

Characteristics of digital artifacts in international endeavors of digital-based international new ventures

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Abstract

Research Summary: Current research on digital artifacts and international business reveals that digitalization is changing how firms enter international markets and operate within them. The unbounded nature of digital artifacts provides opportunities for entrepreneur-driven firms to rapidly launch and develop digital platforms for international markets. However, extant literature provides little guidance on leveraging the specific characteristics of digital artifacts and what entrepreneurs should do to facilitate internationalization. We conducted an extensive longitudinal case study spanning more than 10 years to garner data on digital-based INV pursuing internationalization. We aimed to conceptualize a theoretical model explaining the role of entrepreneurs in integrating, building, and reconfiguring their capabilities to leverage the characteristics of digital artifacts for platform development.

Managerial Summary: What actions should entrepreneurs take to leverage the characteristics of digital artifacts to support their firm's internationalization? This study offers entrepreneurs a model to pinpoint those actions and possible avenues for digital platform development in the international market context. The model demonstrates how firms can apply digital artifact

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characteristics during the phases of internationalization and how those characteristics can facilitate and accelerate the international development of a digital platform. The findings also reveal how different entrepreneurial resources and capabilities should be integrated, built, and reconfigured throughout the process.

KEYWORDS

digital artifacts, digital-based INVs, dynamic capabilities, internationalization, platforms

1 | INTRODUCTION

Digitalization has created new value and business opportunities for entrepreneur-driven firms (e.g., Henfridsson et al., 2018; Nambisan, 2017; Yoo et al., 2010). Consequently, firms providing digital services have attracted the attention of international business researchers (e.g., Chen et al., 2019; Li et al., 2019). That is because digitalization has changed how international new ventures (INVs) enter international markets and create value to support cross-border competitiveness (Monaghan et al., 2020). The type of INV that relies heavily on digitalization is often referred to as a digital-based INV (e.g., Ojala et al., 2018). Nevertheless, while digitalization can play a very important role in a firm's internationalization, there is relatively little research on how the specific characteristics of digital artifacts (Kallinikos et al., 2010, 2013) enable that international growth (see Coviello et al., 2017; Monaghan et al., 2020).

The term *digitalization* refers to the use of digital technologies to create value and new business models (Autio et al., 2021; Nambisan, 2017; Stallkamp & Schotter, 2021). A precursor is digitization, where information or analog data based on hardware (a physical artifact) is converted into a digital form comprising a series of zeros and ones (a digital artifact), so it can be read and processed by computers (Yoo, 2012). Generally, digital artifacts are digital representations of physical products, such as photographs or audio files, or a software program. Digital artifacts differ from most physical products in having intangible characteristics, such as country agnosticism or reprogrammability (Yoo, 2012).

Digital-based INVs can leverage such digital artifact characteristics to accelerate entry into international markets (Coviello et al., 2017; Gabrielsson et al., 2022; Monaghan et al., 2020; Ojala et al., 2018). Despite the body of research available, further study is merited because digital markets are constantly evolving, often in unpredictable directions (Nylén & Holmström, 2018; Ojala, 2016). That market evolution requires firms to react to rapidly changing international environments (Eisenhardt & Martin, 2000). Dynamic capabilities theory can illuminate how entrepreneurs leverage the characteristics of digital artifacts as they internationalize their business (Eisenhardt & Martin, 2000; Sapienza et al., 2006; Teece, 2014; Teece et al., 1997).

Dynamic capabilities theory offers examples of dynamic capabilities that allow entrepreneurs to integrate, build, and reconfigure their resources and capabilities to leverage the characteristics of digital artifacts to deliver early and rapid internationalization. We combine that information with the findings of information systems literature, which outline the potentially useful characteristics of digital artifacts for organizations developing digital services for

international markets (e.g., Kallinikos et al., 2010; Tilson et al., 2012; Yoo et al., 2010). Developing digital services, such as digital platforms, for international markets ultimately calls for careful analysis of the actions firms take (Chen & MacMillan, 1992; Chen & Miller, 2012, 2015).

Accordingly, this study focuses on the following research questions: (i) How do entrepreneurs integrate, build, and reconfigure their capabilities to leverage the characteristics of digital artifacts? (ii) How does this development of entrepreneurial dynamic capabilities help the digital-based INVs leverage digital artifact characteristics to support internationalization? We addressed those questions by conducting a longitudinal study of data spanning more than 10 years. This study develops a theoretical model unveiling the mechanisms explaining how entrepreneurs leverage the characteristics of digital artifacts (e.g., Autio, 2017; Kallinikos et al., 2010; Tilson et al., 2012) to support the evolution of digital platforms in international markets.

The current research makes three important contributions. First, it illuminates the role of the characteristics of digital artifacts (Kallinikos et al., 2010) in the early and rapid internationalization of digital-based INVs. That contribution complements INV theory (Oviatt & McDougall, 1994, 2005) and the emerging literature on the topic (Monaghan et al., 2020; Ojala et al., 2018). In addition, this aspect contributes to the literature on digital artifacts by illustrating their ontology (see also, Kallinikos et al., 2013; Nambisan, 2017; Yoo et al., 2012) and role in the internationalization of the firm. Second, the study extends dynamic capabilities theory (Teece et al., 1997) by revealing the important role of entrepreneurs in developing dynamic capabilities needed to leverage the characteristics of digital artifacts in their internationalization efforts. Third, we create an important theoretical bridge between dynamic capabilities theory and digitalization literature. That extends our knowledge of digital-based INVs (e.g., De Mello et al., 2019; Nummela et al., 2016) fostering the rapid internationalization of digital platforms through the associated entrepreneurs mobilizing dynamic capabilities and digital artifacts. The current research thus responds to calls for work explaining the role of the entrepreneur in underpinning firm-level outcomes (Felin et al., 2012; Pentland et al., 2012; Teece, 2007, 2012), such as firms' actions related to digital platform development and internationalization.

2 | LITERATURE REVIEW

2.1 | Characteristics of digital artifacts

In INV theory (Oviatt & McDougall, 1994, 2005; Shrader et al., 2000), digital technologies are conceptualized as important enablers and accelerators of internationalization in new ventures. Further, the literature on INVs (e.g., Gabrielsson et al., 2008; Knight & Cavusgil, 2004) establishes that (digital) technologies play a critical role in the internationalization process of new ventures. These technologies can be divided into hardware (a physical artifact) and software or data (digital artifacts). Digital artifacts are generative and evolving as they can create new outputs, structures, or behavior without input from the system's originator (Yoo, 2012; Zittrain, 2006). Possessing a basic knowledge of the most common characteristics of digital artifacts (Kallinikos et al., 2010, 2013; Yoo et al., 2010) means that we can better understand how digital services come about and how those features can make new international opportunities available.

First, digital artifacts can be relatively easily used on a range of technical devices, signaling their *product agnostic* nature (Henfridsson et al., 2018; Yoo et al., 2010). The extent of that

product agnosticism varies depending on the digital artifact in question. For instance, standard files like a jpg or mp3 are easily used on various devices. In contrast, more complex digital artifacts like software or platforms may require more adaptation before they can be used on different devices or operating systems. Usage can also be blocked if the company developing a device or a platform wants to prevent other firms from adding digital content to their device or platform. However, entrepreneurs generally prefer their digital artifacts to be capable of being *multihomed*, that is, to be compatible with several devices (Anderson et al., 2014; Ojala & Lyytinen, 2022). Multihoming facilitates global connectivity by integrating a digital service with new devices used or developed in areas with different regional standards to those where the service originates. However, there might also be technological limitations in certain markets, such as incompatibility with different technologies, standards, and digital artifacts (Ojala & Lyytinen, 2022), that limit the use of product agnostic features. Some countries or firms might also have regulations or patents limiting access to certain technologies.

Second, digital artifacts can be relatively easily distributed across national borders (cf. Eck et al., 2015). The information systems literature commonly describes this feature as *country agnosticism* (see Kallinikos et al., 2010, 2013). A digital artifact of a country agnostic nature can be accessed over great distances and in multiple locations simultaneously, with little or no transportation cost (e.g., Autio et al., 2021). However, a certain level of country adaptation might be required if access to digital content is limited by technological or strategic bottlenecks, such as internet access or efficiency restrictions (Ojala et al., 2018). The country agnostic nature of an artifact can also be diminished by issues such as country-level differences in consumer preferences, languages, and cultures (Blum & Goldfarb, 2006; Shaheer & Li, 2020). Further, national regulations can affect the application of digital artifacts in different locations. There might be compatibility issues with the socio-cultural background, restrictive regulatory conditions, or a technological lag in some markets.

Third, the non-physical form of digital artifacts makes them easily *editable* and *interactive*. Editability enables different elements of digital artifacts to be modified or updated as necessary (Nambisan, 2017). Updating can be undertaken by rearranging the different components that form a digital artifact; that might involve adding new elements or removing or modifying existing elements (Kallinikos et al., 2010, 2013). For example, a digital 3D model of a bookshelf can be easily edited to change its color, add or remove elements, alter its size, and reflect customer preferences. Editability makes it possible for entrepreneurs from digital-based INVs to meet the needs of local customers worldwide.

Interactivity permits contingent activities from the users (Kallinikos et al., 2013). In contrast to the fixed responses of physical objects, interactivity enables a function to have different outcomes depending on the user and their choices, such as language selection. Consequently, different functions can be embedded into a digital artifact to facilitate its use in different markets.

Fourth, digital artifacts can be distinguished based on their openness (Ondrus et al., 2015). This feature refers to the extent to which they are accessible and modifiable by computer programs (Kallinikos et al., 2013), in other words, whether they are *reprogrammable*. Consequently, it is possible to modify the structure of a digital artifact and its original purpose (Eck et al., 2015). A reprogrammable artifact can be modified to perform new functions after its initial production (Nambisan, 2017; Yoo et al., 2012; Zittrain, 2006). In contrast to editability, which focuses on a simple reorganization, addition, or deletion of the elements comprising a digital artifact, reprogrammability enables more fundamental changes to be made to the logical structure that governs it (Kallinikos et al., 2013). A firm that runs a digital platform that has

significant reprogrammability can apply boundary resources that enable customers and/or third parties to bring content to the platform (Ghazawneh & Henfridsson, 2013). Further, a digital artifact's reprogrammability makes continuous updates and modification possible throughout its life cycle (Hylving et al., 2012). This quality can facilitate entry into new market segments and foreign markets (Ojala & Lyytinen, 2022).

The available literature on digital artifacts in the context of this study has some limitations. It has primarily been developed to explain how digital artifacts differ from physical artifacts and to illustrate the ontology of those digital artifacts. Unfortunately, the available research offers limited information on the mechanisms permitting digital artifacts to be leveraged to support the internationalization of digital-based INVs. We believe entrepreneurs have a pivotal role in developing the capabilities necessary to leverage the characteristics of digital artifacts. Accordingly, we access dynamic capabilities theory to explain the entrepreneurial agency involved in how characteristics of digital artifacts can be built, integrated, and reconfigured during the internationalization of digital-based INVs.

2.2 | Dynamic capabilities and digital-based INVs

Dynamic capabilities theory (Teece et al., 1997) has its roots in the resource-based view (Barney, 1991, 1997; Wernerfelt, 1984). Dynamic capabilities were first conceptualized by Teece et al. (1997), and Eisenhardt and Martin (2000) later extended that conceptualization. The term here refers to a firm's organizational and strategic routines where entrepreneurs change their firm's resource base by acquiring, shedding, integrating, and recombining competencies to respond to rapidly changing environments and to generate new value (e.g., Autio et al., 2011; Teece, 2012; Teece et al., 1997). Dynamic capabilities theory is particularly useful for explaining resource reconfiguration longitudinally when entrepreneurs adapt and modify the products and services of digital-based INVs to identify new business opportunities (Teece, 2012, 2014). The research on dynamic capabilities outlines how a firm's evolution in its markets is based on resources and evolving skills (Helfat & Peteraf, 2003) as the entrepreneurs respond to changes initiated by drivers such as changing technology, regulations, and competition.

Digital-based INVs generally operate in highly volatile environments (Ojala et al., 2018), where technological changes can occur suddenly and be disruptive (Arthur, 2009). The dynamic capabilities perspective (Teece et al., 1997) provides a useful framework to illustrate how entrepreneurs organize resources and capabilities within their firms. Dynamic capabilities also contribute to successful internationalization (Oviatt & McDougall, 2005). They create a unique positioning in the market (Weerawardena et al., 2007), contribute to firms' financial performance, enhance competitive advantage (Eisenhardt & Martin, 2000), and are often central to firms' survival, especially in the case of INVs (Freixanet & Renart, 2020). Here, we use the conceptualization of dynamic capabilities developed by Teece et al. (1997, p. 516), referring to the "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." Teece (2014) clarifies that dynamic capabilities are higher-level activities involving the strategic orchestration of a firm's resources. Three main organizational processes available for entrepreneurs underpin that orchestration: *integration*, which entails combining various resources and capabilities to develop new products or processes; *building* through learning, which entails absorbing best practices and sanctioning the improvement of the tasks being performed; and *reconfiguration*, which entails amending and recombining existing resources and capabilities (see Teece, 2007; Teece et al., 1997). As noted

by Al-Aali and Teece (2014), in the INV context, the development of dynamic capabilities rests primarily on the shoulders of the founders, who are instrumental in the firm's establishment and resource acquisition enabling the firms' internationalization.

In the extant literature, the capabilities that facilitate reconfiguring existing resources are typically conceptualized as being able to construct a chain of competitive moves (Chen & MacMillan, 1992; Chen & Miller, 2012, 2015). These moves generally aim to improve or defend a firm's position in the market; however, the conceptualization does not assume direct competition with other firms in the market, as such moves can also occur in pre-market stages (Chen & Miller, 2012). To analyze different moves at the firm level, we apply the term *firm actions* and leverage dynamic capabilities theory (Teece et al., 1997) to clarify entrepreneurial agency. Firm-level outcomes depend on the skillful deployment of dynamic capabilities by entrepreneurs (Felin et al., 2012; Teece, 2007, 2012); hence, we examine the mechanisms used to *integrate*, *build*, and *reconfigure* those capabilities applied to leverage the characteristics of digital artifacts to support firm actions such as internationalizing digital operations. The operations in question in our case firm are bringing a digital platform to the international market and developing it thereafter.

A digital-based INV seeking to expand must leverage resources and learn from new and competing technologies and customers' reactions to new digital services. That learning becomes embedded as a capability of the digital-based INV over time. The firm will have to adjust the digital technologies its expansion relies on if there are changes in the external environment or a mismatch arises between the digital service and customer preferences. This study examines the role of the entrepreneur as the source of the development process of dynamic capabilities (Teece, 2007, 2012). Furthermore, we scrutinize the deployment of the characteristics of digital artifacts (Kallinikos et al., 2010, 2013), which our case digital-based INV (see Coviello et al., 2017; Monaghan et al., 2020) utilized to respond to market turbulence as it internationalized its platform solution.

3 | RESEARCH METHOD

We applied a longitudinal single-case study method (Yin, 2009) to understand the interplay between the characteristics of digital artifacts, dynamic entrepreneurial capabilities, and the firm action related to commercializing digital platforms in international markets. We selected a longitudinal, exploratory approach to investigate the research problem in detail. We then acquired empirically rich data on a real-life phenomenon (Dyer & Wilkins, 1991; Edmondson & McManus, 2007; Yin, 2009) with marked cause-and-effect relationships between different events (Eisenhardt, 1989; Pettigrew, 1990). The selected approach also provides the flexibility and openness to study unexplored phenomena, given that no well-developed concepts, hypotheses, or fixed procedures were available to use as a guide (cf. Swanborn, 2010). Further, given the scant understanding of the phenomenon and because the internationalization process can be affected by unpredictable events, the approach permits scrutiny of emerging events (Yin, 2009).

A single-case study will usually offer a superior understanding of organizational processes (Doz, 2011; Langley et al., 2013). Specifically, an in-depth analysis of a single firm can be used as a case method to study phenomena in light of dynamic capabilities theory (Bingham et al., 2015). Further, several studies highlight how longitudinal studies can illuminate how entrepreneurs of INVs develop digital platforms (de Reuver et al., 2017; Ojala, 2016), which is a complex and often an unpredictable process (Dattée et al., 2018; Nambisan, 2017).

3.1 | The case firm

The case firm is assigned the pseudonym, Visualizer. The firm's entrepreneurs developed a digital platform and related business model for foreign markets by leveraging different characteristics of digital artifacts. Visualizer also represents a typical digital-based INV, with its main service offering being developing and operating business-to-business (B2B) digital platform (see also Lucking-Reiley & Spulber, 2001; Sharif, 2017). This case-firm feature differentiates the current study from previous work on internationalization among platform providers, which focused solely on platforms developed for business-to-consumer (B2C) markets (Brouthers et al., 2016; Chen et al., 2019; Gawer, 2009; Thomas et al., 2014). In contrast, digital B2B platforms have received little attention to date. The objectives of such B2B platforms are to increase productivity and variety, achieve mass customization, and improve flexibility in new product design (Gawer, 2009). Although developers of B2B platforms are not as well-known as those operating directly in consumer markets, the market for B2B platforms is four times larger in terms of volume sold than that of B2C platforms (Patel, 2018; Reuter, 2014). Hence, the case firm represents an important group of companies. Based on its active development of digital technologies, Visualizer is also recognized as one of the leading digital platform providers of virtual and augmented reality (VR and AR) based visualization globally.

The case firm's platform is primarily a cloud-based service that enables its main customers, furniture manufacturers, and retailers, to present their furniture in three-dimensional (3D) digital models. Visualizer's customers can then use its platform as a sales tool with their customers (consumers). Both the platform and the content (3D models) are digital artifacts. The platform is a digital sales catalog that can hold an enormous volume of furniture elements in various combinations and colors. Visualizer was established in Finland in 2006 and has actively internationalized its operations since 2007. The firm has employed between 10 and 50 employees in the course of its existence, and there are currently around 40 staff. Visualizer has its own offices or representative offices on four continents and a global clientele. Consequently, the firm accords with the commonly accepted definition of an INV presented by Oviatt and McDougall (1994).

Finally, the first author of the study has cooperated with the case firm on several projects and has had unrestricted access to confidential firm-specific information available to a very small number of people that the firm trusts implicitly (Myers & Newman, 2007). The CEO of Visualizer also facilitated meetings with other employees and partners in Finland and overseas. That access meant we could gather extensive insights from other professionals and clarify details of the firm's platform development and internationalization (cf. Stake, 1995).

3.2 | Data collection

The empirical material collected covers the entire history of the case firm from 2006 to 2021. It reveals how the firm's founders were involved in building, integrating, and reconfiguring the various capabilities of the firm to leverage the characteristics of digital artifacts in support of internationalization. Interviews with the top management team, consisting of the entrepreneurs, formed the main source of the material. In addition, we interviewed six other employees and two representatives of a partner firm (a retailer). We sought to avoid personal and elite bias (Myers & Newman, 2007), to triangulate and improve the

validity of the study, and to acquire a comprehensive perspective and the most relevant information on each topic (Huber & Power, 1985). The firm's internationalization and active development of a digital platform for foreign markets made it an interesting subject for study. Data collection began in 2011 and interviews were conducted between 2011 and 2021 (see Table 1). In 2021, we ceased interviewing because the numerous interview rounds had by then provided sufficient data. The collected data reveal the firm's actions, its digital artifacts, and the dynamic capabilities supporting the evolution of its digital platform in international markets. The CEO nominated other interviewees whose knowledge of various phases of the internationalization process and the technologies used could enhance the study's impact. The interviews with the additional employees were tailored according to their role in the firm, their involvement in foreign market entries, their networking with partners, etc.

We conducted 19 interviews for this study. The duration of the interviews ranged from 45 to 135 min, and the average duration was around 65 min. Ten interviews were conducted in Visualizer headquarters in Oulu (Finland), two in Helsinki (Finland), one in Copenhagen (Denmark), one in Singapore, two in Yokohama (Japan), and three online using Zoom video conference software owing to the Covid-19 pandemic. The first interviews focused on the early history of the firm, the business idea, the technological development of the initial platform, and the early internationalization process. The subsequent follow-up interviews built on previous interviews by focusing on the characteristics of the digital artifacts, global platform development, and the firm's internationalization. We took notes during the interviews and photographed the drawings made by the interviewees when they illustrated the development of their platform and the foreign market operations. All the interviews were recorded and transcribed verbatim, resulting in 225 single-spaced pages of interview data. In addition to formal interviews, there were informal discussions with the case firm's managers and employees during several seminars and events. These discussions increased mutual trust (Myers & Newman, 2007) and provided detailed, confidential insights into the firm, its service, and the internationalization process. The second and third authors of the paper were not involved in the interviews. This approach was intended to maintain an objective perspective necessary to avoid biased theorizing.

Although the face-to-face interviews formed the main source of the data, we used telephone and email communication to clarify inconsistencies found in the interview data or secondary material. After each interview, we returned the complete transcripts to the interviewees to review and, if necessary, comment on them. In most cases, the interviewees accepted the transcripts as they stood. However, in some cases, the interviewees fed back comments on some particular wording, added a few details, or clarified the names of partners.

To avoid retrospective bias (Huber & Power, 1985), we collected several types of secondary data (Table 2) to validate and triangulate the primary data (Miles et al., 2013). Visualizer offered access to internal PowerPoint presentations intended to be confidential marketing material. In addition, we accessed the case firm's social media sites (LinkedIn, Facebook, and Instagram) to collect information related to the firm's actions in the market ($n = 638$: all social-media posts). These postings revealed important information on the firm's market activity and guided us to articles reporting on Visualizer's market activities. This part of the process was complemented by systematically comparing the interview data with the secondary data. All the inconsistencies between the interview data and the secondary data were discussed with the interviewees and the CEO to eliminate possible misunderstandings and mitigate the chance of retrospective bias.

TABLE 1 People interviewed.

Person interviewed	Time of the interview(s) (month/year)	Duration of the interview(s) (h/min)	Field of knowledge
CEO (co-founder)	4/2011	1:10	- Business idea
	6/2011	0:50	- Internationalization
	4/2017	1:15	- Establishment of the firm
	2/2018	1:20	- Global business development
	1/2019	1:00	- Service development
	10/2019	0:50	
	5/2021	2:15	
	9/2021	0:45	
COO (co-founder)	4/2011	1:00	- Service development - Internationalization (especially in Scandinavia and Italy)
CTO (co-founder)	3/2013	1:10	- Technical development
Art Director (co-founder)	6/2011	0:55	- Visualization - Technical development
Vice President, Sales	8/2011	1:00	- Sales in Scandinavia and Central Europe
Sales Manager, Europe	11/2014	0:50	- Internationalization into European markets
	2/2018	0:55	- Sales engineering
	1/2019	1:05	- Customer relationships
Sales Manager, South-East Asia	12/2014	0:45	- Internationalization and sales in South-East Asia and Australia - Business development in Japan
Sales Manager (partner in Japan)	5/2012	1:00	- Sales development in Japan
Technical Director (partner in Japan)	5/2012	1:10	- Technical requirements in Japan - Sales development in Japan

TABLE 2 Secondary sources of information.

Data source	N. of data (posts)	Time period covered by the source
Facebook	352 posts	2012–2021
Instagram	106 posts	2016–2021
LinkedIn	147 posts	2019–2021
Website	33 posts	Years n/a

3.3 | Data analysis

Qualitative techniques were applied to analyze the data (Eisenhardt, 1989; Miles et al., 2013). The great volume of transcribed data required that we first conduct a data reduction process (Miles et al., 2013) to remove data that did not relate to internationalization, digital artifacts, and the various capabilities developed. To do so, we used complete transcripts from the interviews and secondary data (Eisenhardt, 1989). This aligns with the recommendation of Pettigrew (1990) to arrange incoherent aspects of context evolution into chronological order to clarify the causal links between critical events. The data reduction exercise produced a document spanning the firm's entire history.

Following data reduction, the next step was to organize the data into more detailed events. To do so, we implemented an open thematic content analysis (Corbin & Strauss, 2014; Strauss, 1987; Taylor et al., 2015). We organized the events of the case firm's internationalization into chronological order to develop a case narrative illustrating the four actions of the firm in international markets. When we no longer recognized new firm actions from the data or new mechanisms driving them, we judged we had reached data saturation. Finally, we triangulated the findings from the case study with previous literature on the evolution of digital technologies and artifacts (e.g., Nylén & Holmström, 2018; Tilson et al., 2012; Yoo et al., 2010).

We applied a continuous coding method to the longitudinal empirical evidence following a qualitative logic based on our research questions (Gioia et al., 2013; Langley et al., 2013). Following a similar approach as Rana and Sørensen (2021), we demonstrated the logical links between codes and the subsequent connection to the entrepreneurial capability to leverage the characteristics of digital artifacts for internationalization purposes. A detailed example of the coding process is presented in Appendix 1. We interpreted the findings using Abell's theory of narrative explanations (1993, 2004), which states narrative structures contain actors (in our case, the entrepreneurs), a stream of actions (here those of the firm) to reach certain states (here the internationalization), over time (in this case, the chronology of the platform evolution). Following the sequences between firm actions and within the case narrative made it possible to formulate an abstract theory that identifies common generative mechanisms and generalizations.

4 | CASE NARRATIVE

The case narrative describes the evolution of Visualizer's digital platform, its services, and its relation to the internationalization process in chronological order. The passage presents that process in six partly overlapping phases and links the platform's evolution and Visualizer's internationalization.

4.1 | Launching the digital platform and the early period of internationalization, 2006–2009

The case firm, Visualizer, was established in 2006 in Finland by four entrepreneurs with extensive knowledge of 3D software tools and visualization gained in previous roles. The entrepreneurs were able to integrate their managerial capabilities, such as marketing and sales knowledge related to the furniture sector and their technical skills in 3D modeling to develop a

digital platform. The platform offered furniture retailers a sales tool on which to present their wares to customers in 3D form. The furniture manufacturer and retailer customers could add content in digital form to present to their customers as a digital artifact. The platform ran on a server located in Finland, and customers were able to use it as a service over the Internet.

Visualizer's platform soon became popular with customers internationally, especially those looking to be first movers in their industry. During the first year, the entrepreneurs used their network skills to develop connections with customers from Scandinavia, Estonia, and Poland. Most customers came through contacts made at trade fairs Visualizer attended to demonstrate its service offering. In some cases, foreign customers were attracted after seeing the digital platform on Visualizer's or a competitor's website and contacted Visualizer directly. The chief operating officer of Visualizer explained the firm's international focus:

Since establishing this firm, we have aimed to be in global markets. That is why we have aggressively sought new opportunities in foreign markets ... In the beginning, we quite opportunistically caught all the foreign customers we could get.

During the launch phase, the firm used its platform to address the most immediate opportunities arising in international markets. Owing to the country agnostic nature of the digital platform, internationalization was relatively easy in the beginning. Still, some problems related to adaptation arose in the later phases of internationalization. These included restrictions, regulations, or technical issues and limited the number of foreign markets. However, at this stage, it was enough sufficient to improve the integration of marketing and technical skills to facilitate the launch.

Marketing and sales processes often require face-to-face negotiations with potential customers to convince them of the benefits of a service. These consultations can take time that detracts from product development. In 2007, Visualizer signed a distribution agreement with an Italian firm to market and sell its services to Italy, Spain, France, Portugal, the Netherlands, the UK, and the USA to resolve such a time resource problem. A second issue draining resources from Visualizer was that the firm provided all the 3D visualization (e.g., imported depictions of physical furniture onto the digital platform) for their customers as an additional service. Although the issue was later resolved, it initially slowed the internationalization process. During this phase, progress depended on the entrepreneurs integrating their knowledge of the furniture sector with their technological skills to serve their customers. As marketing, sales, and 3D visualization took time, they had to prioritize rapid international expansion. The European sales manager explained why it was important to be selective with potential customers:

We are visible globally on the Internet, so we get all kinds of inquiries related to our service. We had inquiries from African countries, Russia, and so on, but we could not put resources into every inquiry, even though some were very interesting.

4.2 | Extending functionalities and international markets of the digital platform, 2010–2011

By 2010, the entrepreneurs of Visualizer anticipated the importance of incorporating AR functionality. Integrating entrepreneurs' managerial capabilities, such as technological

(AR functionality) and marketing skills (platform promotion through marketing) meant the firm could leverage the digital artifact characteristics of editability and interactivity. The major benefit for end-users was that they could photograph rooms and superimpose furniture to enhance the purchasing process. Visualizer could not be sure what impact the new AR technology would have on their customers but opted to bring the new functionality to the market. Visualizer became among the first firms globally to adopt AR for business purposes, offering competitive advantages in the market. This move proved successful as it increased global interest in Visualizer's service. The European sales manager saw the benefits of AR in the firm's international sales:

Integrating AR functionality into our platform service was a good marketing strategy. We were among the first firms to benefit from AR in business use. It was good and fun to have. If we talk about international sales, you visit foreign customers, and you have something to show that knocks your customers from their chairs and makes them say, "wow, this is very cool!" It was the kind of functionality that opened many doors for us.

The ability of the entrepreneurs to anticipate future market needs was key to the firm's development. They were able to integrate their managerial capabilities, such as marketing and technological skills to add AR technology to Visualizer's platform service. This opened new foreign market opportunities especially in Japan and Australia. The AR option meant foreign customers could add new content to the platform, so the platform could be tailored to match their cultural preferences.

4.3 | Extending the use of the digital platform and international market development, 2011–2015

Apple releasing its first iPad alerted Visualizer's founders to the importance of ensuring its digital platform was accessible via different devices. That sensing of the opportunities arising from other digital communities and platforms demonstrated the entrepreneurs' networking ability. Consequently, in 2012, they applied their managerial capabilities in the form of technical skills and marketing knowledge to launching client software accessible via an iPad to extend the platform's product agnostic features. The development was possible by using Apple's standard interfaces. Visualizer's customers could then see how a room looked with different furniture on a portable device and in real-time. Integrating the platform for Android devices took far longer (integration occurred in 2017). The delay was mainly due to a heterogeneous group of devices using Android's operating system with multiple variations of the system. In 2013, Visualizer developed a virtual space application that permitted the 3D presentation of a building and its design. The firm describes this technology as a "guided selling tool which streamlines the sales process and allows customers to see a product, interior design, or an entire building before buying it." The technology proved an important platform characteristic when extending sales to international customers.

The networking ability of the entrepreneurs and the growing interest in the platform prompted Visualizer to look for international retailers and foreign offices to handle marketing and sales-related tasks and to extend market coverage. In 2011, the firm started to develop its sales reach by establishing a sales unit in Japan. A year later, Visualizer expanded its reach by

opening offices in Singapore to manage retailers and customers in Australia, Japan, and South-East Asia. Concurrently, it opened a unit in the USA to market the service in the North American markets.

By this stage, the physical distance between Visualizer's server in Finland and the foreign customers using it had increased considerably, and so too had the bandwidth required to handle the volume of data supporting the service. Customers in the most distant locations suffered from the service slowing down, which undermined the country agnostic benefit of the Visualizer platform. The Visualizer founders also realized that the platform was not attractive to some large international furniture firms because Visualizer's server could not handle the volumes of data their global sales operations generated. For these reasons, customers in Australia and Japan set up own data servers to guarantee the required data transfer speeds, adversely affecting the customer experience. The issues complicated updating the service as all the customers were not using the same data server. The technical director of the firm's retailer in Japan explained this as follows:

We rented a server and maintained it here [in Japan]. It is much easier and better for our customers and us. If the server is in Finland, it is painfully slow [to use the service]. Now when it is in Japan, the speed is not a problem.

Visualizer addressed the update management problem affecting its overseas customers in 2014 by partnering with Microsoft to use its Azure cloud computing service. The Visualizer entrepreneurs mobilized managerial capabilities, such as technical skills, to see the potential application of Microsoft's cloud infrastructure. The adoption of Microsoft Azure helped overcome deficiencies in the platform's country agnostic character arising from its expansion to distant countries like Japan and Australia. At the same time, the firm gained access to more clients globally as the service could handle more data flowing between far-flung locations. In 2018, Visualizer's CEO described how using Microsoft Azure had improved service delivery:

Azure works so that there are data centers in the EU, Japan, the USA, and so on ... Our service application is located in each of these centers. Then they have CDNs [content delivery networks] more densely so that all heavy 3D models that take up a lot of broadband are located nearby. So, larger files are located near the users, and lighter, basic features, can be in more distant locations. Azure optimizes it so that the users get the fastest possible service.

In 2018, the European sales manager explained how Microsoft Azure facilitated internationalization:

We got really big international customers after we moved to Microsoft Azure. Without that extension, it would not be possible; as they need to use our service in different countries. Earlier, we could not handle the large amount of data that those new customers required.

Although Visualizer had customers globally at this stage, the management saw the importance of avoiding becoming too dependent on Microsoft or large international retailers. Therefore, the firm continued developing its technology to maintain its market-leading position and acquire more customers globally. Hence, in 2014, when Visualizer started to use Microsoft

Azure, it also developed client software applications to enable several new features such as AutoCAD connectivity, a virtual space tool, and automatic virtual environment (CAVE) technology. These extensions were relatively easy to implement due to standard interfaces, and they offered novel ways to adapt the content for global customers and local end-users.

4.4 | Expansion to new industry segments and further globalization: 2016 onward

During this stage, the firm acquired technological and industry-specific knowledge. Prompted by the learning ability of the entrepreneurs, Visualizer realized the market potential in new industry segments and decided to expand into the home improvement and renovation businesses in 2016. Doing so required the firm to reconfigure its existing technological and sales skills to leverage the digital artifact characteristic of reprogrammability. The reconfigured platform service could display how different textiles, tiles, and wallpaper, could be used in different spaces. The new industry segments increased the number of customers, especially in Scandinavia, Australia, and Japan. In 2017, the European sales manager explained the developments:

The platform already had quite a lot of things that we were able to use for this new segment. We signed the first deal in Finland, but soon we got a request from an Australian firm for this kind of service too for different surface materials. Now we have two sub-segments for this service there and also in Japan. However, this is not always easy, as we need to understand how the service is used for sales processes within these new segments.

4.5 | Providing boundary resources to better serve global customers: 2016 onward

The networking ability of Visualizer's founders helped them sense the need for a change to the firm's business model. The entrepreneurs built new managerial capabilities through technological skills by leveraging reprogrammability to develop a software development kit (SDK), which optimized the business model function. The SDK enabled customers and subcontractors to develop and insert their content into the existing platform, increasing adaptation capability for different purposes. It was initially used by the firm's subcontractors in Belarus, who had started to undertake 3D modeling for customers of Visualizer in 2016. From 2018 onwards, the tool was made available to global customers and subcontractors specializing in content integration for the platform. Subcontractors and customers using the tool could independently transfer physical furniture elements into digital 3D models, which freed Visualizer staff to focus on platform development. The advent of the new content creation tool meant that distributors in Japan (in 2016) and the USA (in 2017) started to use the SDK to model their local customers' furniture into digital 3D models. However, using the SDK required considerable technological knowledge, and not all customers were willing to use it. In 2018, the European sales manager described the situation as follows:

In general, customers do not have the know-how or resources required for modeling content. Now we have a partner in Belarus who helps us with 3D modeling for

our customers globally. In addition, our partners in Japan and partly in the USA make content and do the modeling for their local customers. If a customer has enough technical knowledge and wants to do the modeling, we now have a tool for it. The option to outsource the modeling to partners or customers has had a positive impact on our internationalization.

4.6 | Further extension of usage of digital platform service in global markets: 2017 onward

In 2017, the networking ability of the entrepreneurs came into play once more when they elicited local customer needs from the firm's Japanese distributor. Visualizer's entrepreneurs applied their managerial capabilities, both technological and marketing skills, to understand and adapt to those needs. The resulting extension to the platform was the addition of high-quality rendering (HQR) and VR technologies. Doing so leveraged the editability and interactivity characteristics of digital artifacts. The use of HQR enables the photorealistic reproduction of (digital or physical) products for showrooms, 4K screens, or VR headsets and the visualization of objects in different spaces, such as in a house a customer is planning to build. Accordingly, VR technology enables customers to design and experience how furniture or surface materials will look in virtual spaces. These integrations with new devices were relatively easy to implement as there were standard interfaces to facilitate adaptation. The novel technological developments generated from the cooperation with the Japanese partner led to Visualizer being recognized as among the top VR/AR firms in the world by CBInsights and by Eurobiz as Japan's market leader for 3D visualization in the retail segment.

The greatest interest in the new platform extensions was felt mainly in the Asian markets. Although the platform's product agnostic characteristics meant it was relatively easy to integrate into the new AR/VR devices, usage was quite culturally sensitive and varied based on customer preferences in different markets. In 2019, Visualizer's CEO explained this as follows:

Some time ago, AR was something new that interested customers globally, even though it was not the main thing in our service. At the moment, it seems to be the same thing with VR, but not in all markets. We started to develop HQR and VR technologies with our Japanese partner. These technologies opened many doors in Japan. VR is especially popular in Japan, whereas European markets seem more difficult for this technology. In Europe, customers do not feel comfortable using VR headsets.

5 | PROPOSITION DEVELOPMENT AND DISCUSSION

Referring to the case narrative and previous literature on digital artifact characteristics (e.g., Autio, 2017; Kallinikos et al., 2010; Tilson et al., 2012) and that on dynamic capabilities (e.g., Eisenhardt & Martin, 2000; Teece, 2014; Teece et al., 1997), we indicate that Visualizer conducted four different actions to establish its digital platform in international markets. As our conceptualization is based on a longitudinal single-case study, we enrich our findings by showing how previous studies have addressed the individual phases involved in developing a platform service and provide industry-related examples (Table 4).

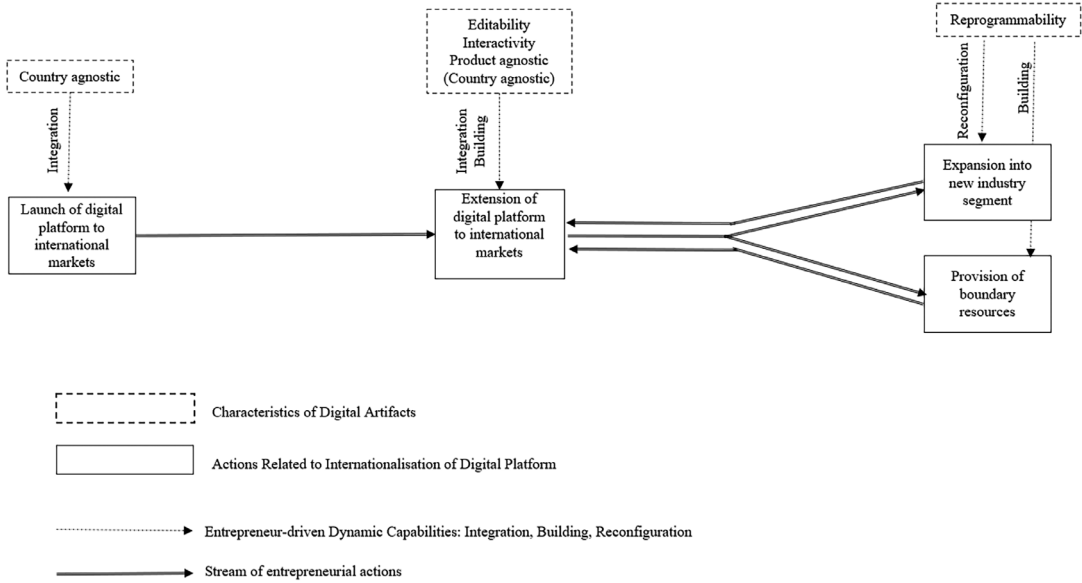


FIGURE 1 Dynamic model of the digital platform's evolution to encompass international markets.

Our research identifies specific entrepreneur-level abilities that underpin the dynamic capabilities development process. By integrating, building, and reconfiguring various abilities and leveraging digital artifact characteristics, the entrepreneurs enabled a sequential logic of the firm's actions in international markets. Theoretically, those actions exemplify a range of potential transitions of the digital platform evolution in international markets. Through conceptualizing those actions and their sequential logics generated by entrepreneurial capabilities, we could build a model (Figure 1) using empirical observations and findings (see Table 3). The model is based on analytical reasoning whereby not all the combinations of different moves or all sets of occurrences of phases are logically feasible. The model seeks to illustrate how digital-based INVs can leverage the characteristics of digital artifacts to launch a platform internationally. Next, we explain the four phases illustrated in Figure 1 by connecting them to the empirical findings, relevant literature, and dynamic capabilities theory.

Launch of the digital platform into international markets. In this phase, the firm leveraged the country agnostic nature of digital artifacts (cf. Kallinikos et al., 2010, 2013) to reach customers internationally and enable rapid internationalization. Nevertheless, the positive impact of the country agnostic feature diminished when the firm internationalized to more distant markets. This finding shows that this digital artifact characteristic may vary depending on the service provided and the internationalization phase. It also demonstrates that entrepreneurs can adopt different strategies and use their managerial capabilities (e.g., technical skills and knowledge of technology) to foresee potential issues and overcome problems. For Visualizer, internationalization per se was achieved relatively smoothly. The main challenge for the firm was learning how foreign customers might use the service so it could present the features, attributes, and benefits to them. At that stage, the entrepreneurs' networking ability became essential, for it enabled them to integrate their managerial capabilities (see Teece, 2007, 2014; Teece et al., 1997), such as technological and marketing skills to leverage the country agnostic nature

TABLE 3 Firm actions, digital artifacts, and dynamic capabilities.

Year	Digital platform evolution phases to international markets	Characteristics of digital artifacts	Dynamic capabilities	Entrepreneurial role	Action
2006–2009	Launch of the digital platform into international markets	Country agnostic	Integration of entrepreneurs' managerial capabilities (marketing, sales, knowledge of the furniture sector, and technological skills—e.g., 3D modeling).	Networking ability to understand the need within an international customer segment and to grab it by leveraging the country agnostic nature of digital artifacts.	Entrepreneurs become faster and more accurate at leveraging the country agnostic nature of digital artifacts enabling them to push the internationalization process quickly from inception.
2010–2011	Extension of the digital platform to international markets	Editability Interactivity	Integration of entrepreneurs' managerial capabilities, such as technological skills (AR functionalities) and marketing knowledge (platform promotion through marketing).	Learning ability to understand latent international customer needs (new segments) and respond by leveraging characteristics of digital artifacts.	The entrepreneurs become quicker and more accurate at leveraging the editability and interactivity of digital artifacts by introducing new services for the customer (e.g., AR features that bring new foreign customers and markets).
2011–2015	Extension of the digital platform to international markets	Product agnostic	The learning elicited from the firm's action enabled building new technological skills (multihoming into an iPad and virtual space application) and marketing skills (understanding the customer need for flexibility and mobility,	Networking ability to understand the opportunities of other digital communities/platforms (bringing new customers) and respond by adapting their product agnostic nature of digital artifacts to enable shared	The entrepreneurs become more adaptive and flexible in leveraging the product agnostic nature of digital artifacts (e.g., by multihoming the platform service to iPads), and enabling service delivery and production in collaboration with retailers and other digital platforms (e.g., new ways of marketing, new equipment and own data centers, new offices opened in Japan, Singapore, and the USA).

(Continues)

TABLE 3 (Continued)

Year	Digital platform evolution phases to international markets	Characteristics of digital artifacts	Dynamic capabilities	Entrepreneurial role	Action
2016–2021	Expansion into a new industry segment	Country agnostic	<p>opening foreign sales, and marketing units).</p> <p>The managerial obstacle of reaching foreign customers led the entrepreneurs to integrate their technological skills by leveraging cloud services and adding new technical features.</p>	<p>ownership and value creation.</p> <p>Networking ability to understand the opportunities offered by emerging global digital communities/platforms (Microsoft Azure, the country agnostic nature of digital artifacts) and respond by reconfiguring the business model relying on resource complementarity (dependence).</p>	<p>The entrepreneurs became more strategic—leveraging the country agnostic nature of a digital cloud service (e.g., Microsoft Azure) to make the service more scalable and providing a better service experience for international customers (persuading large foreign firms to use the platform).</p>
2016–2021	Provision of boundary resources	Reprogrammability	<p>Reconfiguration of existing technological and sales skills to enter new industry segments.</p>	<p>Learning ability to sense new international customer needs (new segments) and respond by leveraging the reprogrammability of digital artifacts.</p>	<p>The entrepreneurs became more adaptive in leveraging the reprogrammability of digital artifacts when expanding into new industry segments (e.g., enabling Visualizer to enter the textile services, home improvement, and renovation sectors and expand into Scandinavia, Japan, and Australia).</p>
2016–2021	Provision of boundary resources	Reprogrammability	<p>Based on the learning around the need for an effective business model, the</p>	<p>Networking ability to understand the need for a new business model (relying on</p>	<p>The entrepreneurs became more strategic and flexible by deciding to extend the reprogrammability of digital artifacts to the service delivery of distributors</p>

TABLE 3 (Continued)

Year	Digital platform evolution phases to international markets	Characteristics of digital artifacts	Dynamic capabilities	Entrepreneurial role	Action
2017–2021	Extension of the digital platform to international markets	Editability Interactivity	entrepreneurs built new technological skills to develop an SDK. Integration of technological skills and marketing knowledge by adding HQR and VR technologies.	reprogrammability of the digital artifact) with partners and respond by providing customer training. Networking ability to understand and respond by adapting the offering (leveraging editability and interactivity) to the needs of global partners (e.g., in Japan).	(e.g., Visualizer developed an SDK that foreign distributors, and later customers, could use independently to create content for the platform service). The entrepreneurs became more adaptive and flexible in extending the editability and interactivity features of digital artifacts for use by their global partners (e.g., Visualizer multihomed the firm's service by integrating it with 4K screens, showrooms, and VR through head-mounted displays. Particularly in Japan, the VR extension attracted new foreign customers).

of their digital artifact. Visualizer could then accelerate the internationalization process in those markets where country-specific adaptations were not an immediate priority. The CEO of Visualizer described the launch of the digital platform in international markets:

First, we aimed for as many foreign markets as possible; our technology enabled it. However, after that we looked at customers' needs in more detail and tried to meet them. We built internal technological skills that have been the guiding star of our operations since we began ...

Proposition 1 below is based on dynamic capabilities theory and empirical analysis. This proposition illustrates the facilitating role of dynamic capabilities, specifically the integration capabilities of the entrepreneurs evident in leveraging the country agnostic feature of digital artifacts during the international launch of the digital platform to global customer segments. Our findings indicate that the networking abilities of the entrepreneurs were particularly critical to understanding the common needs of these early emerging international markets, even though country-specific adaptation was not required at that stage. As shown in Table 4, there may be a need for experimentation to searching and finding the specific segment, where adaptation is not required.

Proposition 1. *Entrepreneurial integration capabilities leverage the country agnostic features of digital artifacts during the launch of a digital platform to international markets where specific adaptation is not required.*

The next phase—*extension of the digital platform for international markets*—follows the *launch of the digital platform into international markets*; however, this firm action can occur over time (as happened in this case). Extending the digital platform to suit international markets requires entrepreneurs to integrate and build on their managerial capabilities (see Teece, 2007, 2014; Teece et al., 1997), such as technological knowledge and marketing skills. The outcome might be introducing new customer services, new collaborative service delivery, and production methods, or adapting the business model by fostering resource complementarity (while avoiding over-dependence on business partners).

The entrepreneurs' underlying networking and learning abilities enable the development of dynamic capabilities, which permit them to leverage the characteristics of digital artifacts in rapid, adaptive, and flexible ways. The product-agnosticism facilitated the development of interfaces enabling the extension of the use of the platform to different devices. However, the capability to integrate the platform into new devices was largely dependent on how standardized these devices were and on the entrepreneur's technological abilities.

Moreover, editability and interactivity particularly facilitate the localization of the service according to the specific needs of various end-users in different geographical markets (cf. Kallinikos et al., 2010, 2013; Yoo et al., 2010). The product agnostic feature is an important characteristic facilitating the extension of the platform to new user groups using other devices. Nevertheless, editability and interactivity become particularly useful as they enable the platform to be integrated with customers' existing technological infrastructures.

Earlier research has associated the adaptation of INVs to foreign markets with the learning advantage of newness (Autio et al., 2000) and, more recently, with managers' goal orientations (Domurath et al., 2020). In addition to those aspects, our findings indicate that successfully leveraging the specific characteristics of digital artifacts in the form of dynamic

TABLE 4 Firm's actions and examples from previous literature.

Firm's action	Example from the case	Examples from previous literature and practice
<i>Launch of the digital platform into international markets</i>	When developing the platform, various business segments were open to the entrepreneurs. However, by focusing on one, they launched the platform into the most suitable niche for their digital service.	There are several different ways to launch the digital platform to the market (Evans & Schmalensee, 2010, 2016; Parker et al., 2016; Stummer et al., 2018). However, the process might be challenging owing to both market- and technology-related barriers (Evans & Schmalensee, 2010). For instance, gaming platform provider <i>G-cluster</i> tried several technologies and market segments before it successfully launched its service (Ojala, 2016; Ojala & Lyytinen, 2022).
<i>Extension of the digital platform to international markets</i>	The entrepreneurs extended their platform by adding new functionality (e.g., AR, VR, and HQR) and extending compatibility with, for example, iPad and Microsoft Azure.	Facebook extended its social-media service by adding, for example, video calling functionality, iPad compatibility, and the Marketplace application (Brügger, 2015).
<i>Expansion into a new industry segment</i>	Visualizer expanded its digital services from the furniture industry to the home improvement and renovation segments.	Amazon expanded its target segment from being an online bookstore to, for example, cloud services (Amazon EC2), digital books, music, and movie delivery (Isckia, 2009).
<i>Provision of boundary resources</i>	Entrepreneurs developed the SDK that enabled third parties to develop content for the platform.	Most digital platform providers like Google, Apple, and Microsoft permit third parties to develop content for their platforms through SDKs or similar tools (Charland & Leroux, 2011; Webb & Ashley, 2012).

capabilities requires the entrepreneurial abilities of networking and learning. This perspective is also consistent with the learning-by-exporting literature, which highlights how distributors and customers operating abroad help internationalizing firms develop their innovations (e.g., Freixanet et al., 2020; Freixanet & Rialp, 2022). The CEO of Visualizer elaborates on these abilities' impact on the extension of the digital platform in international markets:

For instance, when we looked at the competition, how other players had lumped everything into the core 3D engine. However, technologies change, and you must build your product so that it is not too dependent on it. We could build 3D content for different customers' needs and applications from the same [core engine] technological source.

The ability to leverage editability, interactivity, and product agnostic characteristics might depend on the possibility of integrating and building capabilities to adapt the digital platform for extension into international markets. Here, the entrepreneurial abilities related to networking and learning are critical because they provide access to the knowledge required for adaptation to meet the needs of the global customer base and existing technological infrastructure. Hence, we make the following proposition.

Proposition 2. *The product agnostic feature of digital artifacts is leveraged by entrepreneurial integration and building capabilities for the extension to new users, while the editability and interactivity are leveraged for adaptation to international markets.*

Expansion into a new industry segment occurs when the entrepreneur reconfigures existing technological and marketing skills to allow the firm to do so. Using those capabilities means that the reprogrammability of digital artifacts could be leveraged to expand the original platform and make it suitable for various foreign markets and segments (Kallinikos et al., 2010, 2013). We believe that digital artifact characteristics such as reprogrammability make it easier to adapt digital platforms to business segments and sectors and bolster the opportunities for foreign expansion for the firms running them. Our findings indicate that the learning ability to respond to the needs of new customer segments is an essential entrepreneurial capability. It enables the entrepreneur to be more receptive to leveraging the reprogrammability aspect of digital artifacts when expanding into new industry segments. Previous INV literature argues that such firms tend to internationalize into niche markets (Fraccastoro et al., 2020; Gabrielsson et al., 2008; Luostarinen & Gabrielsson, 2006). In contrast, our study shows that leveraging the characteristics of digital artifacts through reconfiguration capabilities can facilitate the expansion of a digital-based INV into new global industry segments. The CEO of Visualizer emphasizes the important role of learning ability when expanding into new industrial segments:

Innovations reside in distributors and direct customers. Our ideas stem from them. Often, we just replicated what we did with previous customers, thinking: “hey, that may also work here!” We then started to investigate the possibilities. For instance, renovation is one new segment; there are ceramic tiles, doors and windows producers, and vending machines. We learned by doing. It works if the customers are large and mostly if they are ready to invest in the fact that the supplier learns about their business.

Leveraging the reprogrammability characteristic of digital artifacts might rely on the existence of dynamic capabilities, particularly entrepreneurial reconfiguration capabilities. Those existing technological and marketing capabilities can facilitate expansion into new industry segments. Such an expansion will likely involve adapting the digital platform to reflect the end-user's needs and offering them new ways of working with it. Successfully doing so can advance internationalization for digital-based INVs. Hence, we propose:

Proposition 3. *The reprogrammability features of digital artifacts can be leveraged by entrepreneurial reconfiguration capabilities, which enable adaptation pivotal to the international expansion of the digital platform into new industry segments.*

The provision of boundary resources phase is based on the established need for an effective business model. Networking ability can enable entrepreneurs to accrue new technological skills to leverage the reprogrammability of digital artifacts and improve the platform service (Ghazawneh & Henfridsson, 2013; Kallinikos et al., 2010; Yoo et al., 2012). That ability can encourage strategic and flexible approaches to extract benefits from the integration of new types of digital services and content provided by various stakeholders, such as distributors. Our case firm developed an SDK to permit international customers to add content independently, which allowed the firm to provide a global service while allowing for adaptations to meet the needs of a particular foreign market (cf. Gabriellson et al., 2006). The CEO of Visualizer elaborates on this in terms of the firm's recent efforts to provide boundary resources and attain global status:

The old platform kind of froze. Then lighter and more agile start-ups overtook us by, for instance, having one feature better than we had. We understood that something must be done and started developing a new platform. It is now based on the idea that anyone can produce and add content. In Japan, we have such a content provider. We want to be a platform provider and have others do the customer delivery.

Our empirical analysis revealed that leveraging the reprogrammability characteristics of digital artifacts might rely on the existence of dynamic capabilities, particularly entrepreneurial building capabilities, to create new types of digital services based on content from various stakeholders. That relies on providing boundary resources to enable customers to create content for the platform. Here, the networking ability of the entrepreneurs was critical to successfully building a platform capable of adapting to the needs of international stakeholders and customers. Hence, we suggest:

Proposition 4. *The reprogrammability features of digital artifacts can be leveraged by entrepreneurial building capabilities, which enable adaptation that is pivotal to the provision of boundary resources for international customers.*

In the dynamic model (see Figure 1), the extension of the digital platform to international markets, expansion into a new industry segment, and provision of boundary resources form a loop within which the three firm actions may alternate, supported by dynamic capability development mechanisms that leverage digital artifacts. The entrepreneurial networking and learning abilities enable this dynamic capability development process underpinning platform development and the firm's actions in international markets. Owing to the entrepreneurially driven building, integration, and reconfiguration of technological skills, the most appropriate characteristic of digital artifacts can be leveraged to expand a digital-based INV's international presence.

The study also reveals that at the early stages of international expansion, the characteristics of digital artifacts can be applied in the platform as a largely standardized solution for early users. However, when extending the platform to more distant countries, new user groups, and new application areas, the level of adaptation required tends to increase. Our model (Figure 1) and conceptualization enrich this research area that has thus far overlooked the dimensions of internationalization, digital artifact characteristics, and entrepreneur-driven dynamic capabilities related to platform development over time.

6 | CONCLUSIONS

6.1 | Theoretical contribution of the findings

This longitudinal case study offers several theoretical advancements to internationalization research by looking at the platform evolution of a digital-based INV through the application of different digital artifact characteristics (e.g., Henfridsson et al., 2018; Holmström, 2018; Nambisan et al., 2017) and dynamic capabilities theory (Eisenhardt & Martin, 2000; Teece, 2012; Teece et al., 1997). First, we advance INV theory (Oviatt & McDougall, 1994, 2005) and the literature on digital-based INVs (Ojala et al., 2018), also referred to as *born digitals* (Monaghan et al., 2020), by explaining the exact role of digital artifact characteristics (Kallinikos et al., 2010, 2013) in the rapid internationalization of these firms. Earlier research shows the pivotal role of technology in the growth of INVs (e.g., Fraccastoro et al., 2021; Gabrielsson et al., 2008; Ojala et al., 2018). The current research contributes by elucidating how digital technologies, underpinned by dynamic entrepreneurial capabilities (Al-Aali & Teece, 2014), trigger digital platform development and internationalization.

Al-Aali and Teece (2014) assert that in the INV context, the development of dynamic capabilities rests primarily on the shoulders of the founders. This study empirically examines that perspective and extends dynamic capability theory by revealing the nuanced mechanism affecting the role of dynamic capabilities in leveraging digital artifact characteristics for digital-based INVs. More specifically, our study reveals that certain digital artifact characteristics are more critical than others during the evolution of a digital platform (see Figure 1). Hence, our study concludes that the impact of these characteristics on internationalization can depend on the platform provided and the stage of internationalization. Furthermore, the characteristics of digital artifacts should be seen as a continuum, where some can be leveraged in full in the early phases, while others require adaptation alongside the platform in the later phases to address various market contexts. For instance, in the earlier stages of international expansion, the characteristics of digital artifacts can be applied to the platform as a largely standardized solution. However, they will need to match the required degree of adaptation, which tends to increase as the platform is extended to more distant countries, new user groups, and applications. Specifically, we suggest that (i) the country-agnosticism quality of digital artifacts is applied to open avenues for the early cross-country launch of the business within global customer segments. Nevertheless, the positive impact of the country agnostic feature decreases in tandem with the digital platform's spread to more distant markets, as greater adaptation to the market context becomes necessary. (ii) Editability, interactivity, and product-agnosticism permit digital-based INVs to adapt rapidly to the needs of foreign customers. The possibility to adapt enables the expansion of the global customer base within that particular segment by, in turn, allowing the use of existing technology infrastructure and extending the scope of existing market segments. However, the effectiveness of the product agnosticism might depend on integrating the platform with existing devices. (iii) Reprogrammability facilitates the firm expanding its operations to new industry segments and offers end-users new ways of working with a platform. Overall, we show that a conjoint and systematic use of the characteristics of digital artifacts, leveraged by entrepreneurial capabilities, helps digital-based INVs to internationalize successfully.

Second, the study unveils the entrepreneur as the main actor in orchestrating the building, integration, and reconfiguration of resources and capabilities to leverage the characteristics of digital artifacts to develop digital platforms and internationalize. We found entrepreneurs' networking and learning ability enabled them to respond and adapt to changing customer and

market conditions. Those abilities offer essential support to the development of dynamic entrepreneurial capabilities, pivotal in expediting digital-based INVs' international expansion. Accordingly, we extend dynamic capabilities theory (Teece et al., 1997). Such knowledge answers the calls for more research on the mechanisms of dynamic capabilities (Coviello et al., 2017) in the internationalization of digital-based INVs (Ojala et al., 2018).

Third, we advance literature dealing with digital artifact characteristics (Kallinikos et al., 2010, 2013; Nambisan, 2017; Yoo et al., 2012) and dynamic capabilities theory (Teece et al., 1997). We demonstrate that country and product agnostic features are context-specific, and that the utilization of these characteristics depends not only on technological issues and market context but also on entrepreneurial capabilities. Accordingly, this study sheds light on the ontology of digital artifacts during the internationalization of digital-based INVs and thus, our analysis expands knowledge of the strategies available to digital-based INVs on the path toward rapid globalization and digitalization.

6.2 | Managerial and public policy implications

The key managerial contribution of this study is providing a model of use to digital-based startups. That model can help identify the options to leverage the characteristics of digital artifacts to bring their digital services to international markets and support the evolution of their business. Our model of digital platform evolution indicates in what phases certain characteristics of digital artifacts are more useful than others (see Figure 1). Furthermore, we suggest the characteristics of digital artifacts, such as country agnosticism, should be seen as a continuum, where some characteristics can be leveraged in full in the early phases while requiring more adaptation to the market context in later phases. The theoretical model and the empirical findings here reveal how firms should develop their dynamic capabilities if they intend to leverage the characteristics of digital artifacts to internationalize their business early and rapidly. The findings also illustrate how digital-based INVs can overcome the financial liabilities and difficulties associated with new foreign markets, become global, and thrive in different industry segments by leveraging managerial capabilities in the form of technological and marketing skills.

The findings here will benefit public policy actors, among which we can mention export promotion organizations (Freixanet, 2022). These can use the study's results to better tailor export promotion programs for small and young firms specializing in digital platforms. This is important as, in many cases, these firms have very scarce resources for international expansion. The early phase of internationalization might be relatively easy if a firm focuses first on the markets where country and product agnostic characteristic of the service have only minor role. However, these firms might need more help from these organizations when they take further steps in their global expansion and extend their services' offerings to countries where digital artifacts require more adaptation.

6.3 | Limitations of the study and further research directions

The empirical setting of this study focused on B2B digital-based INVs for two reasons. First, we sought to expand the existing research on digital services that mainly investigates B2C platform providers such as gaming platforms (Ojala et al., 2018). Second, B2B platform providers are an important group of firms (Patel, 2018; Reuter, 2014). However, the research focused on a single-

case study, which limits the potential to generalize the empirical findings. Accordingly, we call for more research to refine the theoretical model developed. Such research might employ cross-sectional case studies covering different digital service providers and different types of digital platforms and services, such as artificial intelligence (AI), blockchain, Internet-of-Things (IoT), and social media platforms. The model could also become more generalizable if tested using large-scale longitudinal survey data with panel-data analysis methods.

Although this study contributes to the literature by showing the connection between the characteristics of digital artifacts and internationalization, there are several interesting avenues open to further research. For instance, this study focuses solely on the positive outcomes of digital technologies and artifacts in internationalization. Nevertheless, digital technologies can also limit internationalization opportunities if a firm applies technologies that are not sufficiently mature or if such technology is controlled by competitors (e.g., Parker et al., 2016). The digital platform the case firm developed was generic and standard, making challenges related to the country agnostic nature of digital artifacts less impactful. For platforms delivering more sensitive content, for instance, where intellectual property rights must be protected, the situation becomes more complex, and the positive impact of country agnosticism might be mitigated. We suggest that our findings related to digital platforms could be possibly applied to physical products possessing similar attributes to digital artifacts, and thus call for future studies extending the domain of our study to physical products having digital elements. Furthermore, digital technologies are also developing fast together with regulations and geopolitical context, which can imply a various array of constraints to digital artifacts' use in international endeavors. These changes have a potentially great impact on the dynamics of international business, which are worth of further academic investigation.

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How to cite this article: Ojala, A., Fraccastoro, S., & Gabrielsson, M. (2023). Characteristics of digital artifacts in international endeavors of digital-based international new ventures. *Global Strategy Journal*, 1–31. <https://doi.org/10.1002/gsj.1483>

APPENDIX

DATA ANALYSIS ON LEVELS OF DIGITAL ARTIFACTS CHARACTERISTICS AND DYNAMIC CAPABILITIES IN THE INTERNATIONALIZATION PROCESS OF PLATFORMS BY DIGITAL-BASED INVS

