

Entrepreneurship in the Digital Society

Completed Research Paper

Mikael Gustavsson
University of Gothenburg
Gothenburg, Sweden
mikael.gustavsson@ait.gu.se

Jan Ljungberg
University of Gothenburg
Gothenburg, Sweden
jan.ljungberg@ait.gu.se

Abstract

Innovation and entrepreneurship are tightly coupled. Schumpeter put forward a view where entrepreneurship, performed either by individual persons or large firms, is perceived as the driving force of innovation. Entrepreneurial activity revolves around the identification and exploitation of opportunities in order to create value and capture a substantial share of that value. Over the last years a growing discourse on digital innovation has emerged, while the digital entrepreneur has been more rarely addressed. In this conceptual paper, we discuss the nature of digital entrepreneurship based on a theoretical framework rooted in the discourse on digital innovation and the characteristics of digital artefacts. We argue that it makes more sense to talk about entrepreneurship in a digital society, than the digital entrepreneur as a new species. By applying the framework on examples, we discuss four key dimensions of entrepreneurship – the nature of opportunities, personal traits of the entrepreneur, risk and uncertainty, and replicative or innovative entrepreneurship. We contribute by problematizing digital entrepreneurship in relation to these dimensions.

Keywords: Digital Entrepreneurship, Digital Innovation, Digital Artefacts

Introduction

Innovation and entrepreneurship goes hand in hand. Schumpeter claimed that entrepreneurship, performed by individual entrepreneurs or large firms, was the driving force for innovation and growth (Schumpeter 1911/1934). In the wake of the digitalization of society, a growing discourse on digital innovation is emerging (Yoo et al. 2010; 2012), while digital entrepreneurship has been more rarely addressed. A variety of efforts to conceptualize entrepreneurship in the intersection of information systems and entrepreneurship has occurred, with related concepts such as cyber entrepreneurship (Bouwman and Hulsink 2002), Internet entrepreneurship (McKelvey 2001; Millman et al. 2010; Colombo and Delmastro 2001), and E-commerce entrepreneurship (Sebora et al. 2009). While, these papers acknowledge the technology as a transformative power and source of opportunities, they do not link the specific characteristics of *digitality* to entrepreneurship. While discussing digital entrepreneurship, very little theorizing is spent on the nature of digitality itself (Nambisan 2016).

In this conceptual paper, we discuss the nature of digital entrepreneurship based on a theoretical framework rooted in the discourse on digital innovation and the characteristics of digital artefacts. We argue that it makes more sense to talk about entrepreneurship in the digital society, than the digital entrepreneur as a new species. The research question that sets out to guide this article is: *How do the unique characteristics of digital technology and the digitalization of society affect entrepreneurship?*

The paper proceeds as follows. The next section provides an overview of entrepreneurship theory. We then position the paper within related research in the intersection of entrepreneurship and information systems. Following that, we present a framework for digital entrepreneurship rooted in digital innovation and characteristics of digital artefacts. The subsequent section discusses examples of digital entrepreneurship in relation to the framework. The last section concludes the paper.

Entrepreneurship Theory

We will here discuss some of the main theoretical issues in entrepreneurship research. Given all aspects of entrepreneurship occurring in this literature, we concentrate on the core of the classical entrepreneurship literature and on dimensions that we consider most useful for discussing digital entrepreneurship.

Many definitions of entrepreneurial activity revolve around the identification and exploitation of opportunities in order to create value and capture a substantial share of that value. Closely related to this definition is the notions of risk and uncertainty. Schumpeter (1911/1934) defined the entrepreneur as the person who carries out new combinations that causes discontinuity, and thus acts as a leader and contributor to the process of creative destruction. Kirzner (1985) viewed the entrepreneur as someone who perceives profit opportunities and act in order to fill unsatisfied needs in the market or to improve inefficiency. Schumpeter (1942) later viewed entrepreneurship as less individualistic, so that the entrepreneur doesn't have to be a person, but a group of people or an organization.

In the following we present four recurrent themes, that we consider useful for discussing digital entrepreneurship: the nature of opportunities, personal traits of the entrepreneur, risk and uncertainty, and the kind of entrepreneurial engagement.

Discovery and Creation

One important strand of entrepreneurship research is the nature and source of the opportunities. Two theoretical strands have dominated the research that deals with how entrepreneurs recognize and perceives opportunities: discovery and creation theory (Alvarez and Barney 2007; Dyer et. al 2008). The discovery theory predicts that opportunities are already out there. This relates to Kirzner's idea of opportunities as gaps in the market that the entrepreneur would fill, thus moving the economy towards equilibrium. An important source of opportunities is exogenous shocks caused by changes in technology, regulations or demography. Therefore, an entrepreneur's focus should be to scan the surroundings for opportunities to exploit. Thus, a key activity in discovery theory is opportunity search. The entrepreneur then brings agency to the opportunity. Another key activity is to develop complete and comprehensive business plans, in order to explain the business potential and nature of the opportunities for outside sources of capital.

According to creation theory on the other hand, opportunities is created by actions of entrepreneurs. This relates to Schumpeter's idea that entrepreneurial action doesn't result in equilibrium, but in creative destruction (1911/1934). Opportunities are not perceived as independent of the entrepreneur but are created by the same. It is therefore the entrepreneurs' actions that enables opportunities to be revealed. In creation theory, key activities are emergent since an unplanned action may begin a process that leads to the formation of opportunities. Here, a business plan would only be meaningful to develop after an opportunity has been created, and it is difficult to explain the nature of the opportunities for outside capital sources. Alvarez and Barney (2007) emphasizes the potential of one being able to, ex-post, interpret the formation of a specific opportunity as either a discovery or creation process.

The actions that entrepreneurs perform can be viewed as a manifestation of the assumptions they make of the setting in which they operate. Is it a perceived as a discovery context or a creation context? (Alvarez and Barney 2007).

Personal Traits of the Entrepreneur

Although, much research recognizes, in line with Schumpeter's (1942) later work, that the entrepreneur does not have to be a person, but could also be an organization, an important category of entrepreneurship research focuses on the characteristics of the entrepreneur itself. Here, the focus is why some individuals become entrepreneurs, and if that there exist personal (cognitive) traits that can explain entrepreneurial behavior (McMullen and Shepherd 2006). In the research focusing on the entrepreneur as an individual,

one of the stumbling blocks is in what way the cognitive aspects and other individual attributes contributes to the emergence of entrepreneurial behavior and capabilities. There exist advocates across the spectrum. Bull and Willard (1993) do not put that much emphasis in personal traits, instead they perceive an entrepreneur as a role that someone/anyone can take on during a period of time (Bull and Willard 1993). At the other end of the scale Segal et al. (2005, p. 44) states that: "Human endeavours, especially complex activities such as new venture initiation, are a result of people's cognitive processes." Mitchell et al. (2002) further believes that the cognitive perspective is essential to be able to understand the entrepreneurial process. That research in entrepreneurial cognition seeks to uncover and understand the different mental models that entrepreneurs employ (Mitchell et al. 2002). The traits approach is most common in relation to the discovery theory, given the assumption that entrepreneurs who are able to discover and exploit opportunities are significantly different from non-entrepreneurs.

Uncertainty and risk

Another key issue in entrepreneurship research is risk and risk taking. The notion of the entrepreneur as a risk taker goes back to the originator of the entrepreneurship concept Richard Cantillon in 1755. He described the entrepreneur as "someone who exercises business judgment in the face of uncertainty" (Bull and Willard 1993). Action is, in a way, inherently uncertain because the future is uncertain (McMullen and Shepherd 2006). The potential profit of an opportunity is directly related to the uncertainty of outcomes. If uncertainty and risk was not attached to entrepreneurial opportunities, everyone would exploit them. Therefore, uncertainty and risk is viewed as an important concept in most theories of entrepreneurship, and the entrepreneur has been described as someone who transforms uncertainty into a calculable risk (Knight 1921). The terms risk and uncertainty are often used interchangeably, but have distinct meanings in the entrepreneurship context. A risk occurs if it is possible to collect enough information to anticipate different possible outcomes of an action, and to estimate the probability of each of these outcomes. If it is not possible to gather this information, the situation is uncertain.

Thus, for risk, the probabilities of an outcome are quantifiable, while for uncertainty it is not. For discovery theory, entrepreneurial action is risky since opportunities are perceived as already existing objective phenomena, and thus able to gather enough information about, in order to calculate the probability of outcomes. In creation theory, entrepreneurial action is uncertain, since it is not possible to gather the information needed to envision possible outcomes and their probabilities. From one perspective, uncertainty is just lack of information or knowledge, but from another perspective one can consider how much uncertainty an agent can handle, where motivation is the key factor to cope with uncertainty (McMullen and Shepherd 2006).

Replicative and innovative entrepreneurship

The conception of the entrepreneur ranges from anyone that runs a small business, or changes from an employee job to being self-employed, to the innovative creator that habitually seeks opportunities to exploit. In the first end of this spectrum is what Baumol (2008) calls the replicative entrepreneur, a person that replicates an enterprise that has been launched many times before, in order to seek autonomy or as a way out of poverty (cf. necessity-based entrepreneurship: Block and Koellinger 2009; Fairlie 2013). In the other end of the spectrum is the innovative entrepreneur, who has done something never done before, and is seen as the key to innovation and economic growth in society (Schumpeter 1911/1934; Baumol 2008). Here, the amount and speed of wealth creation and profit goes far beyond what is possible in the small business enterprise.

Schumpeter (1942) made a distinction between the owner or manager of a business and the entrepreneur. He also made a distinction between role of the entrepreneur and the inventors. He viewed the entrepreneur as a function that anyone that carries out new combinations can take. As soon as they have built up their business and settles down to run it, they would leave this role and become an ordinary manager. Baumol (2008) makes a similar distinction between the replicative and the innovative entrepreneur. These distinctions are closely related to the notions of value creation and value capture (Lepak and Smith 2007). The entrepreneur creates value for someone, for example by putting an innovation into use, but also capture that value in terms of profit. However, it is not necessary the entrepreneur who captures all the value. More

or less of the profit may go to others, such as company owners or investors. It is also an issue of how much value that is created, how much profit that generates, and in what ways that may be captured.

Related Literature: Towards Digital Entrepreneurship

Preceding the discourse on digital innovation, a variety of efforts to conceptualize entrepreneurship in the realm of Internet and e-commerce have been proposed (see table 1). Recently also a few papers that draw explicitly on the digital entrepreneur has occurred (Davidson and Vaast 2010; Hafezich et al. 2011; Hull et al. 2007; Nambisan 2016).

Concept	Source
E-Commerce Entrepreneur	Sebora et al. (2009)
IT-Entrepreneur	Sebora et al. (2009)
Digital Entrepreneurship	Davidson and Vaast (2010); Hull et al. (2007); Hafezieh et al. (2011); Nambisan (2016)
Internet Entrepreneurship	McKelvey (2001); Millman et al. (2010); Colombo and Delmastro (2001)
Internet-based Entrepreneur	Liao et al. (2009); Hafezieh et al. (2011)
Dot.com entrepreneur	Serarols-Tarrés et al. (2006)
Netpreneurship	Avgerou and Li (2013)
Cyber-Entrepreneurship	Bouwman and Hulsink (2002)
High-Tech Entrepreneur	Bouwman and Hulsink (2002)

Table 1. Related literature

Going through the literature in the intersection of entrepreneurship and information systems we identified three main themes: the role of technology, personal traits and the entrepreneurship process.

All the articles relate entrepreneurship more or less to the *role of the technology*. Many authors don't go deep into the functionality of the technology, but rather what it enables (Avgerou and Li 2013; Davidsson and Vaast 2010; Serarols-Tarrés et al. 2006; Colombo and Delmastro 2001; Millman et al. 2010). Some points to specific competitive factors that relates to technology, such as limitations due to web site filtering; traditional views on how to build ICT infrastructures; low internet speed and high costs for bandwidth (Hafezieh et al. 2011; Hull et al. 2007). Sebora et al. (2009) investigates how different aspects of e-services - such as, reliability, responsiveness and ease of use - matters when it comes to establishing a successful e-commerce venture (Sebora et al. 2009). McKelvey (2001) points to the potential of the technology to pave the way for a distributed innovation process that might be significantly different from traditional patterns of knowledge development (within firms or organization). This relates to the whole field of open innovation and crowd-sourcing.

Some of the literature turn to the traditional entrepreneurship stream that focus on *personal traits*, that are common to, or unique to the digital entrepreneur. Examples here are locus of control, risk-taking propensity, achievement orientation, networking, educational background, working experience, and motivation for self-employment (Colombo and Delmastro 2001; Sebora et al. 2009). An ambitious study was conducted by Serarols-Tarrés et al. (2006), investigating how gender, age, education, entrepreneurial experience, incubator organization, triggering events, and planning capacity, affects and shapes digital entrepreneurs. Liao et al. (2009) emphasizes the need of continuous innovation and that digital entrepreneurs therefore must foster a mindset of flexibility and experimentation based on knowledge of the technological fields that they intend to explore and exploit. Millman et al. (2010) studied students and their willingness to engage in digital entrepreneurial activities and found that students that choose IT-related subjects were more oriented toward digital entrepreneurship than those who went for non-IT subjects, including business disciplines.

Some papers focus on the *entrepreneurial process*. Common here is a latent discovery perspective on opportunity seeking. Hafezieh et al. (2011) identified a four-step process that Internet-based entrepreneurs use when they launch their business: (1) Identification of business opportunity (2) Emergence of business idea (3) Analysis of market needs (4) Feasibility study. Liao et al. (2009) studied the process of recognizing opportunities in internet firms and pointed out the importance of firm's ability to mobilize its resources and capabilities and align them dynamically with the changing opportunities in the environment. Hull et al. (2007) brings forward a typology of digital entrepreneurship that consists of three types of digital entrepreneurship - mild, moderate, and extreme. Where mild means that the venture uses digital technology as a supplement; moderate digital entrepreneurship require significant focus on digital products and cannot exist without a digital infrastructure. A venture that falls in the extreme category is a venture that is completely digitalized (Hull et al. 2007). Davidson and Vaast (2010) takes a creation perspective on opportunities, and points to the creative destruction process as part of digital entrepreneurship. They claim that three previously distinct areas of entrepreneurship – business, knowledge, and institutional – now, by means of, sociomaterial practices, converge into a new domain – that of digital entrepreneurship (Davidson and Vaast 2010).

Although contemporary research within the field of digital entrepreneurship acknowledges technology as a transformative power, technology is treated more as a context for study, and less as locus (Nambisan 2016). This focus neglects the unique characteristics and aspects of digital technology. We therefore adhere Namibian's (2016) call for a digital technology perspective on entrepreneurship. More specifically, we discuss how certain characteristics of digital artefacts, along with the concept of generativity, interact with human agency in the evolution of entrepreneurial opportunities.

From Digital Innovation to Digital Entrepreneurship

The growing discourse on digital innovation and digital artefacts, provides us with a suitable theoretical framing to discuss the nature of digital entrepreneurship. In the digital innovation literature, much focus has been on the digitalization of previously non-digital artefacts in an industrial context, i.e. on product innovation (Yoo et al. 2010). However, Schumpeter's four other types of innovation - new production methods (process innovation), new sources of supply, the exploitation of new markets, and new ways to organize business – are relevant to digital innovation and digital entrepreneurship as well.

Kallinikos (2009) points to the binary nature of computing. This property gives Information Technology the possibility to reproduce interoperable facets of reality that never has been possible before. As a direct consequence of this characteristic follows that the (analogue) nature of reality can be reduced to (digital) binary variations. These variations can be interpreted as syntactic or semantic. Where syntax stipulates how things are written (bit sequence), semantics is about what things mean (interpretation of bit sequence). Semantics is therefore concerned with the association between syntax and concepts (Lee 2017). These basic characteristics are foundational for digital innovation to happen.

The fundamental properties of digital innovation are re-programmability, data homogenization, and the self-referential nature of digital technology (Yoo et al. 2010; Yoo et al. 2012; Kallinikos et al. 2013). These properties have opened for unrepresented opportunities for innovators and entrepreneurs, since they unfold two vital characteristics of innovation: convergence and generativity. Where convergence points to the digital technologies inherent possibility to fuse together previously separated infrastructures, services and appliances (Tilson et al. 2010a); leading to distribution channels, which was previous separated (text, image, audio, video), now being fused together, putting previously separated actors into the same domain (i.e. Internet). A key aspect here is generativity. Generativity defines an innovations' capacity to spur further innovation, and points to the nature of digital technology as intentionally unfinished and therefore malleable; that it invites to be experimented with. Further, that digital technology can be compiled into a variety of different combinations (Kallinikos 2012; Kallinikos et al. 2013; Yoo et al. 2010; Yoo et al. 2012; Zittrain 2006). But this incompleteness is not just of good. The dynamic nature of digital artefacts makes them difficult to control. "They are objects yet they lack the plenitude and stability afforded by traditional items and devices" (Kallinikos et al. 2013, p. 357-358). Thus, we can understand digitalization as continuous evolution and technology in constant flux, leading to the notion of a generative matrix (Kallinikos 2012).

Another key aspect is digital infrastructure. The notion of infrastructure traditionally points to a fixed and rigid structure; a pathway that support transfer of certain kind of transportables - such as electricity, trains or cars. The property of interconnectivity is applicable for a digital infrastructure as well, where standardized

protocols (e.g. TCP/IP) enables transparent movement of data along physical devices such as fiber optics cables, routers and switches. A digital infrastructure also acts as a generative mechanism with a self-emergent, recursive behavior, where the systems different components contribute to the further development of the whole (Henfridsson and Bygstad 2013). This recursive nature points to the flexibility of a digital infrastructure, where rapid reconfigurations are possible to change the behavior of the system (Tilson et. al 2010b). But the self-emerging nature of digital infrastructures also imposes that the system can drift. This drift points to the side-effects, accidental outcomes, and unexpected use that appears in the wake of the evolution of an infrastructure (Ciborra and Hanseth 2000).

A Conceptual Framework for Digital Entrepreneurship

Traditionally, entrepreneurship and innovation have presupposed stable and finite boundaries for new product ideas that underlie an entrepreneurial opportunity. But regarding digital innovation these boundaries appear instead as fluid and porous; the notion of generativity points to the fact that digital artifacts continue to evolve even after the commercial introduction (Nambisan 2016). For example, an Operating System is constantly in the making, both when it comes to stabilization as well as addition of new features. Also, platforms such as Google Cloud, Microsoft Azure, and AWS (Amazon Web Services) continuously introduces new digital capabilities for entrepreneurs to explore and exploit. This continuous introduction of new features can give a presumption that the entrepreneur has a gigantic smorgasbord of opportunities to choose from, and where the limit for innovation is that of the entrepreneur's own imagination.

In what follows we introduce a conceptual model where critical aspect of digital innovation is presented: Here we discuss what types of skills and/or prerequisites is needed to be able to undertake entrepreneurial opportunities in the digital realm (table 2).

Digital Artefacts are *programmable* as well as re-programmable (Yoo et al. 2010; Yoo et al. 2012; Kallinikos et al. 2013). This fact is fundamental for the emergence of the generative matrix, as software provides almost unlimited flexibility in information manipulation (Tilson et. al 2010a; 2010b). The entrepreneur can, by employing programming skills, create or modify digital artefacts so that they appear in new, novel ways. This possibility to (programmatically) create, modify, and use capabilities and affordances which appear within digital artefacts lays the foundation for generativity to emerge (Yoo et. al 2012). An entrepreneur can both discover (modify existing artefacts) as well as a create (create new artefacts) opportunities with respect to the programmable characteristic.

Digital Artefacts can be *editable* (Kallinikos et al. 2013). Editability is a built-in property which gives the entrepreneur a possibility to create and update content (blogs, vlogs). The entrepreneur can make use of widespread platforms (Wikipedia, YouTube, Instagram), to tap into already existing user bases. While this possibility lowers the barrier of distributing content on a wider scale – compared to what has traditionally been the case – the notion of the long tail can make the battle for attention from the user base quite a challenge (Anderson 2004). Of course, it can be discussed whether the entrepreneur is a creator, in the sense of creating content. But since this article focuses on digital entrepreneurial logics, it is more important to notice that the entrepreneur must discover a digital opportunity (that is editable) before s/he can create content.

Digital Artefacts are *interactive* (Kallinikos et al. 2013). Entrepreneurs can make use of digital artefacts by interacting with the functions and affordances they present. By employing digital technologies to facilitate their day-to-day work, entrepreneurs can make their processes more efficient as well as reduce operational costs (Accenture 2014). Maybe this notion of interactivity, more than any of the other, underlines the dilemma of reframing an entrepreneur as a digital one. Because in many cases, entrepreneurs conduct their core business in the tangible world, while all other activities are performed within the digital sphere. Hence, the entrepreneur must cope with both the digital as the non-digital.

Digital Artefacts can be combined, leading to *combinatorial* innovations (Yoo et al. 2010; Yoo et al. 2012). Entrepreneurs can create new products or services by combining software and data from multiple sources; sources that follow specific standards or exposes certain API: s which the entrepreneur can employ to create new experiences (de Reuver et. al 2017; Fultz 2011). Thus, digital modules providing specific services can be mashed-up with other digital modules to provide novel services. For example, map APIs may be combined with digital applications related to boating, driving or running.

Digital Artefacts can be connected, and thereby become *interoperable*. An entrepreneur can discover an opportunity in connecting previous unconnected artefacts and by that allowing transparent movement of data (Marston et. al 2011). But the self-referential nature of digital innovation – where digital artefacts are employed to create or manipulate other digital artefacts – reveals a structure that is recursively composed, where previous digital artefacts become sediment for future ones (Kallinikos 2013; Yoo et. al 2010; Hanseth and Lyytinen 2010). In the light of this, interoperability may be needed in many layers. To begin with, it may be necessary for the systems at all to talk with each other (syntactic interoperability; cf Lee 2017). But only exchanging data may not be enough, oftentimes it is the common comprehension of what the data should conceptualize that needs to be agreed upon (semantic interoperability; cf Lee 2017).

Discussion: Entrepreneurship in the Digital Society

By starting off in the digital realm the entrepreneur appears in a global context from day one. New technologies contribute to open up new markets as well as reduce the cost of international expansion. Due to the generative, elastic and inexpensive nature of cloud computing, the entrepreneur can act with a great amount of flexibility both when it comes to day-to-day operational activities as well as further development (Zysman and Kenney 2018; Accenture 2014). But on the other hand, the notion of convergence brings entrepreneurs together, operating in the same channel which increases the possibility of rivalry and competition over attention and relevance amongst customer. This might lead to winner-take-all tendencies and a fiercer competition that might be the case for a traditional entrepreneur (Parker, van Alstyne and Choudray 2016; Kenney and Zysman 2016).

Although digital technology lower barriers, the entrepreneur might also face issues quite unique to the digital realm. Consider data as a commodity. Rules and law handing this commodity are not conforming to a global standard. Given that today’s data-driven world presupposes a transparent flow of data, traditionally regulatory approaches are being challenged (Accenture 2014). While in the tangible world, national borders are distinct and well-defined, things are a bit fuzzier in the digital realm.

Digital businesses can appear as immature and not yet stable where policymakers and institutions are trying to catch up. But this stance can be a bit misleading, since latent within such a reasoning lies the perceiving of technology as static. But the notion of generativity tells us that technology is all but static, and we do not really know how the future unfolds. With the notion of technology in constant flux follows a view of the world where laws and regulations always will be challenged.

Digital Characteristic	Technology	Entrepreneurial Action	Example
Programmable	Operating Systems; Applications; device drivers; programming languages; middleware	Create new, or changes existing, digital artefacts.	Platforms, e.g. Whatsapp, Youtube, Uber-App developers
Combinatorial	Mash-ups	Combine existing digital artefacts in new, novel ways.	E.g. services that use google maps
Interoperable	E-health; Infrastructures; Internet of Things	Connect previously unconnected digital artefacts.	E.g. gateways, proxys
Editable	Blogs; Wikipedia; YouTube; Instagram	Create, change or update content.	Youtubers and bloggers, e.g. PewDiePie
Interactive	Features and affordances presented by applications	Make use of interactivity	Uber drivers

Table 2. A framework for digital entrepreneurship

Digital Opportunities

Digital technology seems to alter, or add to, the behavior on how opportunities arise. The generative potential of digital technology acts as breeding ground for future innovation to happen. Generativity thus brings an additional dimension to the relationship between entrepreneur and opportunity. Not only can an opportunity be created or discovered (Alvarez and Barney 2007), but it can also be enabled. In the case of discovering and creating an opportunity, the entrepreneur actively performs actions to explore and exploit said opportunity. The intention of the entrepreneur is to produce a new service or product and bring it to the market. But when it comes to describing an opportunity as enabled, we must consider the nature of digital technologies as intentionally unfinished (Kallinikos et. al 2013); that an entrepreneur deliberately lets parts of his creation open up for others to use or build upon. From this perspective an entrepreneur can, in the digital realm, both explore and exploit opportunities (discover/create) as well as make possible for opportunities to appear (enable).

When an entrepreneur enables an opportunity, s/he cannot know in beforehand how this opportunity will be used, or for that matter, if it ever will be exploited. For example, Google Cloud, AWS (Amazon Web Services), and Microsoft Azure are digital platforms who presents countless opportunities which can be used for innovation; the services offered, spans from building and managing IT-infrastructure, to data analytics and machine learning services. What these actors do is that they enable opportunities that in turn can be used as building blocks for innovation by other entrepreneurs. Due to the self-referential nature of digital technology, the entrepreneurs can themselves in turn leave their creation intentionally unfinished (by exposing API:s, or offer open data etcetera) for others to build upon. In this way, entrepreneurs recursively enable opportunities which in turn leads to the layered, sedimentary structure of digital technology, where platforms are built upon platforms. Unlike creation or discovery of an opportunity - where profits in a sense are collected directly - the gain of enabling an opportunity is buried in the future, along with the coming entrepreneurs' possibility to exploit it. Just like in the case of creation, enabling opportunities is closely related to uncertainty, since information of future actions is unknown.

If we then return to the conceptual framework earlier presented, and to that add the discussion about opportunities, a vista on entrepreneurship in the digital society slowly emerges. Where the digital artefacts different characteristics and relations describes which options, an entrepreneur can utilize and employ to make use of the said artefact and to further innovate. And where the different views on opportunities gives the possibility for the entrepreneur to choose whether s/he will exploit (discover/create) opportunities or enable them – or maybe both. These choices will affect the strategic approach. For example, if an entrepreneur chooses to primarily enable opportunities – to devote to value creation – the strategic choices will be about platform thinking and how to build healthy and vibrant ecosystems.

Personal traits and knowledge

What type of knowledge must an entrepreneur conquer to be able to pursue entrepreneurial opportunities in the digital realm? The literature that describes digital entrepreneurs' characteristics, investigated traits such as locus of control, risk-taking propensity, educational background, previous experience etcetera. (Sebora et al. 2009; Hull et al. 2007; Colombo and Delmastro 2001; Serarols-Tarrés et al. 2006; Millman et al. 2010). Nothing of what really could be said to be unique for an entrepreneur in the digital realm. Millman et al. (2010) found a positive correlation between IT-education and willingness to engage in digital entrepreneurship. This, one could claim, has something to do with digitalization in the sense that Information Technology is the driving force behind the process as such. But it has also – and for the entrepreneur concept's sake more importantly – to do with knowledge. That someone gains (IT) knowledge and someone don't. That someone, based on conquered knowledge and acquired skills, can discover and seize opportunities where others can't (cf Segal et al. 2005; Bull and Willard 1993). From a knowledge perspective, there is no difference between the digital entrepreneur and a traditional entrepreneur. It is all about gaining *adequate* knowledge.

If we turn to the conceptual framework, we can note that digital artefacts can be approached differently. And depending on the approach, the knowledge needed to master that approach can also differ. Take the characteristic programmable: To be able to master this characteristic the entrepreneur (or a colleague) must possess the skill of programming. However, the need for the level of competence may vary: On the one hand, to be able to create a complex and innovative artefact, a high level of understanding within the realm of

programming is probably needed (e.g. platforms such as Uber, Facebook, Instagram). On the other hand, if the entrepreneur goes for a combinatorial approach – combining a pair of API:s exposed by different artefacts - there might exist a situation where just a rudimentary knowledge of programming is good enough (cf Fultz 2011). If we then take the characteristics of interactive, the entrepreneur is more a user of existing artefacts which s/he must learn to use: Let it be an online CRM system (Microsoft Dynamics 365; Salesforce) or an app in a mobile phone (Uber, Whatsapp, FB Messenger), or for that matter, an operating system (Linux, Android, macOS).

Entrepreneurship in the digital landscape spans wide areas. This leads to lower barriers for entrance to markets and a vast number of opportunities to explore. But at the same time, it also requires that adequate knowledge and experience exists for being able to exploit these opportunities. Therefore, in terms of knowledge, it is hard to point to a specific type that is relevant for a digital entrepreneur. Furthermore, it is even harder to predict what type of knowledge is desired in the future, since it is difficult to anticipate along which paths technology unfolds; which of today's techniques and applications that prevails, and which will be superseded.

As we earlier discussed: Generativity, latent within digital technology, gives the possibility of vast arrays of re-combinations. This fact, in turn, leads to two things: (1) that the need for new knowledge is constant (2) and a heightened complexity of the innovation process (Yoo et al. 2012). A continuous flow of combinations and re-combinations leads to increased complexity which, in turn, leads to additional demands on knowledge and further innovation for coping with complexity. Hence, the generative matrix (Kallinikos 2012).

Replicative Entrepreneurs versus Innovative Entrepreneurs

Many platforms are examples of innovative entrepreneurship. They may emerge as opportunity creations and evolve as enabling innovations with more or less generative capacity. If they have high generative capacity, they enable other innovative entrepreneurs to innovate further. If they have low generative capacity they still provide opportunities to be discovered by more replicative entrepreneurs.

YouTube has made a journey from being an innovative video-sharing enterprise, to become more of a game changer and an institutional entrepreneur with regards to streaming video of all kinds (video clips, TV-show clips, music videos, movie trailers, video blogs, educational videos etcetera). On the one hand, YouTube presents functionality to upload and store videos (c.f. interactive and editability); on the other, YouTube also exposes API:s which makes it possible for third-party vendors to tap into the platform, and make use of data and functionality in order to innovate and build novel enterprises on top of the YouTube platform (c.f. programmable and combinatorial). This illustrates the possibility for entrepreneurs to innovate on platforms in different ways. Take the phenomenon of Felix Kjellberg (PewDiePie) as an example of the former: During the 2010's Felix Kjellberg's YouTube channel was one of the fastest growing on the platform. On the 23th of August 2016 he was awarded the Guinness world record in the category Most subscribers on YouTube. As of today, the channel has over 62 million subscribers. Is PewDiePie an Innovative entrepreneur?

He cannot be said to be the first person who put a video on YouTube, and he was presumably not even the first youtuber who produced content within the genre of Let's Play (a video that documents a playthrough of a game). Nevertheless, his breakthrough is unprecedented, and in the wake of his success hordes of peoples has been inspired to become youtubers. If an innovative entrepreneur is categorized as a person who locates new ideas and put them into effect (Baumol 2008), then surely, that epithet fits Felix Kjellberg quite well. He is an innovative digital entrepreneur, but without the need to master any specific IT-talents other than the functionalities presented by the YouTube platform. If we look at how he utilizes the underlying technology, he uses YouTube as an infrastructure to deliver content. From the start, PewDiePie could tap into the existing user base of YouTube. But over the years he had become a brand in his own right. PewDiePie has gone through a metamorphosis to now be perceived as a platform - running on top of YouTube - bringing more users and traffic to his own business as well as to YouTube itself.

Another example is Uber. The platform itself is a technology construct which acts as an intermediary between riders and drivers. To its revelation, the platform is clearly innovative. The role as intermediary brings with it a form of Schumpeterian creative destruction in that the company challenges prevailing way of working. But the Uber drivers could be considered as replicative entrepreneurs, they work as self-

employed taxi-drivers augmented by technology. Through the Uber app, the driver interacts with the platform which becomes the coordinator of work.

Conclusion

This paper set out to theorize digital entrepreneurship and discuss how the characteristics of digital technology and digitalization affect entrepreneurship. We present a framework for digital entrepreneurship based on the characteristics of digital artefacts and digital innovation. By applying the framework on examples, we discuss four key dimensions of entrepreneurship – the nature of opportunities, personal traits of the entrepreneur, risk and uncertainty, and replicative or innovative entrepreneurship. We contribute by problematizing digital entrepreneurship in relation to these dimensions. To the opportunity discovery versus creation theory we add a third component: opportunity enabling, which is closely linked to generativity.

We conclude that that digital entrepreneurship in certain fields may require technical knowledge (especially for innovative entrepreneurs), but that the development of digital platforms on the other hand lower these requirements. Finally, many of these platforms are examples of innovative entrepreneurship, in that they both may create or enable opportunities for other entrepreneurs (if they have high generative capacity) and create simpler opportunities to be discovered by self-employed replicative entrepreneurs.

For future research, we suggest investigating whether more dimensions of the framework would be relevant. One example is the nature of individual entrepreneurship as opposed to organizational entrepreneurship. We also propose that more examples of emergent digital phenomena are investigated in relation to entrepreneurship in a digital of society.

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