

Entrepreneurial Decision-Making Logic Related to Software Development in Different Growth Phases of INVs

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Abstract

Software-based innovations with global market-potential are the main product offering of digital-based International New Ventures, an emerging type of rapidly internationalizing firm. Despite increasing research attention on the internationalization phases of these firms, knowledge of how the characteristics of the firm's software offerings change over time remains scarce. In this paper, we analyze how standardization, customization and localization evolve through the growth and commitment of International New Ventures in foreign markets. Specifically, we posit that an entrepreneurial decision-making logic based on a logic of effectuation or causation acts as a trigger mechanism for specific software changes over time. Therefore, this article responds to calls for research on digital entrepreneurship and thus contributes to information system, international business, and entrepreneurship literature.

1. Introduction

Software industry represents a key driver of digital transformation and software play a remarkable role in almost every industry. Digitalization of business activities has also led to the emergence of a new type of firm, digital-based international new ventures (INVs) [26]. These firms commercialize and scale their software-based innovations rapidly to global markets. These innovations may vary greatly from very tailored services to highly standardized software products. However, entering global markets increases the range of customer requirements the firm must address, because of issues like different preferences and regulations in different geographic locations [14; 26]. Inevitably a firm having to address a variety of requirements sets challenges for its rapid internationalization. During the firm's growth in international markets, the entrepreneurs are the key decision makers on the issue of the standardization and adaptation of the firm's

software offering to ensure it meets customer requirements. The central role of the entrepreneur as the main decision maker is highlighted in both Information Systems (IS), [23; 24; 25] and International Business (IB) literature [6; 11]. From an IB perspective, previous research has shown how the decisions made, the activities undertaken, and the processes implemented by entrepreneurs form the basis for the firm's international growth [2; 19]. Gabrielsson and Gabrielsson [11] showed how the entrepreneurial decision-making logic [31] affects INVs' growth and survival in international markets.

Nevertheless, little is known of how entrepreneurial decision-making affects the software development over time. In fact, we have little evidence on the evolution of software characteristics as an INV's internationalization process advances [11]. Specifically, the authors are not aware of any analysis of the entrepreneurial decision-making logic serving as a trigger mechanism to influence software characteristics such as standardization or adaptation over time [34; 35]. During their internationalization processes and increasing commitment in foreign markets, INVs face challenges such as a successful identification and exploitation of international opportunities, a stable foreign commercialization, and a long-term growth that enables reinvestment [7; 10; 11; 26; 30]. These challenges often entail shifts in the target market selection, an increased need to adapt to new technologies or amend product offerings according to emerging customer needs. Such changes eventually reflect on the entrepreneurial decision-making processes and often prompt an evolution in software characteristics.

To bridge these research gaps in the understanding of software development within international markets, our study analyzes: (i) the evolution of software characteristics during the four main international growth phases of INVs, (ii) to what extent a logic of effectuation or causation triggers specific software changes during each of the international growth phases, and (iii) to what extent software standardization and adaptation support

the firm's growth in international markets. By addressing these questions, our study responds to recent calls for further research in the area of digital entrepreneurship [23] and digital-based INVs [26]. Specifically, by applying entrepreneurship decision-making logic theories to the context of international growth and development of software firms, we enrich and extend the scope of existing research streams combining IS and IB literature.

2. Conceptual development

2.1. INVs' growth phases

Around the same time as commercial internet services emerged on the market, several IB scholars observed an increasing number of firms had internationalized soon after inception and started to serve customers globally irrespective of their geographic location. This phenomenon was theorized by Oviatt and McDougall [28] in their theory of International New Ventures (INVs). These firms, also called born globals, "seek to derive significant competitive advantage from the use of resources and the sales of outputs in multiple countries [28:49]". The faster progression of INVs towards growth in international markets has spurred a body of research analyzing their internationalization process [7; 10; 30] because it runs counter to that involving a gradual and incremental involvement in foreign markets, which underpins more traditional internationalization models [17]. In their internationalization process, INVs tend to pursue international opportunities by utilizing their business networks [18] and available unique resources [4].

To better understand how INVs in high-technology sectors internationalize, Gabrielsson and Gabrielsson [11] developed a dynamic model of INVs' growth phases and survival, from the perspective of entrepreneurial decision-making logic [31]. This model is important given the pivotal role that the entrepreneur plays in the firm's international growth through the exploitation of personal knowledge and networks via a proactive or a planned approach [2]. By grounding their analysis on a dominant problem logic, as a method to identify the growth phases of new ventures [20], the authors suggest that the development of international new ventures in international markets follows four main phases, namely: i) INV creation, ii) commercialization and foreign entry, iii) rapid growth and foreign expansion, and iv) rationalization and foreign maturity [11]. In the first phase, when creating a new firm, it is crucial the firm leverages the entrepreneur's skills and experiences to recognize international opportunities. Thereafter, entrepreneurs can start selling and

accumulating financial resources to reinvest in the firm's development. When approaching the second phase—commercialization and foreign entry—problems related to lack of commercialization knowledge can threaten the initial foreign expansion and subsequent successful commercialization. By overcoming these problems, a firm can move to the next phase—rapid growth and foreign expansion—which entails managerial challenges related to the possibility of leveraging economies of scale and continuous growth in foreign markets. In the last phase—foreign maturity—firms need to address challenges related to maintaining an extended and focused presence in a number of diverse foreign markets, which very often entails having to make the firm's activities homogeneous across different markets [11]. In the light of our research aim, this model seems to be the most appropriate given its evaluation of the role of entrepreneurial-decision making logic as factor influencing the development and survival of high-technology INVs operating in the business-to-business field.

2.2. Entrepreneurial decision-making logic during international growth

The important role of an entrepreneur as a key decision maker has become evident in both IS [e.g. 23; 24; 25] and IB studies [e.g. 6; 11]. As noted in the INV growth model [11], the decisions of entrepreneurs play a central role in how INVs expand their business to international markets. In parallel, IS studies have adduced that the current entrepreneurial context is continuously affected by constant technological change that calls for more detailed studies on "digital entrepreneurship" [23], that advance the integration of digital technology and entrepreneurial decision making. In analyzing this perspective, Ojala [24] identifies the two pathways followed by cloud services when entrepreneurs identify and exploit opportunities offered by cloud computing. By integrating insights from IB and IS theories, Ojala et al. [26] analyze how digital-based INVs internationalize by leveraging entrepreneurial networks [15; 16; 18] and firm-specific resources [4], and consequently develop a model for the internationalization of digital platform providers.

These previous works have greatly increased our understanding of entrepreneurial decision making in the context of IS, IB, and the internationalization of INVs. However, we still lack detailed knowledge of how the entrepreneurial decision-making logic varies during the different internationalization phases. Such knowledge would advance the understanding of the triggering mechanisms influencing the software development for global markets across time. We base our analysis on the

entrepreneurship theory of causation and effectuation logics [31; 32].

Causation models have traditionally been central to economic and marketing theories where the aim is to reach a determined goal and to maximize potential returns. On the other hand, under effectuation logic, entrepreneurs have a set of given means and focus is on choosing “between possible effects that can be created with that set of means” [31:252]. Effectuation can be described as an essential aspect of entrepreneurial capability, which provides insights into how entrepreneurs make decisions under uncertainty [25; 29; 31]. Indeed, when the future is unpredictable, planning is not possible and if resources are scarce, the decision-making logic seems to follow an effectual approach [31; 33]. This is evident especially when resource scarcity does not permit detailed analysis of the market and careful planning of future strategies, which are important aspects of causation models [31]. It can therefore be argued that by following a causation logic, entrepreneurs behave using a planned approach, while by following effectuation, their actions are closer to the non-predictive and more proactive form.

2.3. Software development for international markets

Comparing software development to an economic production process, where the product has its own life-cycle [3], implies that the firm’s growth, commitment, and development in national and international markets will have a direct effect on software development. Such an economic perspective opens up insights into entrepreneurial decision-making regarding the changes in software characteristics [3].

Since the first attempts to formulate a theorization of international product development, the debate between product standardization and adaptation [21] has continued to generate rich streams of research dealing with the connected international marketing [5] and communication strategies. In software engineering, the characteristics of the software may vary greatly from highly standardized software to that tailored for customers’ specific needs [34; 35]. Software standardization refers to software packaged for and aimed at mass markets [34]. In this type of offering, the

software targets a potentially wide market segment, where the product has no distinctive features based on specific customer requirements. Usually the maintenance of standardized software is conducted at the firm-level [3]; moreover the development of standardized software functionalities is incremental and involves all users.

In contrast to standardization, software adaptation follows either general actions of adapting the software to country or industry specific needs (e.g., localization of language, measurement units, etc.), or particular actions of adapting the software to single customers’ specific requirements (e.g., user interface, interfaces with other IS systems, specific functionalities, etc.). These approaches can be referred to as localization and customization respectively [1; 13; 37]. In this type of offering, the versions of the software tend to increase and usually vary among customer groups, customer segments, and even for individual customers [14]. Moreover, the development and maintenance of localized and customized software is more likely to be decentralized, through the involvement of external partners such as foreign vendors [3; 27] or clients [1].

When a firm develops and grows in international markets, the characteristics of the software may change considerably, as there is growing heterogeneity of the client base [27]. This heterogeneity increases the variance in customers’ requirements linked to their local or specific needs and divergences between local and foreign legislation and regulations. Nevertheless, to better understand the changes in software characteristics in the course of the firm’s internationalization process, it is crucial to analyze the entrepreneurial decision-making process standing behind the adoption of changes. Here we analyze the effects that these triggering mechanisms have on software characteristics during different growth phases of internationalization [11]. To assist in that analysis we build a conceptual framework where each internationalization phase determines specific product characteristics; however, we direct particular attention to the triggers based on an entrepreneurial decision-making logic of causation or effectuation. The conceptual framework is shown in Figure1.

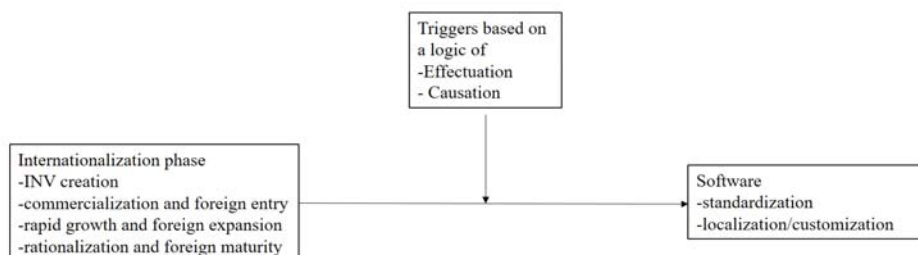


Fig.1. Conceptual framework

3. Methodology

To examine how and why software characteristics change according to triggers based on causal and effectual entrepreneurial decision-making logic, we adopted a qualitative multiple case-study analysis [39]. Because it provides a holistic view of the phenomenon under consideration [38], the methodological approach is appropriate to investigate new research questions that tend to prompt new theoretical development [9]. We used purposeful sampling to pinpoint three rapidly internationalizing small and medium-sized software firms (INVs). Therefore, the main criteria to select the case firms were: (i) to be an INV, (ii) to fulfill the European Commission definition of an SME [40], (iii) to be a software firm and (iv) to have different cultural

background. To gather generalizable findings and high variance in the data, we selected firms exhibiting macro and micro-level differences. At the macro-level, we decided to pinpoint firms from diverse geographic environments, with different levels of economic development, and different cultural characteristics. Consequently, we focus on three software firms from Brazil, Finland, and New Zealand. At the micro-level, the firms had to be advanced in their internationalization process and to commercialize software with different characteristics. Table 1 includes a brief description of the case firms under investigation. For confidentiality reasons, we replaced the original names of the firms with fictitious names representing the firm's main activity.

Table 1. Background of the case firms under investigation

	MyApp	Security Soft	Visualizer
Origin	Brazil	New Zealand	Finland
Business sector	Software house; development of digital platforms	Provider of software as a service for corporate security	Visualization Platform Developer
Age; Start of internationalization	Established in 2011; immediately with one international client; more international in 2013	Established in 2013; first foreign customers from Australia in 2014	Established in 2006; first foreign customers from Sweden and Italy in 2007
Number of countries served	majority of sales from USA; entering Europe and Canada.	USA, Australia, and Malaysia	Europe, Japan, Australia, USA
Number of employees	More than 60	6	50
Headquarters	Sao Paulo	Wellington	Oulu

3.1. Data collection

In the data collection phase of the research process, we used multiple sources of information. Primary data were gathered from direct and semi-structured interviews conducted with the managerial team of the selected firms. The interviews lasted between 45 and 90 minutes on average. To ensure their reliability, the interviews were recorded with the permission of the interviewees and transcribed verbatim. To gather longitudinal data and dynamic information, the researchers ran two rounds of interviews whenever possible. The first interviews focused on aspects such as the history and development of the firm's service offering in international markets and the entrepreneurs' role in such development. The second interviews focused on aspects such as the development of the firm's learning mechanisms to understand customer satisfaction, and the implementation of changes to the software offering's characteristics. Secondary data was gathered from different sources such as the firm's website and social media profiles and analyzed to ensure validity. Primary and secondary data are stored in a database shared by the authors. Table 2 provides a

detailed description of the sources of information constituting the bases for the research.

3.2. Data analysis

The data analysis was conducted following the abductive approach of Dubois and Gadde [8], where we regularly moved backward and forward between the data and the relevant theory. By first building a preliminary conceptual framework based on the reviewed literature, we were able to build "preconceptions" [8:555], that we later tested through the analysis and interpretation of the empirical evidence gathered. When analyzing the data, we followed the three steps suggested by Miles and Huberman [22]: (i) data reduction, (ii) data displays, and (iii) conclusion drawing/verification. In the data reduction phase, we gathered and synthesized primary and secondary sources of information for each firm in single documents highlighting the history of the software development along the firm's internationalization process. We then arranged and displayed the data in tables following the INV growth phase model, as in Gabrielsson and Gabrielsson [11]. Finally, we noted that

patterns of international software development appeared for each of the analyzed firms and we therefore drew figures that represented the evolution of software characteristics over time. The final models are presented

in the section titled *empirical evidence*. After matching the empirical reality with our initial preconception [8], we further developed our conceptual framework and finally advanced theoretical propositions.

Table 2. Data collection and further sources of information

Case Firm	Interviewed person(s)	Time period covered in: 1 st interview (i) 2 nd interview (ii)	Secondary sources of Information for data triangulation
MyApp	Business director and co-owner	(i)2011–2017 (ii)2017–2018	Facebook, LinkedIn, & Twitter profiles, firm’s website, online press articles from the Chamber of Commerce and other online sources, demo of a product sent from an interviewee.
Security Soft	Founder and CEO	(i)2013–2018	Facebook and Twitter profiles, firm’s website and own blog
Visualizer	Sales Manager and CEO	(i)2006–2018 (ii)2006–2018	Facebook, LinkedIn, firm’s website, online press articles, firm presentations

4. Empirical evidence and proposition development

In the following section, we provide an empirical analysis of the firms under investigation. Based on that firm-level analysis, we suggest propositions that help us develop new knowledge on the influence of the firm’s internationalization process and predominant entrepreneurial decision-making logic on the software development over time.

4.1. Brazilian case: My App

Founded by three entrepreneurs and financed by a group of angel investors, My App started strategically in 2011 as a game-developer with the vision of developing standardized games for social media platforms, such as Facebook and Orchus. The analysis of the predominant entrepreneurial decision-making logic reveals how during the INV creation phase, the founders followed a logic of causation [31], by using an accurate predictive logic for the future development of the firm and the means to take action [29]. Nevertheless, and after two years of unsuccessful trials, My App almost went bankrupt and lost two of the original founders. The business director explains what happened: *“The business for social games didn’t work, so we had two choices: to accept failure and close the firm or we could try to use our talent and know-how to work as a service provider.”* By basing its actions on what Sarasvathy [31] defines as a logic of affordable loss or acceptable risk, and by leveraging its knowledge, the firm based its future actions on experimentation, therefore by using an effectuation logic. In practice that meant the firm’s business model shifted toward a service-provider form, and that the product changed

from being a standardized one to become flexible and customized to potential customers’ needs. The firm’s approach to and evolution in terms of international markets also contributed to the product development and to ensuring the survival of the firm. The business director comments on this aspect: *“It [the change] has worked for us, especially since we decided to work more internationally with the clients in the United States.”* By basing its offers on the development of software as a service and by offering customized minimum viable products and technical support to different types of businesses, the firm found stability and continued its growth and expansion into foreign markets. In the mature phases, the management realized that the nature of the applications and software developed was similar, so decided to develop one of the codes further and provide it as a product to license in newly entered international markets (e.g., Europe). Despite the future product development following a logic of causation, driven by the desire to maximize potential returns by following an optimal strategy [31] and by providing standardized products, the management is still open to the development and customization of applications and platforms for new prospects. The business director comments on this issue: *“We can’t afford to put 90% of the firm working on our idea and if we fail we close the firm. We’ve been there before. We were like this in the first couple of years and we saw that betting everything on our products almost got us out of the market.”* Therefore, starting from 2018 and in the current stage, the product development is diversified and based on the adopted decision-making logic. Figure 2 depicts how the firm’s advancement in international markets triggered the software development, which seems, moreover, to be influenced by a logic that

predominantly takes characteristics of causation “C” or effectuation “E”.

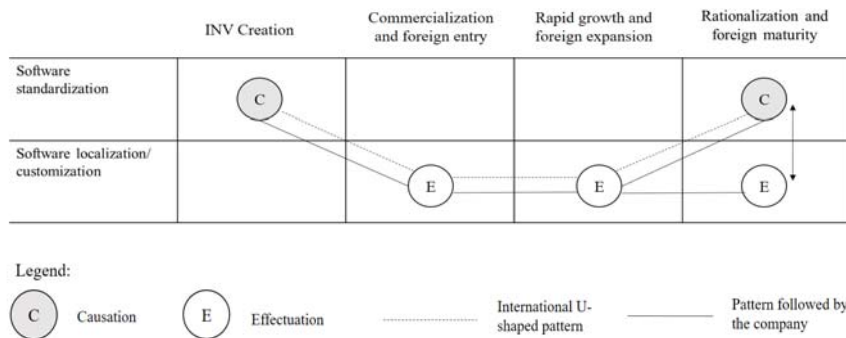


Fig. 2. International growth phases and software development of My App

4.2. New Zealand case: Security Soft

Security Soft started in 2013 by developing a customized security software by working on a project for the New Zealand police force. It can be argued that the predominant decision-making logic characterizing the product development at the initial stage followed an effectuation logic, whereas the firm did not have a set of specified goals, but was instead experimenting with solutions to meet the requirements of its first customer [29; 31]. By “precommitting” to the venture [29:3], the customers co-created and shaped the initial development of the software with the firm. The same type of logic seems to be predominant in the later stages of commercialization, when the firm expanded to the Australian market in 2014 by selling the same versions of the software to equivalent customer groups. The CEO comments on this aspect as follows: “*We found organizations that needed what we could do for them. Initially, we spoke to those organizations and we sold a few more licenses of Security Soft. That was really just as in New Zealand.*” With the growth of the firm, the management understood the potential of international markets such as United States and South-East Asia. However, it felt the need to localize its software to meet specific market needs such as the required language interface (e.g., in South-East Asia) and the applicability of the software. The firm subsequently developed the software as an open source intelligence solution, implementable at a corporate security level. It is

noticeable that during the growth and foreign expansion phase, the entrepreneurial decision-making logic changed and acquired planning characteristics [31]. In this phase, it was particularly crucial to find the best way to achieve penetration of targeted markets and business segments [31]. The same type of logic seems to dominate the current mature phase of product development. When facing very low renewal rates from customers, the management decided to hire someone to assess customer feedback. The feedback and new ideas brought by the customers are currently implemented in regular software updates, which are run for all customers, regardless of their location, by offering the software as a standardized solution. The entrepreneurial decision-making logic seems to be in line with a goal-oriented approach, where the decision maker sets sub-goals and actions to achieve the main firm’s objective [29]. The CEO comments on this aspect as follows: “*We have a plan. We have a number of goals we are trying to achieve from the perspective of revenue, of customer satisfaction, of retention. One of the things we try and do every month is make sure we’ve got something the customer is going to benefit from.*” Therefore, in the more mature phases, Security Soft develops its products and launches new releases based on the feedback from existing customers. Figure 3 shows how the internationalization and predominant decision-making logic have influenced the software development in the case of Security Soft.

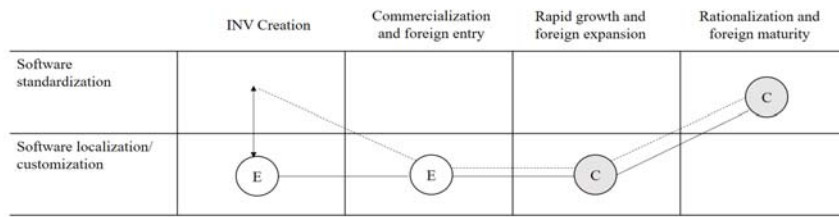


Fig. 3. International growth phases and software development of Security Soft

4.3. Finnish Case: Visualizer

Visualizer was established in 2006 by a group of four software developers with considerable knowledge of 3D visualization software. When first developed, 3D visualization was a rather generic innovation that emerged as a standardized software solution, which could benefit a wide target group of customers. The decision-making logic in this phase followed predominantly a causation model, and the entrepreneurs had clear and defined goals for product development [31]. In the commercialization and foreign entry phase, the entrepreneurs identified a target segment, the furniture industry. The entrepreneurs realized that there was a need for a digital technology that could be used to visualize furniture as a 3D model, and consequently, they developed digital sales software for furniture retailers to present their furniture selection to customers in 3D. In this phase, entrepreneurs expanded their business to foreign markets and obtained its first foreign customers in 2007 from Sweden and Italy. Expansion of the customer base also increased customer requirements related to the software. In 2008, the firm integrated new features such as augmented reality into its software and added interfaces to other software systems like ERP. These changes were mainly based on ideas the entrepreneurs elicited from discussions with existing or potential customers. Hence, the decision-making process in this phase was related to effectuation logic as the entrepreneurs used partnerships [31] to acquire novel ideas to develop their software. The sales manager of Visualizer explains their cooperation in product development with customers: “*One example is our*

augmented reality feature. We discussed and envisaged with a customer that how we could use it as a part of the software and how it would fit into their business needs. We realized that it would work nicely with our software.... We built a pilot version for the customer and it worked perfectly. Now the augmented reality feature is one important part of our software.” In 2012, Visualizer obtained investment funding to support international expansion and established units in all their main markets (USA, Singapore (for Asia), Japan, and Australia). During this rapid growth and foreign expansion phase, the software evolved further through external triggers based on the interaction with customers and partners. For instance, entrepreneurs multi-homed the software through different devices based on a request from customers and also brought the service to the cloud environment. Therefore, the decision-making logic followed an effectuation logic during this phase. In the rationalization and foreign maturity phase, from 2015 onwards, the software became more generic, so reducing the need for changes. However, the firm was still constantly updating the software and integrating it with new technologies when needed. In this phase, decision-making logic can be seen as a combination of causation and effectuation logics as the updates were initiated internally by entrepreneurs but there were still some minor changes initiated by new customers. In this mature phase, the firm began to investigate new segments where it could sell its 3D visualization software. Figure 4 shows how the internationalization and predominant decision-making logic have influenced the software development in the case of Visualizer.

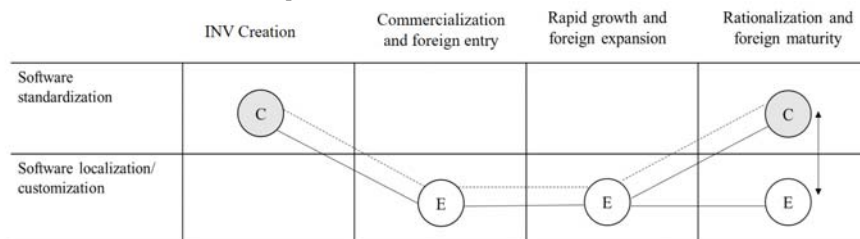


Fig. 4. International growth phases and software development of Visualizer

4.4. Cross-case analysis and propositions development

We noticed that during the INV creation phase, software development was typically initially based on a standardized product. This choice usually reflects the skills of the entrepreneurial/founding team and their ability to recognize opportunities in international markets. Prior research also suggests that at this early stage entrepreneurs “do not know what they do not know,” and therefore cannot fully anticipate the future need for adaptation [36:1091]. Standardized software means firms face lower costs related to adaptation and can therefore maximize returns through products that have a high global potential [12]. Maximizing returns can rapidly yield financial resources available for reinvestment. Nevertheless, during the phases of commercialization and foreign entry, and rapid growth and foreign expansion, it is noticeable how a greater commitment to international markets pushes entrepreneurs to develop and shape products that suit customers’ specific needs. Through the development of localized and customized software solutions [34; 35], INVs can overcome problems related to a lack of commercialization knowledge relating to foreign markets. A firm that can adapt to the specific needs of customers and markets can earn the opportunity to boost sales and profit growth. In the last phase of foreign maturity, we found the firms to be highly involved in certain market segments. The enhanced level of involvement entails the challenge of coordinating activities in different countries; an obstacle that is often overcome by developing and implementing homogeneous software solutions for all the foreign markets the firm has already conquered. This translates to standardized software solutions, while knowledge and experiences drawn from prior software development converge in a final product that meets global customers’ needs and that allows the firm to benefit from economies of scale and maximize returns [11]. Based on the above examination, it becomes evident that firms typically adopt a U-shaped behavior pattern as they evaluate a standardization versus adaptation approach with regards to the characteristics of their marketed software. Initially at the INV creation phase they follow a standardized approach, then, during the commercialization and foreign entry and rapid growth and foreign expansion phases, they apply an adapted approach, and finally, during the rationalization and foreign maturity phase, they return to a standardized approach. The qualitative case evidence thus illustrates the development of standardization of software products that resembles the form of a U- shaped curve. We use

this expression to capture the findings in short, not to relate this to an economic model. Hence, the following proposition:

Proposition 1: The standardization versus adaptation of software characteristics develop along a U-shaped curve during the international growth phases of INVs.

Within the above U-shaped standardization versus adaptation behavior pattern, the entrepreneurs typically followed an entrepreneurial decision-making logic that applied a planned approach during the INV creation phase, an effectuation approach during the commercialization and foreign entry and rapid growth and foreign expansion phases, to return back to a planning approach during the final rationalization and foreign maturity phase. Hence, the entrepreneurial decision-making logic and changes within it seem to depict the development of a standardization versus an adaptation logic with regard to software development.

During the INV creation phase, software development follows a planned approach. The entrepreneurs’ previous knowledge, partial ignorance of the options available, and emerging plans are the starting point for product development. However, in a deviating case, the software development is initiated as a result of negotiations with the customers and the actual product is built around specific customers’ needs. In this case, the “future is co-created by different agents” and not planned [29: 3]. Accordingly, effectual entrepreneurial decision-making logic and the pre-commitment of the funding team together with external partners strongly influence the software characteristics.

It is moreover evident how during the phase of commercialization and foreign entry, decision makers mainly follow a principle of affordable loss, where opportunities are not pursued based on a logic of profit, but on one of acceptable risk [29; 31]. During this phase, the software is mainly adapted to meet international customer’s requirements, in order to allow the firm to pursue rapid growth. During the foreign expansion phase, the decision makers try new approaches to product development, however the software usually remains customized or localized to the specific needs of customers and markets.

During the mature phases, the entrepreneurial decision-making logic greatly shapes the software development. Through a planned approach [31], based on a logic of expected returns [29], the decision makers tend to reduce risks related to product adoption and try to attain economies of scale via high sales volumes. These objectives are usually achieved through standardized and packaged software solutions [34].

Nevertheless, to reduce risks related to product failure, entrepreneurs are also open to new software development opportunities elicited from external partners. This effectual approach [31] leads to software that deviates from standardized solutions and that acquires adaptive characteristics, which often translate into diversified software offerings. Based on these considerations, we develop proposition two:

Proposition 2: The standardization versus adaptation of software characteristics may deviate from the U-shaped pattern based on the applied entrepreneurial decision-making logic of effectuation or causation.

5. Discussions and conclusions

By analyzing the role of the entrepreneurial decision-making logic in standardization and adaptation in the different growth phases of INVs, this multiple case-study brings new insights to the emerging stream of digital entrepreneurship [23] and digital-based INV literature [26]. The main contribution lies in applying existing theories from Entrepreneurship and IB research to the IS context [2; 11; 29; 31]. Moreover, by acknowledging the centrality of the entrepreneurial decision-making logic in software development practices over time, we conceptualize a model defining software development for international markets as a *U-shaped pattern of internationalization*.

An abductive research approach [8] revealed that the software characteristics of standardization, customization, and localization evolve through the four main phases of an INV's internationalization path [11]. In practice, this means that the likelihood of changes in software characteristics increases with the firm's involvement and commitment in international markets. The study therefore contributes to software business and engineering literature by showing how a standardized, customized, or localized software offering [1; 13; 34; 35; 37] is constantly shaped by the firm's responsiveness to the growing heterogeneity of its client base [27], the increasing variance in its customers' requirements, and technological changes occurring during internationalization. We therefore found that these changes in software characteristics, seem to follow a U-shaped pattern of internationalization (Figures 2, 3 and 4 show empirical evidence of the above-mentioned phenomenon). Nevertheless, we also observed deviating effects from the U-shaped pattern of internationalization, whenever a logic of effectuation or causation [29; 31; 32; 33] was applied in a deviating manner when implementing software changes over time. Therefore, by shedding light on a less analyzed research area—the product development of INVs—this study responds to calls for further research analyzing the

entrepreneurial decision-making logic during the internationalization phases of INVs [11] and therefore makes a further theoretical contribution to IB literature. Finally, by analyzing specific changes in software characteristics, we provide empirical evidence on how standardization and adaptation of their software offering help INVs overcome growth and survival challenges during their development in foreign markets. It is particularly noteworthy that in their mature phases, INVs tend to exploit previous knowledge and experiences to create a diversified software offering made up of both standardized and customized/localized solutions. Through this approach, the firms tend to reduce those risks related to product failure and to increase their involvement in international markets. These findings and subsequently developed propositions illustrate an important connection between entrepreneurial decision-making logic and software development decisions, which we expect to also have important ramifications to the requirements for effective information systems. At the forefront is a particular IS's capacity to gather information regarding a foreign market, that is characterized as risky, and in which causation-based logic is applicable, versus one that is so uncertain that effectuation is the only applicable decision-making logic.

Despite richly contributing to the IS and IB theories, we acknowledge that the qualitative nature of this study limits the generalizability of the results to the typology of firms under investigation. Therefore, future development of the present study could follow a quantitative methodology in order to validate the preliminary findings and broaden the investigation to firms of different size and operating in diverse business sectors. Further, we applied the entrepreneurial decision-making logic of effectuation and causation, which is particularly suitable to study digital-based INVs, where the entrepreneurs were the main decision-makers. If following this line of research, we suggest future researchers also consider the co-existence of characteristics of both decision-making logics within a particular decision. Alternatively, the research aim could be further investigated using software development management models. Nevertheless, the purpose of abductive research is to advance theoretical development in under-investigated or emerging research areas [8]. We believe that by providing evidence drawn from firms based in geographically dispersed countries, such as Brazil, Finland, and New Zealand, the scope of our research is broad and can be further extended and validated.

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