will offer. However, it is also important to know what lifecycle they need to go through to achieve success. Despite good business plans, start-ups often fail and need marketing support for their activities. These activities should be developed according to the start-up lifecycle (Nikiforova, 2018). In the professional literature we can find possible divisions according to the product development cycle, validated learning cycle, funding stages cycle, and others,

which we will evaluate, compare and critically assess in the next part of the start-up paper to create a more comprehensive approach to the technology start-up lifecycle.

In their systematic literature review on critical success factors of technology start-ups, Santisteban & Mauricio (2017) present the division of development stages as the start-up lifecycle according to several approaches and provide a possible universal division of particular stages. The output provides the division into 4 life stages, such as seed, early, growth, expansion depending on various divisions according to the authors of scientific publications (W. K. Wong et al., 2005, Yoon-Jun, 2010, Pirolo & Presutti, 2010, Mueller et al., 2012, Ng et al., 2014, Bocken, 2015, Almakenzi et al., 2015). In their approach to the technology start-up lifecycle, the idea itself emerges at the seed stage, where the first sales of early-adopters already take place. Furthermore, the exit stage or exit strategy is not included in the selected studies. Santisteban & Mauricio (2017) allege that there are many exit options, such as selling a technology start-up to another firm that is motivated in this investment by growth, technology gain, or expansion of its products and services, or an IPO, which they find to be less common. Furthermore, the actual exit, or we can rather say failure / bankruptcy of a technology start-up, does not have to follow after the previous stages but at any point in the life of a technology start-up. The study also includes the critical success factors of a technology start-up, where only 5 of the 21 critical factors are associated with a particular stage of the lifecycle – Previous experience of the start-up founding team (launch), technological / business capabilities of the founding team (growth), government support (initial stage), venture capital (growth), clustering (expansion).

According to Crowne (2002), the start-up lifecycle is divided into 4 stages. The start-up stage, where the main idea is created and innovated until the first sale. During this period, it is necessary to establish a small executive team with the necessary skills to produce the MVP. In the stabilization stage, where the first sale is made, validation and verification of the MVP takes place until no overhead on product development is incurred to acquire a new customer. The growth stage is characterized by a stable product development process and runs until the start-up gains a stable market share and growth (size), the mature organization stage where the start-up and its product development is at a high level and can develop new products because of its capacity. The division in terms of a particular product is also reported by Wang et. al (2016) in their concept of product development and its stages are defined by 6 stages - concept, in development, working prototype, functional product with limited users, functional product with high growth, and mature product to analyze the distribution of software start-ups.

The lifecycle can be divided into seed funding, stage A, stage B, stage C, stage D based on the current situation of a start-up, or its specific life stage (Tripathi et al., 2019). In terms of our study, we add the view of Sajid (2019), which states the initial pre-seed stage and the final IPO stage to the stages in question. The concept of the start-up lifecycle according to Bocken (2015) with reference to the study of Marcus et al. (2013) is also divided into 4 stages, for which their characteristics are presented in terms of possible investments. These are the seed, young, growing, and mature stages (Table 1). The three stages in relation to financing and product launch are defined by Salamzadeh & Kawamorita Kesim (2015) - bootstrapping, seed, and creation.

The main start-up promoters in the public are known thanks to business literature such as The Startup Owner's Manual or The Lean Startup (Ries, 2011; Blank & Dorf, 2012). Some concepts are based on this literature and it is appropriate to mention the approaches directly stated in these books. Blank & Dorf (2012) and Blank (2013) argue that the principles of the traditional New Product Introduction Model are not applicable to start-ups and are suitable for firms that already know their customer including the target market, their product is pre-specifiable and have an overview of their competitors. In this traditional concept, the product goes through the following stages: concept / seed, product development, alpha / beta test, and Launch / 1st Ship. Blank & Dorf (2012) do not recommend this approach for start-ups and come up with the concept of Customer Development Model focusing on customer feedback, testing assumptions, and validating hypotheses during the testing stage. They also present this approach in 4 steps - Customer Discovery, Customer Validation, Customer Creation, Company Building, where the first two stages are named "search" focusing on creating the business model and the last two stages as "execute" focusing on testing and validating the first two steps and their business model. The principle is defined by a situation where a particular start-up can go back and forth in each stage, constantly learn, fall, and explore with constant iteration in all stages. A similar approach is reported by Wang et al. (2016) in the validated learning cycle, which can be divided into 4 stages, continuously recurring – problem definition, problem validation, solution definition a solution validation.

The customer focus and the division of the lifecycle based on customer adaptation to the new technology is divided into 5 stages according to Moore (2014) in his book Crossing the Chasm. These stages are defined at the level of

willingness to adopt the latest technology (discontinuous innovation) by the customer. These are Innovators, Early adopters, Early Majority, Late Majority, and Leggards.

A comprehensive concept provided by several authors is explained in their book Lean Analytics by Croll & Yoksowicz (2013). They specify lean analytics stages to define the stages enabling to proceed to the next stage based on certain key metrics - Empathy, Stickiness, Virality, Revenue, and Scale. Giardino et al. (2015) and Wang et al. (2016) replace key metrics with key challenges in their research. They analyze them in the particular stages of product development and validate the learning cycles of a technology start-up. The study is based on the responses to a questionnaire survey provided by several thousand start-ups. The questions focused, among others, on what the respondents see as the biggest problem at the moment and which key challenges are the most dominant.

Table 1 Types of possible investment in different stages of the start-up lifecycle

	Seed	Young	Growing	Mature
FaF, Bootstrapping, Own capital	X			
Government	X			
Crowdfunding	X	X		
Angel Investors	X	X		
Corporate venturing	X	X	X	
Banks	X	X	X	X
Venture capital		X	X	
Private equity			X	X
Profit retention		X	X	X
Institutional investors				X
Stock market – IPO				X

Source: Marcus et al., 2013; Bocken, 2015

4 Defining stages of a technology start-up

Different stages of the technology start-up lifecycle are divided into the form of evaluation, comparison, and critical assessment of different sources and theories. In our search for sources, we notice an obvious ambiguity of the lifecycle division. Moreover, most of the approaches presented are limited to one particular area according to which the division is made by the authors. In our case, the objective is to create a lifecycle diagram that includes more approaches and aims towards a more comprehensive approach. The lifecycle division into stages will be explained in detail. In some cases, the particular stages are given two names. Their designation is intended to indicate the main subject matter of the given stage. These stages include: pre-seed / idea stage, seed / launch stage, growing / scaling stage, maturity stage, exit / IPO / acquisition stage (Figure 1).

Source: author, 2021

Figure 1 Five stages of a technology start-up

4.1 Pre-seed / Idea stage

A large number of technology start-ups fails in the early stages of their life and shows a high failure rate. At this stage, we encounter a high level of risk (Salamzadeh & Kawamorita Kesim, 2015). In the pre-seed stage, the entrepreneurs begin to create and then develop their idea through many activities aimed at creating a future profitable technology start-up. At this stage, funding for a technology start-up is often done in the form of Friends and Family (bootstrapping), where the founders approach their closest family or friends, often investing their funds and, in a smaller number of cases, may also receive an initial investment from angel investors. Staszkiewicz (2016) and Šenkýř et al. (2020) report that 78% of start-up founders invested their own resources to start their business in 2016. In 2019, the trend remains almost unchanged in the Czech Republic with 79%. On the other hand, thanks to

FaF-type investments, technology start-up founders are highly motivated to be more successful than other competitors in order to capitalize on their funds and attract additional financial resources from investors.

In the first two stages, the role of incubators is significant. They form essential support for technology start-ups, providing mentoring, participating in product development and design, and possible space to work. They might also help in approaching potential investors from the private and government sectors. The founders' ideas are supported by incubators. The efforts are being made to put them into practice (Tripathi et al., 2019). Even in the initial stage, we can find possible support in the form of accelerators, which is, however, more dominant only in the next stage of the technology start-up lifecycle.

In the first stage, it is advisable to start immediately with the Customer Development Model and its first stage, i.e. Customer Discovery according to Blank & Dorf (2012). This means that a technology start-up has to test its vision promptly based on experiments in confrontation with the customer. It may not mean selling in the initial stage, but leaving the comfort zone and listening to the customer, and creating its products / services based on the feedback (MVP comes in the next stage). The object of interest in the early stages is focused not only on the problem / solution fit but also on creating or validating the ideas and developing the product - the future MVP. This initial development can already be validated in research done by potential customers (Giardino et al., 2015; Santisteban & Mauricio, 2017). The actual sales have not yet started, but we can say that the emerging product is already being communicated to the innovators, who search with passion for new technological products, as technology is one of their main focus areas. This group is not very large but their feedback is crucial for further work of a technology start-up (Moore, 2014). A simple business plan is developed in a small work team environment (Santisteban & Mauricio, 2017).

4.2 Seed / Launch stage

The seed-stage features, among others, teamwork, prototype development (MVPs), prototype launch (MVPs), looking for possible ways to support accelerators and incubators and gain investment for the growth of technology start-ups. From a technical perspective for technology start-ups, the term prototype has the same contextual meaning as the term MVP (Duc & Abrahamsson, 2016). At this stage, technology start-ups aim for high growth and expansion as opposed to making some profit and creating a business model (Santisteban & Mauricio, 2017; Petru et al., 2019).

Moreover, at this stage, a technology start-up begins to market its product based on a hypothesis-driven approach, where the entrepreneur transforms its idea / vision into falsifiable business model hypotheses and tests these hypotheses using a series of minimum viable products (MVPs) that represent the smallest set of required activities / functions needed to disprove the hypotheses. MVPs can be defined as products with adequate features to gather validated learning about products that are relevant not only for the technology start-up team and founders but also for external stakeholders such as investors, potential users, and mentors. Based on the technology start-up feedback, the entrepreneur / founder can persevere with the current business model, make a pivot to change the model and some of its elements or perish a new start-up (Ries, 2011; Eisenmann et al., 2018). This approach may be called 'The Lean start-up' according to the book of the same name (Ries, 2011). It seeks to reduce wasted resources, with a vision of future growth based on creating a sustainable business. A large number of experienced entrepreneurs, product development experts, quote that this hypothesis-driven business concept has been applied for decades and this approach is not revolutionary new (Eisenmann et al., 2018).

In terms of investment, we may see more support from angel investors at this stage, who in general start investing in a technology start-up at least 10.5 months after its founding and may face a high risk of expropriation. This risk can be managed by the investor while supervising the technology start-up management (A. Wong et al., 2009). The input of angel investors may motivate other potential investors to invest in a technology start-up because of a potential higher success rate and the prospect of a high return on their investment. Their presence further motivates potential VC investments at later stages of the lifecycle. Madill et al. (2005) state in their study that at this stage of a technology start-up, investment in the form of business angels is common. It is a lower size of investment but it comes in time. In the context of Meyer (2006), they state that VCs invest only 1% of their investments in the early stages of a technology start-up life and 5% in the seed stage. At this stage, the accelerators can be seen as supporters of technology start-ups. They can further develop the technology start-up business potential and accelerate its growth through additional support. This is again an opportunity to connect with potential investors and mentor in the areas of product / market fit development orientation, business plan, and business model, lean and agile methods, create a new customer network, and their mutual communication during feedback sessions

(Tripathi et al., 2019). The success of a technology start-up at this stage is not defined by the level of revenue or growth per se, but its level becomes more important from the founders, investors and market observers perspective when a technology start-up already receives VC investment at this stage. This step confirms the quality of a technology start-up and signals its potential future success (Baum & Silverman, 2004; Spiegel et al., 2016). If a technology start-up manages to get VC investment in the first stages of its life, likely, it will not fail compared to technology start-ups without VC investment (Lerner & Kortum, 2000).

The sales orientation depends on early-adopters who complement the aforementioned innovators. The latter are also eager to find new technology products, problem-solving benefits, delivering first revenues to the technology start-up, and primarily feedback to their MVP. The information collected from early-adopters is extremely valuable in leveraging product iteration and attracting potential customers. Their opinion and cash flow procurement facilitate a possible successful transition to the next stage of the lifecycle. The difference between innovators and early adopters is in the level of technological capabilities, i.e. early adopters are at a lower level but make decisions based on their intuition and vision (Moore, 2014; Swenson et al., 2014). From the very beginning, it is crucial to develop their product in cooperation with the customer (Laage-Hellman et al., 2018).

Following Blank & Dorf (2012), we assume that their first stage - Customer Development Model - Customer Discovery, transitions loosely within the seed stage of the lifecycle and launching their MVP in the next Customer Validation stage. At the end of Customer Discovery, the technology start-up has a specific MVP that will be further tested during the Customer Validation stage. During validation, based on its MVP and interaction with the first early-adopters, it is possible to define if this direction is correct, what additional features the customer requires / does not require, and provided that the feedback is negative, such technology start-up often performs a pivot where the MVP is created with wrong assumptions, targets a different customer and market, - one of the core hypotheses about the customer is disproved and such technology start-up has to react to this fact. The aim is to determine whether a profitable business can be created based on a specific product / service and whether the business model can be successful.

In the first two stages, a technology start-up can fall into the “valley of death”. A start-up does not show sufficient output or the MVP is not even slightly positively received by the first customers after its launch. In general, this stage presents a high degree of uncertainty and risk (Salamzadeh & Kawamorita Kesim, 2015).

4.3 Growing / Scaling stage

A technology start-up is growing in size. There is an effort to optimize the product and a strong focus on marketing and attracting investment can be observed. The business model keeps improving and gaining competitiveness and market share. (Santisteban & Mauricio, 2017).

In terms of investment, VC funds represent the primary source. If we want to differentiate closely the type of source, this is VC of a local nature, which is lower in volume and presented more in the seed and growth stages, whereas VC of a global nature occurs more often in the later stages of the lifecycle with more financial support (Tripathi et al., 2019). These VC investments have a great impact on the growth of the workforce and the growth of sales volume in a short time. This growth in workforce is 110% over one year in comparison to the companies without VC investment (Bertoni et al., 2011). Lerner & Kortum (2000) also agree with this statement, supplying the results of their study. They prove that at each stage of the lifecycle, firms with VC investment have a greater tendency to grow than firms without VC investment. In addition to the abovementioned, Keuschnigg (2004) argues that when VC investment is obtained, there is an increase in the level of innovation generation and a general increase in value. The VC investment usually appears after the initial FaF investment and angel investors, and over time, the VC investment entry and exit time maybe around ten years (Marcus et. al., 2013).

The product passes the hypothesis test with MVPs and a technology start-up achieves a product / market fit. The product thus meets the customer needs with sufficient profit for a technology start-up in the target market and can start commercial scaling (Eisenmann et al., 2018).

Growth brings several positive and negative facts to technology SMEs (in our case we are talking about a start-up). Positives include increasing market power over customers and suppliers, expanding capacity for new products and new technologies, and increasing the level of reputation in the market. Negatives include increased rigidity in the organization, possible slowing down of decision-making processes. However, in general, the positives outweigh the negatives (Balboni et al., 2014).

Following Blank & Dorf (2012), the Customer Development Model switches to the Customer Creation stage where a technology start-up is successful in terms of acquiring new customers, creates higher demand in identified market segments, and invests in marketing activities. The significant increase in customers is owed to early-majority buyers who search for practical products with good market ratings. Their portion makes up a large portion of a technology start-up's revenue at this stage (Moore, 2014).

Crowne (2002) states that in the growth stage, a technology start-up may not grow sufficiently due to several problems such as lack of market knowledge and employees not having marketing skills, technology start-up not being able to meet the demand, low quality of the team and other factors. If a technology start-up fails to manage this situation, its growth will be slowed down and it will be theoretically considered a traditional SME over time. It is also true that as the number of customers and deals increases, so does the competition (Santisteban & Mauricio, 2017). The authors of this paper refer to this situation as "stagnation".

4.4 Maturity

Technology start-ups are becoming the dominant business entity in the market, escalating and expanding on a global scale (Santisteban & Mauricio, 2017). Expansion is motivated by increased profitability, management level, and the search for complementary services (Ng et al., 2014). There is also the possibility of establishing collaborations / alliances to reach other markets and segments (Yoon-Jun, 2010; Bocken, 2015).

As the lifecycle time progresses, the volume of VCs may decline, a technology start-up may be supported by banks and maybe preparing for the exit stage, which may take several forms - acquisition, IPO, or failure (Lerner & Kortum, 2000; Marcus et. al., 2013).

Following Blank & Dorf (2012), the Customer Development Model moves to the Company-Building stage where a start-up has a scalable and repeatable business model. At this stage, the founders often change their roles and hire a professional CEO. An organizational structure is created in a technology start-up according to teams such as sales, marketing, business development, etc. The growth of a technology start-up is generally slowed down. New customers are still partly made up of early-majors. On the other hand, there are also late-majors coming in. The latter wait for an established standard with significant support from an established company (Moore, 2014).

4.5 Exit, IPO, Acquisition, etc.

What can be considered a successful end of a technology start-up? There are several options such as selling the start-up or an IPO. From an investment perspective, an IPO has generally been considered the best outcome for VCs investors (Bertoni et al., 2011). There is also a greater chance of obtaining an IPO when VC investment is made earlier in the lifecycle and more likely earlier than technology start-ups without VC investment.

We cannot directly state who the customer is at this stage unless we have defined the exact scenario. However, it is true that the last group of new customers could be the laggards who have nothing to do with the latest technology but are in a situation where their old technology is no longer viable and cannot be replaced by the same component. For this reason, they are forced to adapt to the new technology. At this stage, we still cannot say that such a technology start-up is a big company and therefore we believe that the group of customers referred to as late-majors are also the main new customers of a technology start-up (Moore, 2014).

Table 2 Characteristics of technology start-up lifecycle stages

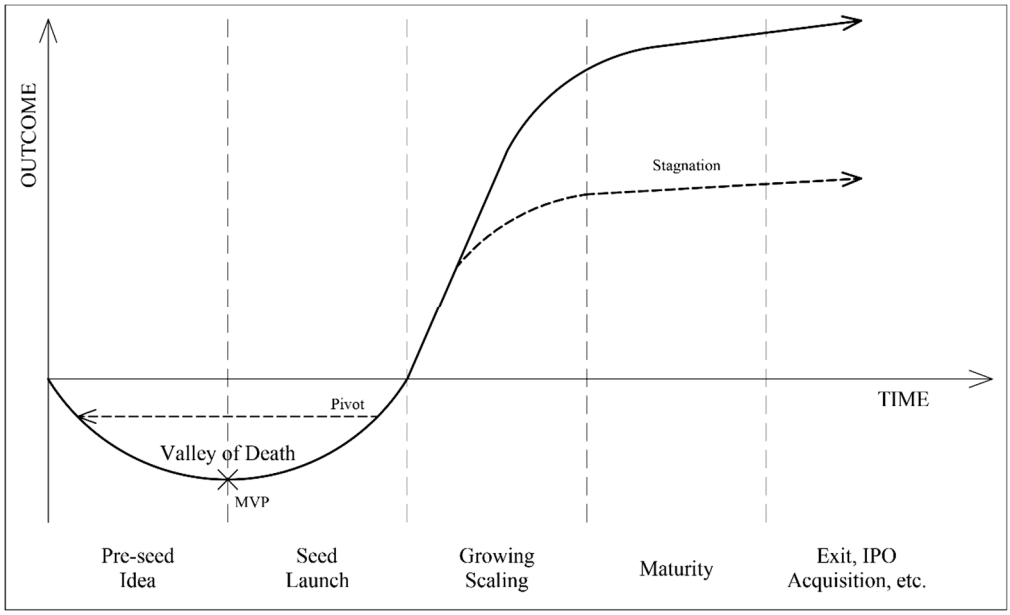
Objective	Pre-seed idea	Seed launch	Growing scaling	Maturity	Exit, IPO, acquisition
Funding	Bootstrapping, FaF, own resources, incubators	Angel investment, accelerators, crowdfunding	Venture capital, accelerators	Late VCs, Private Equity firms, Banks, Hedge	IPO, Acquisition
Product	Preparing MVP	Validate MVP	Continuous improvement of product	Stable high-quality product	Depends on the situation of exit
Type of Customer	Innovators	Innovators Early-adopters	Early-majority	Early-majority Late-majority	Late-majority Laggards
Customer Development	Customer Discovery	Customer Discovery / Validation	Customer Creation	Company-building	Depends on the exit situation
Risk	High risk	High risk	Medium risk	Medium risk	Medium risk

Business plan / model	Preparing business plan	Preparing business model and iterated it	Working business model	Repeatable business model	Working high-level business model
Focus on	Problem / solution fit	Customer / market	Increase market share, revenues	Retain customers, preparing for exit	Evaluation of a start-up
Notables	Idea	Pivot, Lean principles, Valley of Death	Exponential growth, scaling, stagnation	Expansion	Depends on the exit situation

Source: Author, 2021

5 New theoretical framework – a technology start-up lifecycle

Depending on the creation of the stages of a technology start-up and their description, we list the main areas of interest-based on the stages of a technology start-up (Table 2). We follow a more comprehensive concept that can be tested in practice. With the results, founders, experts in the given area, and other stakeholders may use this breakdown to determine which stage of the lifecycle a technology start-up is in at the given moment and define objectives of the main area of interest. We demonstrates a graphical representation of the newly created lifecycle (Figure 2). In this paper, we have not zoomed in on financial indicators such as costs or market valuation of a technology start-up. The vertical axis, therefore, shows the general output of a technology start-up, which is theoretically below the horizontal axis in the first two stages due to the consumption of financial resources. In the following stages, from the point of sale onwards, this output increases. In case of success, this increase is very fast. A technology start-up may fail at any stage of its lifecycle. The first two stages are the most critical in general. They are therefore referred to as the "valley of death" (Salamzadeh & Kawamorita Kesim, 2015). Moreover, the exit of a start-up may not always be considered successful, i.e. to grow at a great pace and to saturate its success on the market during its lifetime, when a large part of start-ups move gradually to a more traditional form of business. This start-up is not hugely successful in comparison to some of its predecessors and is not so interesting for investors. This fact is known as "stagnation" in the growing / scaling stage, which we believe is the most common phenomenon in this stage.



Source: Author, 2021

Figure 2 Technology Start-up lifecycle

6 Discussion and Conclusion

Based on the division of the stages of a technology start-up, we can see a more complex concept compared to previous approaches. A summary graphic was created to demonstrate the theoretical framework and to show the situation of a start-up at the given stage according to the sources of financing, level of risk, type of customers, level of product, size of output, etc. The authors find this issue to be unexplored, with a large part of the sources

being business literature dealing with this topic in practice. In our case, we have introduced the division into 5 stages with a detailed description of each stage. These stages are as follows: pre-seed / idea stage, seed / launch stage, growing / scaling stage, maturity stage, exit / IPO / acquisition stage.

Unlike most authors, such as Wang et al. (2016) and others working on this topic, this study does not focus on only one area according to which technology start-ups can be divided into life stages. The main contribution of this paper is the effort to provide a comprehensive approach to the given problem. However, there are limits. The division into different stages, based on a combination of information from secondary sources and our subjective opinion, is considered the biggest limitation. Surprisingly, we found that most of the available information is about the first stages of the start-up lifecycle. On the other hand, later stages such as maturity and exit are hardly ever mentioned in the literature.

In practice, we may encounter various opinions on the topic. For further research, however, it is useful to make this general division. Without defining the particular stages, it is not possible to observe the change in some assumptions and areas during the technology start-up cycle. The outcomes of this study will be further used to validate the findings by qualitative research through interviews with the technology start-ups´ representatives. The main purpose of developing a theoretical framework of the start-up lifecycle consists in its further use for research on the marketing strategy of technology start-ups in relation to the lifecycle. For further research on the technology start-up lifecycle, it is useful to extend this concept with additional information about technology start-ups such as the size of a technology start-up according to finance, personnel, financial ratios, etc.

We conclude that the objective of creating a theoretical framework for the technology start-up lifecycle has been met. Of course, this framework can be further tested and extended with additional relevant information. On the other hand, we see not only great positives in this more comprehensive concept but also its potential applicability in practice. The start-up topic is constantly mentioned in the media and often referred to as a “buzzword”. Yet, the issue is not sufficiently explored in the professional field and therefore we see great potential in this topic for the future.

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