10th Scandinavian Conference on Information Systems

Scandinavian Conference on Information Systems

8-14-2019

Evolution of Digital Innovations Based on Entrepreneurial Opportunities

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EVOLUTION OF DIGITAL INNOVATIONS BASED ON ENTREPRENEURIAL OPPORTUNITIES

Research paper

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Abstract

Digital innovations evolve unpredictable as the characteristics of digital technology provide diverse opportunities for entrepreneurs. The flexible, malleable, and unbounded nature of digital technologies makes the evolution process unpredictable as entrepreneurs can rarely estimate beforehand how new digital technologies might impact the evolution process. It is also hard to predict how customers will react to the changes enabled by digital technologies. In this longitudinal case study, we were interested in different competitive moves that entrepreneurs apply to effectuate changes in the evolutionary pathway of digital innovations. Further, we were fascinated by how the evolution of digital innovations is shaped by the characteristics of digital technologies. Based on the longitudinal case study, we recognized five different moves taken by entrepreneurs to bring to the market and further evolve their digital platform–based innovation. These moves were related either to the creation of new, unexpected opportunities that digital technologies enabled or to more planned decisions to expand market opportunities. This study contributes to digital entrepreneurship literature by providing a detailed method for analyzing the evolution of digital innovations through competitive moves.

Keywords: Digital entrepreneurship, Digital artifacts, Entrepreneurial opportunities, Competitive moves, Digital platform

1   Introduction

Digitalization has radically changed the way entrepreneurs create new market offerings and business models. The use of digital technologies has led to the creation of new types of entrepreneurial opportunities in the form of novel value creation through digital products, platforms, and services (Nambisan et al., 2017). Consequently, there digital innovations[1] have received increasing scholarly interest in the field of information systems (IS) (Baber et al., 2019; Henfridsson et al., 2018; Holmström, 2018; Nylén and Holmström, 2018; Ojala and Laatikainen, 2019). However, how these digital innovations are initially designed by entrepreneurs and what triggers effectuate change in a firm's market offering when entrepreneurs configure new digitally enabled opportunities have received much less attention (Amit and Han, 2017; Nambisan, 2017; Ojala, 2016a).

Digital innovations commonly evolve unpredictably making firms' business models less stable and constantly changing (Nambisan, 2017). Thus, to be successful, firms rely on entrepreneurs' capabilities to discover or create opportunities (Alvarez and Barney, 2007; Shane and Venkataraman, 2000) and make changes that are, in many cases, subject to the possibilities and boundaries set by existing technologies (Ojala, 2016a). Despite increasing theorizing and extensive literature on digital innovations (see Nambisan et al., 2017), we know very little about the actions entrepreneur(s) take to configure digitally enabled resources for a successful evolutionary pathway for digital innovations. Furthermore, we have a very meager understanding of how digital innovations evolve based on

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[1] Digital innovation refers here to an outcome of entrepreneurial process whereas digital technology refers to existing digital technologies.

different types of competitive moves[2] made by entrepreneurs when they configure resources and create new value for partners and customers (cf. Amit and Han, 2017).

To enhance our theoretical understanding of the evolution of digital innovations, we draw upon three closely related streams of literature. First, we conceptualize the creation and evolution of digital innovations as entrepreneurial actions to implement new market opportunities (Alvarez and Barney, 2007, 2010; Sarasvathy, 2001, 2008). Entrepreneurship theories help better understand the role of an entrepreneur as an agent who generates changes in digital innovations based on existing knowledge, resources, and imagination (Alvarez and Barney, 2007; Sarasvathy, 2001; Shane and Venkataraman, 2000). Second, we draw on strategic management literature by studying the actions taken by entrepreneurs as competitive moves (Chen and MacMillar, 1992; Chen and Miller, 2012, 2015) to make changes in a digital innovation. Third, to better understand the underpinnings of digital innovations, we integrate IS literature on digital artifacts (Kallinikos et al., 2010, 2013; Tilson et al., 2012) with entrepreneurship literature.

Based on the discussion above, the aim of this article is to longitudinally analyze the creation and evolution of digital innovations. More specifically, we study 1) what kinds of competitive moves entrepreneurs apply to effectuate changes in the evolutionary pathway of digital innovations and 2) how the evolution of digital innovations is shaped by the characteristics of the digital technologies and entrepreneurial actions.

2 Conceptual Development

In this section, we first review literature on entrepreneurial opportunities and competitive moves in the context of digital innovations. Then, we examine the characteristics of digital technologies in the form of digital artifacts.

2.1 Entrepreneurial opportunities and competitive moves

Entrepreneurship theories can shed light on how entrepreneurs bring digital innovations to market and how these innovations evolve over time. New opportunities are recognized based on two different philosophies, opportunity creation and opportunity discovery (Alvarez and Barney, 2007, 2010; Alvarez et al., 2013). In opportunity creation, opportunities do not exist independently of entrepreneurs. That is, there is no opportunity "waiting to be recognized." Instead, opportunities are created based on the imagination, perceptions, social networks, and actions of entrepreneurs seeking to explore new products or services (Alvarez and Barney, 2007, 2010). Generally, opportunity creation focuses on the formation of new market needs based on new kinds of products or services (see, e.g., Ojala, 2016a, 2016b). In contrast, in opportunity discovery, opportunities exist independently of entrepreneurs and are waiting to be identified and exploited (Alvarez and Barney, 2007; Kirzner, 1997). In other words, opportunity discovery emphasizes active search behavior in which a problem or need in the market is already known, and entrepreneurs can search for a solution to an existing problem or need (Ardichvili et al., 2003; Sarasvathy et al., 2003).

After creating or discovering a new digital innovation, entrepreneurs bring the innovation to market, and then, the innovation evolves based on the actions taken by and reactions of the entrepreneur. Because digital innovations are built on a layered modular structure with loosely coupled interfaces with other digital systems (Yoo et al., 2010), there are several possibilities for developing the innovation further. This process requires several capabilities from entrepreneurs, such as perception of new opportunities, imagination, and social interaction with customers, users, partners, etc. (Alvarez and Barney, 2007; Sarasvathy, 2001). Moreover, the process requires an understanding of new

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[2] We conceptualize competitive moves as actions by which entrepreneurs either proactively seek to improve or reposition a firm's position in the market or defend the firm's current position in the market (Chen and Miller, 2012).

technologies and how these new technologies create possibilities for or restrictions on actions to develop the digital innovation further (Ojala, 2016b). However, entrepreneurship theories provide an abstract conceptualization of entrepreneurial actions. Thus, there is no detailed guidance for how digital innovations evolve based on actions taken by an entrepreneur. Therefore, we integrate strategic management literature on competitive moves to better understand how entrepreneurs build digital innovations as a series of competitive moves (Chen and MacMillar, 1992; Chen and Miller, 2012, 2015).

Overall, digital innovation literature has not systematically investigated how an innovation is initially brought to market by entrepreneurs and how and why entrepreneurs build competencies to develop the innovation further as a series of competitive moves (Chen and MacMillar 1992; Chen and Miller, 2012, 2015). This process is fundamentally related to how entrepreneurs design, integrate, and orchestrate digital technologies that enable a successful evolution process for a digital innovation (Ojala and Lyytinen, 2018). The competitive moves can be used to study how actions by a firm or an entrepreneur build capabilities and effectuate changes in the product or service in the market (Chen and MacMillar, 1992; Chen and Miller 2012, 2015; Gnyawali and Madhavan, 2001). These actions can be defined as "a specific and detectable market move" initiated by an entrepreneur. The moves can be either proactive or reactive. In a proactive move, an entrepreneur aims to improve a firm's position in the market, for instance, by creating new opportunities that integrate new technologies with the innovation. In a reactive move, an entrepreneur tries to defend a firm's position, for instance, by discovering an opportunity that solves the existing problem in the market (cf. Alvarez and Barney, 2007; Chen and Miller, 2012; Sarasvathy, 2001). Competitive moves do not assume direct competition with other markets as these moves may also occur before a firm commercializes its product or service innovation.

2.2 Digital artifacts

IS literature has investigated various characteristics of digital artifacts that form a digital technology. These attributes vary somewhat between different works, and there is no all-embracing list of all the possible characteristics (see, e.g., Kallinikos et al., 2013). In this literature review, we present the characteristics that are closely related to firms' service development.

Digital artifacts are product agnostic (Henfridsson et al., 2018; Yoo et al., 2010). This term refers to the idiosyncrasy that enables the use of digital artifacts on various physical devices. For instance, Spotify can be used on mobile phones, tablets, desktop computers, amplifiers, TVs, etc. However, as all possible devices for use cannot be pre-determined, this product-agnostic nature enables the integration of a digital service with new devices when a technology evolves, and new devices are launched on the market (cf. Yoo et al., 2010). Because of the product-agnostic nature of digital artifacts, entrepreneurs generally aim to multihome their services so that customers can get easy and convenient access to the service on various devices (Anderson et al., 2014; Ojala and Lyytinen, 2018).

Digital artifacts are borderless as the extent of usage is maintained technologically (Kallinikos et al., 2010, 2013). This characteristic, also referred to as distributedness, includes the idea that digital artifacts are not confined by physical or institutional borders (Eck et al., 2015). Instead, digital artifacts spread through the Internet and other information infrastructures (Kallinikos et al., 2010, 2013; Tilson et al., 2012) and are accessible through digital technologies (Yoo et al., 2010). For example, when a publishing house publishes a new book in digital and physical forms at the same time, the digital version of the book is immediately available all over the world if potential users have Internet access and a device on which to read the book.

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 whenever needed (Nambisan, 2017). This can be conducted by rearranging the different components that form a digital artefact by removing existing elements, adding new elements, or modifying elements (Kallinikos et al., 2010, 2013). Editability opens up several opportunities for entrepreneurs as their digital services can be easily modified to meet their customers' preferences. Interactivity enables activities that are contingent

in nature (Kallinikos et al., 2010, 2013). In contrast to the fixed responses of physical objects, interactivity enables actions to be developed in which the outcome of the digital service varies based on the type of the user and his or her choices.

Depending on the openness (Ondrus et al., 2015), digital artifacts are accessible and modifiable by computer programs (Kallinikos et al., 2010, 2013) making the artifacts reprogrammable. This makes it possible to modify the structure of a digital artifact and its original purpose (Eck et al., 2015). That is, this reprogrammable nature allows firms to introduce new digital devices and services to the market (Nambisan, 2017; Yoo et al., 2012). In contrast to the kind of editability that focuses on changes in the use of a digital service, reprogrammability enables more fundamental changes to be made to the service and for instance, may allow the firm to enter new market segments.

3   Research Methods

To obtain a deeper understanding of the interplay between digital artifacts and the evolution of digital innovations, we applied a longitudinal single-case study method (Yin, 2009). We selected an exploratory approach as it helps investigate the research problem in a detailed manner and uses empirically rich data that focus on a real-life phenomenon (Dyer and Wilkins, 1991; Edmondson and McManus, 2007; Yin, 2009). This approach also provides the flexibility and openness needed to study relatively new phenomena, given that there were no well-developed concepts, hypotheses, or fixed procedures that we could use as a guide for the study (cf. Swanborn, 2010). Further, as we have a very meagre understanding of the phenomenon and taking into account the unpredictable nature of digital technologies (Nylén and Holmström, 2018), this approach allowed us to observe entrepreneurial actions in detail (Yin, 2009). A single-case study also helps to gain a better and deeper understanding of evolutional processes within firms (Langley et al., 2013). Further, as adduced in several works, longitudinal studies help to better understand the evolution of digital services (Ojala, 2016a; de Reuver et al., 2018).

3.1   The case firm and data collection

The case firm, Visualizer, was selected as it represents a typical digital innovation provider that operates and develops digital platforms as its main service. The platform can be used to visualize customers' content (e.g., furniture or elements of furniture) as three-dimensional (3D) digital models. Consequently, the main target customers, furniture manufacturers and furniture retailers, can use this service as a sales tool for their customers (consumers). Visualizer was established in 2006 and the size of the firm has varied between 10 and 50 employees during the firm's history, and the current size is around 40 employees.

The collected empirical material covers the entire history of the case firm, from 2006 to 2019. Interviews with the senior management team formed the main source of the material. In addition, we interviewed six other employees and two representatives of a partner firm (retailer) to avoid personal and elite bias (Myers and Newman, 2007), to triangulate and improve the validity of the study, and to gain an in-depth perspective and the most relevant information on each topic (Huber and Power, 1985). These interviews were conducted between 2011 and 2019 (see Table 1). With the help of the chief executive officer (CEO), other interviewees were selected according to their knowledge of various phases of the evolution of the technology and the service. The interviews with the additional employees were tailored according to their role in the firm.

Person interviewed	Time of the interview(s) (month/year)	Duration of the interview(s) (hours/minutes)	Field of knowledge
CEO	4/2011	1:10	- Business idea
	6/2011	0:50	- Establishment of the firm
	4/2017	1:15	- Global business development
	2/2018	1:20	- Service development
	1/2019	0:50	
COO	4/2011	1:00	- Service development
CTO	3/2013	1:10	- Technical development
Art Director	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	- Sales and market development in Europe
	2/2018	0:55	- Sales engineering
	1/2019	1:05	- Customer relationships
Sales Manager, Southeast Asia	12/2014	0:45	- Sales and market development in Southeast 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 1.   Persons interviewed.

For this study, we conducted 15 face-to-face interviews. The length of the interviews varied from 45 to 80 minutes, and the average length was around 60 minutes. The first author of the paper conducted 14 interviews, and one was managed by a PhD student with relevant knowledge of qualitative interviews. The first interviews focused on the early history of the firm, the formation of the business idea, and the technological development of the initial service. The follow-up interviews focused on the evolution of the service, business models, and different reasons behind the changes in the service and business models. All the interviews were recorded and transcribed verbatim. In addition to formal interviews, the first author of the paper had several informal discussions with the case firm's managers and employees during a number of seminars and leisure time. These informal discussions increased the mutual trust (Myers and Newman, 2007) and provided some detailed, confidential insights into the firm, its service, and the internationalization process.

Although the face-to-face interviews formed the main data source, we used telephone and email communication to clarify inconsistencies found in the interview data or secondary material. After each interview, we sent the complete transcripts back to the interviewees so that they were able to review, and if necessary, comment on the transcripts. In most cases, the interviewees accepted the transcripts in the form in which they were written. However, in some cases, the interviewees gave minor comments relating to particular wording, added a few details, or clarified the names of partners.

To avoid retrospective bias (Huber and Power, 1985; Miller et al., 1997), we collected several types of secondary data. The main source of the secondary data was the firm's PowerPoint presentations that were aimed as confidential marketing material and provided detailed information about the firm's history and service development for global markets. Further, we followed the firm's social media sites and collected secondary material from their Facebook, Instagram, and LinkedIn pages. By working in this way, we were able to cover the entire history of the firm and validate the interview data whenever possible. In addition to the firm's presentation and social media sites, the secondary material included press releases, video materials for advertising purposes, websites, and brochures.

In addition to refining our findings, we used the secondary data to validate and triangulate the primary data from the interviews (Miles et al., 2013). This was complemented by a systematic comparison of the interview data with the secondary data collected from the firm. All inconsistencies between the interview data and the secondary data were discussed with the interviewees and the CEO to eliminate possible misunderstandings and retrospective bias (Huber and Power, 1985).

3.2 Data analysis

We used qualitative techniques to analyze the data (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Miles et al., 2013). As we had a lot of transcribed data, we first conducted a data reduction process to remove unnecessary data (Miles et al., 2013). In this phase, we sought to find the events related to digital artifacts and decision-making logic in the collected data. We used the complete transcripts from the interviews and the secondary data (Eisenhardt, 1989). We followed Pettigrew (1990), who recommends arranging incoherent aspects of context evolution into a chronological order to gain a clearer view of the causal links between critical events. We developed a document that covered the entire history of the firm.

After we reduced the data, the next step was to organize the data into more detailed events. For this task, we implemented an open thematic content analysis (Corbin and Strauss, 2014; Strauss, 1987; Taylor et al., 2015). First, we organized the case firm's actions in the market in chronological order. Based on this, we were able to develop a case narrative that demonstrated the firm's history and evolution of the digital innovation. We traced the different competitive moves that emerged from the data. For instance, when an interviewee stated, "Now we are actively searching for new industry segments like home improvement and renovating firms," we coded the statement as an *opportunity discovery* and a *reactive move* to a new industry and named it the New Segment move. In contrast, we coded the statement "We have been among first ones to bring AR into business use in this segment... It was really something that they [customers] were not waiting for" as an *opportunity creation* and a *proactive move* to expand the functionalities of the platform and named it the Extension move. Then, we traced all the changes in the digital innovation to understand the evolution process. When we no longer recognized new competitive moves from the data, we had reached the level of saturation (Corbin and Strauss, 2008).

4 Findings and Discussion

In the longitudinal case study, five different groups of competitive moves emerged from the data. These competitive moves, taken by the entrepreneurs, can be divided into Launch, Extension, Multihome, Facilitate, and New Segment. Next, we relate these moves to entrepreneurial decision-making logics, the characteristics of the digital technology that enabled the move, and the rationality behind the moves. Table 2 in the end of the section summarizes the case findings and evolution of the digital platform based on the competitive moves.

4.1 Launch

Launch was the first move to bring the digital platform to the market. The editability, interactivity, and distributedness of the digital technology (Kallinikos et al., 2010, 2013) enabled several opportunities for market entry. The editability and interactivity of 3D content provided several opportunities to develop a service in which end-users can edit and interact with 3D models. This made it possible to develop 3D catalogues where customers can add content and end-users are able to edit and interact with the content. Further, distributedness (Kallinikos et al., 2010, 2013) enabled access to the content through different technologies.

When Visualizer brought their digital platform to the market in 2006, the first challenge was finding the right target sector. Three-dimensional modeling was a generic innovation, and Visualizer had challenges finding the right niche for market entry. The evolution of the digital platform started as a trial-and-error process in which Visualizer was looking for the right market segment to bring the platform to the market. Opportunity creation (Alvarez and Barney, 2007, 2010) and proactivity (Chen and MacMillar, 1992; Chen and Miller, 2012, 2015) had a central role in this process as there was no specific well-defined goal in the market. That is, the loosely coupled structure of the platform (Yoo et al., 2010) enabled several possibilities to serve different markets or make the platform available through different technologies. However, in the early phase of the evolution, this was a challenge as entrepreneurs were not able to estimate the proper market or technology in advance. To find the right

target industry for the innovation, Visualizer tried several different industries, such as car manufacturing and medical industries, but these endeavors failed. Finally, the firm ended up with the furniture industry. They realized that in the furniture industry, a 3D tool that can be used in marketing and sales processes was lacking. Further, as furniture commonly has several components, colors, and ways of combining different components and colors, an interactive and editable 3D tool that can be used on different devices has potential in the market. The CEO of Visualizer explained how they ended up in the furniture industry:

> *"In the beginning it was like a roller-coaster. One day, it was the world's best idea, and another day, it was world's worst idea…We tried all possible industries that we were able to imagine, like elevators, handheld devices, cars, medical instruments, etc. The furniture industry was one that we tried, and we realized that there is no competition, and we have something to offer that they are really lacking."*

4.2   Extension

The Extension move emerged in 2008 when Visualizer extended their digital platform by adding new features that enabled consumers to build a room in which they could add 3D furniture and a feature that connected the sales tool software to a customer's enterprise resource planning (ERP) system. This move was based on opportunities enabled by the reprogrammability of the digital artifacts (Kallinikos et al., 2010, 2013) as Visualizer was able to reprogram the platform so that it interfaced with other services (cf. Yoo et al., 2010).

The second extension emerged in 2010 when Visualizer added features so that augmented reality (AR) could be used with the innovation. This extension makes it possible to upload photos from a room and add them in the service. Then, the service shows how the furniture fits in the room. During the same year, entrepreneurs added an interface that integrated the service with a customer's customer relationship management (CRM). The third extension of the digital platform took place in 2014. Visualizer integrated the service into social media platforms so that the end-users can share what they have designed by using the service with friends on social media. All these extensions were based on the interactivity, editability, and reprogrammability of digital artifacts (Kallinikos et al., 2010, 2013) that make them flexible and malleable (Yoo et al., 2010). The European sales manager explained the extension to AR as follows:

> *"We were among first to bring AR into business use in this segment. It was something that was nice to show to customers as it figuratively dropped them down from chairs, and they said, "wow"; this is something great. It was really something that they were not waiting for."*

The rationality of these moves was based on new functionalities enabled by digital technologies. These moves expanded the ways of using the platform and make it more attractive to existing and potential customers. This move was based mainly on proactive decision making in which the entrepreneurs created new market opportunities (Alvarez and Barney, 2007, 2010; Chen and Miller, 2012, 2015) as the extensions were launched to the market without any requirements from the customer side.

4.3   Multihome

The Multihome move was related to the product-agnostic nature of digital technology (Henfridsson et al., 2018; Yoo et al., 2010) by which an innovation can be used different devices. In 2014, Visualizer multihomed their service to iPads to expand ways to use the service especially in furniture retail stores when sales persons interact with customers. This enabled more convenient ways to present different combinations of furniture elements so that customers can see how the final product will look. Later in the same year, Visualizer multihomed their service to a cave automatic virtual environment (CAVE) technology where walls of the room were used as screens. This also opened up new possibilities for furniture retailers to show how rooms can be furnished. The third multihome move took place in 2017

when the service was multihomed to 4K screens, showrooms, and head-mounted displays. The CEO of Visualizer explained their motivation for multihoming as follows:

> *"We have had integration for the first iPad model forward…The same thing when showrooms or VR came to the market, we know that these interests many potential customers, and we wanted to be involved."*

The rationality for these multihoming moves was to expand to markets by making the digital service available to customers through various devices and/or networks. Overall, multihoming followed the general development of information technologies. When a new device became available, Visualizer proactively (Alvarez and Barney, 2007, 2010; Chen and Miller, 2012, 2015) created opportunities to benefit from these innovations and integrated the firm's service into the new technology. Thus, new technologies provided opportunities to effectuate changes (Sarasvathy, 2001) in the innovation that expanded market possibilities.

4.4   New Segment

The New Segment move was based on the expansion of the platform to new industry segments. This move was based on causal logic and was a reactive move (Alvarez and Barney, 2007; Chen and Miller, 2012; Sarasvathy, 2001) as in 2016 Visualizer was actively discovering opportunities to expand its business to new market segments. Consequently, the firm expanded use of their digital platform from the furniture industry to the textile services, home improvement, and renovation sectors. In these sectors, the Visualizer platform enabled new ways to serve customers. The European sales manager explained the expansion of the customer segments as follows:

> *"In addition to the furniture industry, we have now textile service firms and home improvement firms as our customers. They take benefit especially from our AR application. They can use photos and configure it, and then show their customers what the outcome looks like. This is very useful for surface materials, like wallpaper, floor tiles, parquet, etc. The system will also calculate the final price of the renovation."*

This move was facilitated by the reprogrammability of digital innovations (Kallinikos et al., 2010, 2013). That is, although the basic innovation remained the same, Visualizer was able to find new ways to reprogram and utilize the innovation in other industry segments.

4.5   Facilitate

The Facilitate move was realized in 2018. The rationality behind the move was to make content provisioning easier for customers. The technical knowledge of Visualizer's customers varies considerably. Most customers could not bring their content into the platform by themselves. In these cases, either Visualizer or their partner helped customers to bring physical furniture components into digital 3D models. However, some customers liked to do this by themselves, and Visualizer developed the Content Studio tool that customers can use for this purpose. The European sales manager explained as follows:

> *"Now we have also customers that use our Content Studio for 3D modeling by themselves. They implement [by using Content Studio] rules how different elements can be united, and they can add rules for different elements. They can do this independently, just in time, whenever they want and without a service fee for us or our partners."*

This move was based on reactive decision making (Alvarez and Barney, 2007; Chen and Miller, 2012; Sarasvathy, 2001) where Visualizer discovered opportunities to facilitate content design for the platform. The move was related to the reprogrammability of digital artifacts (Kallinikos et al., 2010, 2013) through which boundary resources (Ghazawneh and Henfridsson, 2013), such as interfaces and tools for third parties, were added so that they can add their content to the platform.

Year	Competitive move	Decision-making logic/ Activity	Entrepreneurial opportunity	Characteristics of digital artifacts	Rationality behind the move
2006	Launch (fail)	Opportunity creation/ Proactive	Bring the new 3D visualization platform to the market and see how customers react to the new innovation.	Editability and interactivity, Distributedness	3D visualization was a generic innovation that serves various industries. In the beginning, the entrepreneurs had problems finding the right target industry for their innovation. They tried the car manufacturing and medical industries without success.
2006	Launch	Opportunity creation/ Proactive	Bring the 3D visualization platform to the furniture industry and see how customers within the industry react and start to use the platform service.	Editability and interactivity, Distributedness	Entrepreneurs realized that there is a need for a digital technology that could be used to visualize furniture as 3D models. Consequently, they developed a digital sales platform that furniture manufacturers and retailers use to present their selection of furniture for customers in 3D models.
2008	Extension	Opportunity creation/ Proactive	Expand ways to use the platform and make it more attractive for existing and potential customers.	Reprogrammability	Entrepreneurs extended the platform service by adding new features that enabled consumers to build a room in which to add 3D furniture and a feature that connected the sales tool software with a customer's ERP system.
2010	Extension	Opportunity creation/ Proactive	Expand functionalities included in the platform and make it more attractive to existing and potential customers.	Editability and interactivity	Entrepreneurs added features to the platform that enabled use of augmented reality. This extension made it possible to upload photos from a room and add them in the service. Then, the service shows how the furniture fits in the room. During the same year, the entrepreneurs added an interface that integrated the service with a customer's CRM.
2012	Multihoming	Opportunity creation/ Proactive	Expand the use of the service to a mobile device to make the service more interesting and attractive to existing and potential customers.	Product-agnostic nature	Entrepreneurs multihomed the platform service to iPads as soon as they came on the market. This enabled more flexible usage of the service as a sales tool in furniture retail stores and consequently increased the attractiveness of the service.
2014	Multihoming	Opportunity creation/ Proactive	Expand the ways of using the service by making it scalable and easier to use.	Distributedness	Entrepreneurs multihomed the platform through the Microsoft Azure cloud service that enables flexible usage of the service and a better user experience.
2014	Multihoming	Opportunity creation/ Proactive	New way to visualize objects to see how existing and potential customers react to possibilities enabled by new technology.	Product-agnostic nature	Entrepreneurs developed a cave automatic virtual environment (CAVE) technology where walls of the room were used as screens.
2014	Extension	Opportunity creation/ Proactive	Possibility to share a design with friends on social media and make the service known among potential users.	Editability and interactivity	Entrepreneurs integrated the service in social media platforms so that end-users can share what they have designed by using the service with friends on social media.
2016	New segment	Opportunity discovery/ Reactive	Expand the business to new industry segments.	Reprogrammability	Entrepreneurs were actively looking for new business opportunities in other sectors, and with a partner, they expanded their business from the furniture industry to the textile services, home improvement, and renovation sectors.
2017	Multihoming	Opportunity creation/ Proactive	Expand the ways of using the service with new technologies and make it more interesting for existing and potential customers.	Editability and interactivity	Entrepreneurs multihomed their service by integrating it with 4K screens, showrooms, and head-mounted displays.
2018	Facilitate	Opportunity discovery/ Reactive	Provide a tool for customers to add their own concept in the platform by themselves.	Reprogrammability	Entrepreneurs developed Content Studio - tool for customers who liked to add content into the platform independently.

Table 2.   Evolution of the digital platform based on competitive moves.

5 Conclusions

Based on the longitudinal case study, we recognized five different competitive moves during the evolutionary path of a digital innovation. These moves were based on entrepreneurial opportunities in the market and aimed to bring the service to the market (the Launch move), extend functionalities included in the service (the Extension move), extend the ways to use the service (the Multihoming move), enter new market segments (the New Segment move), and provide boundary resources for a content creation (the Facilitate move). All these moves aimed to improve the case firm's position in the market and make the firm's digital platform more attractive to customers.

Three moves, Launch, Extension, and Multihoming, were based on opportunity creation or proactive decision making (Alvarez and Barney, 2007; Chen and Miller, 2012, 2015) as the entrepreneurs were not able to estimate how the new technologies would develop and how customers would react to the innovation. Although the unpredictable nature of digital innovations has been reported in several studies (Austin et al., 2012; Nylén and Holmström, 2018; Ojala, 2016a), in this study, we showed how entrepreneurs can broaden their market possibilities through competitive moves that are based on the unpredictable nature of digital innovations. These moves were executed without a need or request from customers highlighting the effectual process (Sarasvathy, 2001) with the high uncertainty related to the outcome of the move. The malleable and unbounded nature of digital technologies (Nylén and Holmström, 2018; Yoo et al., 2010) were the main sources that enabled these moves. In more detail, the product-agnostic nature, editability, interactivity, and reprogrammability (Eck et al., 2015; Kallinikos et al., 2010, 2013) made it possible to launch the digital innovation in the market, and the case firm was able to extend the innovation's functionalities, integrate it in existing systems and innovations in the market, and extend the use of the digital innovation through various devices.

Two moves, New Segment and Facilitate, were based on opportunity discovery or reactive decision-making logic (Alvarez and Barney, 2007; Chen and Miller, 2012, 2015) as these moves were carefully planned and implemented for a certain need. Within these moves, the entrepreneurs were actively searching for new ways to either enter new industry segments or develop a tool that customers can use to create content. Reprogrammability (Eck et al., 2015; Kallinikos et al., 2010, 2013) was the main enabler of these moves as the firm was able to use their existing platform and extend it to new segments. Further, due to the tool's reprogrammability, a version of the content development tool used by the firm was developed for customers.

As a theoretical contribution, this study provides a more detailed method for analyzing the evolution of digital innovations through competitive moves instead of using abstract theories that divide entrepreneurial actions into opportunity creation or proactive or opportunity discovery or reactive decision-making logics (cf. Alvarez and Barney, 2007; Chen and Miller, 2012, 2015; Sarasvathy, 2001). Further, this study increases our understanding of digital entrepreneurship. It answers Nambisan's (2017) call for more studies on the evolution of novel digital innovations and how the characteristics of digital technologies can be used when a firm brings its digital innovations to the market.

References

Alvarez, S.A., and Barney, J.B. (2007). "Discovery and creation: Alternative theories of entrepreneurial action." *Strategic Entrepreneurship Journal* 1 (1-2), 11-26.

Alvarez, S.A., and Barney, J.B. (2010). "Entrepreneurship and Epistemology: The Philosophical Underpinnings of the Study of Entrepreneurial Opportunities." *The Academy of Management Annals* 4 (1), 557-583.

Alvarez, S.A., Barney, J.B., and Anderson, P. (2013). "Forming and Exploiting Opportunities: The Implications of Discovery and Creation Processes for Entrepreneurial and Organizational Research." *Organization Science* 24 (1), 301-317.

Amit, R. and Han, X. (2017). "Value Creation through Novel Resource Configurations in a Digitally Enabled World." *Strategic Entrepreneurship Journal* 11 (3), 228-242.

Anderson, E.G., Parker, G.G. and Tan, B. (2014). "Platform performance investment in the presence of network externalities." *Information Systems Research* 25 (1), 152-172.

Austin, R.D., Devin, L. and Sullivan, E.E. (2011). "Accidental Innovation: Supporting Valuable Unpredictability in the Creative Process." *Organization Science* 23 (5), 1505-1522.

Baber, W.W, Ojala, A. and Martinez, R. (2019). "Transition to digital distribution platforms and business model evolution." In *Proceedings of 52nd Hawaii International Conference on System Science (HICSS 2019),* Maui, Hawaii, January 8-11.2019.

Chen, M-J., and MacMillar, I.C. (1992). "Nonresponse and Delayed Response to Competitive Moves: The Roles of Competitor Dependence and Action Irreversibility." *Academy of Management Journal* 35 (3), 539-570.

Chen, M-J., and Miller, D. (2012). "Competitive Dynamics: Themes, Trends, and a Prospective Research Platform." *Academy of Management Annals* 6 (1), 135–210.

Chen, M-J., and Miller, D. (2015). "Reconceptualizing competitive dynamics: A multidimensional framework." *Strategic Management Journal* 36(5), 758-775.

Corbin, J., and Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory,* California: Sage.

de Reuver, M., Sørensen, C. and Basole, R.C. (2018). "The digital platform: a research agenda." *Journal of Information Technology* 33 (2), 124-135.

Dyer, W.G. and Wilkins, A.L. (1991). "Better Stories, not Better Constructs, to Generate Better Theory: A Rejoinder to Eisenhardt." *Academy of Management Review* 16 (3), 613-619.

Eck, A., Uebernickel, F. and Brenner, W. (2015). "The Generative Capacity of Digital Artifacts: A Mapping of the Field." *PACIS 2015 Proceedings*.

Eisenhardt, K.M. (1989). "Building Theories from Case Study Research." *Academy of Management Review* 14 (4), 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007). "Theory building from cases: Opportunities and challenges." *Academy of Management Journal* 50(1), 25-32.

Edmondson, A.C. and McManus, S.E. (2007). "Methodological fit in management field research." *Academy of Management Review* 32 (4), 1155-1179.

Ghazawneh, A., and Henfridsson, O. (2013). "Balancing platform control and external contribution in third-party development: The boundary resources model." *Information Systems Journal* 23 (2), 173-192.

Gnyawali, D.R., and Madhavan, R. (2001). "Cooperative Networks and Competitive Dynamics: A Structural Embeddedness Perspective." *Academy of Management Review* 26 (3), 431-445.

Henfridsson, O., Nandhakumar, J., Scarbrough, H. and Panourgias, N. (2019). "Recombination in the open-ended value landscape of digital innovation." *Information and Organization* 28 (2), 89-100.

Holmström, J. (2018). "Recombination in digital innovation: Challenges, opportunities, and the importance of a theoretical framework." *Information and Organization* 28 (2), 107-110.

Huber, G.P. and Power, D.J. (1985). "Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy." *Strategic Management Journal* 6 (2), 171-180.

Kallinikos, J., Aaltonen, A., and Marton, A. (2010). "A theory of digital objects." *First Monday* 16(6).

Kallinikos, J., Aaltonen, A., and Marton, A. (2013). "The Ambivalent Ontology of Digital Artifacts." *Mis Quarterly*, 37 (2), 357-370.

Kirzner, I.M. (1997). "Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach." *Journal of Economic Literature* 35 (1), 60-85.

Langley, A., Smallman, C., Tsoukas, H. and Van de Ven, A.H. (2013). "Process Studies of Change in Organization and Management: Unveiling Temporality, Activity, and Flow." *Academy of Management Journal* 56 (1), 1-13.

Miles, M.B., Huberman, A.M. and Saldana, J. (2013). *Qualitative Data Analysis: A Methods Sourcebook*. SAGE Publications.

Miller, C.C., Cardinal, L.B. and Glick, W.H. (1997). "Retrospective reports in organizational research: A reexamination of recent evidence." *Academy of Management Journal* 40 (1), 189-204.

Myers, M.D. and Newman, M. (2007). "The qualitative interview in IS research: Examining the craft." *Information and Organization* 17(1), 2-26.

Nambisan, S. (2017). "Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship." *Entrepreneurship Theory and Practice* 41 (6), 1029-1055.

Nambisan, S., Lyytinen, K., Majchrzak, A. and Song, M. (2017). "Digital innovation management: Reinventing innovation management research in a digital world." *Mis Quarterly* 41 (1), 223-238.

Nylén, D. and Holmström, J. (2018). "Digital innovation in context: Exploring serendipitous and unbounded digital innovation at the church of Sweden." *Information Technology & People*.

Ojala, A. (2016a). "Business models and opportunity creation: How IT entrepreneurs create and develop business models under uncertainty." *Information Systems Journal* 26 (5), 451-476.

Ojala, A. (2016b). "Discovering and creating business opportunities for cloud services." *Journal of Systems and Software* 113, 408-417.

Ojala, A. and Laatikainen, G. (2019). "Pricing of digital innovations as an entrepreneurial process." In *Proceedings of 52nd Hawaii International Conference on System Science (HICSS 2019),* Maui, Hawaii, January 8-11.2019.

Ojala, A. and Lyytinen, L. (2018). "Competition Logics during Digital Platform Evolution." In *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS 2018)*, 1026-1035.

Ondrus, J., Gannamaneni, A. and Lyytinen, K. (2015). "The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms." *Journal of Information Technology* 30 (3), 260-275.

Pettigrew, A.M. (1990). "Longitudinal Field Research on Change: Theory and Practice." *Organization Science* 1 (3), 267-292.

Sarasvathy, S. D. (2001). "Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency." *Academy of management Review* 26 (2), 243-263.

Sarasvathy, S.D. (2008). *Effectuation: Elements of Entrepreneurial Expertise*. New Horizons in Entrepreneurship, Cheltenham, UK: Edgar Elgar.

Sarasvathy, S.D., Dew, N., Velamuri, S.R., and Venkataraman, S. (2003). "Three Views of Entrepreneurial Opportunity." In *Handbook of Entrepreneurship Research: An Interdisciplinary Survey and Introduction,* Z.J. Acs and D.B. Audretsch (eds.), London: Kluwer Academic, 141-160.

Shane, S. and Venkataraman, S. (2000). "The promise of entrepreneurship as a field of research." *Academy of management review* 25 (1), 217-226.

Strauss, A.L. (1987). *Qualitative analysis for social scientists*. Cambridge University Press.

Swanborn, P. (2010). *Case Study Research: What, Why and How?* SAGE Publications Ltd.

Tilson, D., Lyytinen, K. and Sorensen, C. (2012). "Digital Infrastructures: The Missing IS Research Agenda." *Information Systems Research* 21 (4), 748-759.

Taylor, S.J., Bogdan, R., and Devault, M. (2015). *Introduction to Qualitative Research Methods: A Guidebook and Resource*. John Wiley & Sons.

Yin, R.K. (2009). *Case study research: Design and methods*. SAGE Publications.

Yoo, Y., Boland, R.J., Lyytinen, K. and Majchrzak, A. (2012). "Organizing for Innovation in the Digitized World." *Organization Science* 23 (5), 1398-1408.

Yoo, Y., Henfridsson, O., and Lyytinen, K. (2010). "The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research". *Information Systems Research* 21 (4), 724-735.