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# The digital entrepreneurial ecosystem

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Abstract A significant gap exists in the conceptualization of entrepreneurship in the digital age. This paper introduces a conceptual framework for studying entrepreneurship in the digital age by integrating two wellestablished concepts: the digital ecosystem and the entrepreneurial ecosystem. The integration of these two ecosystems helps us better understand the interactions of agents and users that incorporate insights of consumers' individual and social behavior. The Digital Entrepreneurial Ecosystem framework consists of four concepts: digital infrastructure governance, digital user citizenship, digital entrepreneurship, and digital marketplace. The paper develops propositions for each of the four concepts and provides a theoretical framework of multisided platforms to better understand the digital entrepreneurial ecosystem. Finally, it outlines a new research agenda to fill the gap in our understanding of entrepreneurship in the digital age.

Keywords Entrepreneurship · Ecosystem · Matchmakers · Digital infrastructure · Digital governance · Digital citizenship · Multisided platforms · Information technologies

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# JEL classification L26 · 011 · P40 · P00

#### **1** Introduction

As the Economist magazine went to press the lead story was about reinventing the company.<sup>1</sup> This new company type is at the heart of a growing debate on how to understand the digital economy. Ever since the launch of Uber, Snapchat, and AirBnB and the earlier success of Google, Amazon, and Facebook, a new breed of company has emerged that uses digital technology, entrepreneurship, and innovation to upend industries on a global scale (Stone 2017).<sup>2</sup> Most of these companies are matchmakers (Evans and Schmalensee 2016, p.1).<sup>3</sup> What these companies have in common is that they all connect members of one group with another group. The core competencies of these companies are their ability to match one group of customers with another group of customers by reducing the transaction cost of a match (Coase 1937). These multisided platforms would not exist without the explosion of information and communication technologies (ICT). While

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<sup>&</sup>lt;sup>1</sup> Reinventing the Company. *Economist Magazine*, October 24, 2015. <sup>2</sup> This trend is reflected in the continuing decline in the cost of computing, the rise of open-source software, the move to the "cloud" and the emergence of huge datacenters where companies such as Amazon, Google, and Facebook are designing their own approaches. <sup>3</sup> Fifteen companies that were together worth less than \$10 billion in 2000 are now among the world's 50 top technology companies as measured by market capitalization, with a combined who of \$2.1 trillion. Had Amazon been included this number would have swollen by another \$250 billion (Moritz 2015).

Walmart would not be as efficient without the Internet, it would survive, because it has a physical location. Amazon on the other hand could not function without the Internet, since it has no physical outlet. These new companies are startups in many ways. They are young, only a few years old in some cases, but they ignite very quickly (Aghion 2017; Coad et al. 2016; Stenholm et al. 2013).

The entrepreneurship literature has not examined this type of startup (Daunfeldt and Halvarsso 2015). The reason the entrepreneurship literature has not studied the billion-dollar digital startup is because entrepreneurship research is focused on selfemployment both as business ownership and as sole trader (Parker 2002; Shane and Venkatraman 2000). The entrepreneurship literature focuses on thousands of small startups and often these small startups fail due to the lack of customer base (Acs et al. 2016). In other words, entrepreneurship has not focused on finding customers first before they start a business. In the digital economy, it is precisely the opposite we have much fewer startups, and each startup has millions of customers.<sup>4</sup>

What about Uber drivers and AirBnB renters? Are they digital entrepreneurs? On the one hand, they are performing a very traditional service, driving taxis, and providing rooms for rent, while on the other hand, they are engaged in business using digital technologies. However, one can argue that they are not doing anything creative and therefore are business owners but not digital entrepreneurs. However, many of multisided platforms are populated with digital entrepreneurs that write millions of apps that power smartphones, Facebook, and thousands of other businesses. In fact, writing a business App is one of the most common types of business startup today (Haefliger et al. 2010).

In some sense, entrepreneurship research has ignored both the role that digital technologies play in entrepreneurship and the role that users and agents play in digital entrepreneurship. In short, a significant gap exists in our understanding of entrepreneurship in the digital age because entrepreneurship research does not have a consolidated way to study the impact of digitization. In other words, entrepreneurship research has yet to contextualize within the digital economy in terms of how *institutions* and *agency* will be changed as a result of digitization. In fact, extant literature about digitization and the impact of digitization from other disciplines in business (management information systems, marketing) are available to inform us about the impact of digitization and how it may possibly change the way we understand entrepreneurship.

The purpose of this paper is to fill the gap in our understanding of the role of agents and users in the digital economy. This paper uses literature surrounding digitization—since digitization is not about one technology, we use the literature on digital ecosystems (Dini et al. 2011; Li et al. 2012). Coincidentally, entrepreneurship also has an ecosystem literature (Acs et al. 2014a, 2017; Stam 2015). We thus integrate the two to form a new conceptual framework—the digital entrepreneurship in the digital economy. The digital entrepreneurship in the digital economy. The digital entrepreneurship in the digital economy. The digital entrepreneurship in the digital composed of Schumpeterian (1911) entrepreneurs creating digital companies and innovative products and services for many users and agents in the global economy.

In this new framework, we introduce four key concepts: digital infrastructure governance, digital user citizenship, digital entrepreneurship, and digital marketplace. By integrating the role of agents and users in the same conceptual framework, we are able to advance entrepreneurship thinking into the digital economy. This paper makes four important contributions to the entrepreneurship literature. First, it contributes to entrepreneurship by bringing the research into the digital age specifically digital infrastructure and their impact on entrepreneurship in general. Second, by introducing the role of users in digital ecosystem, this paper adds a new dimension to entrepreneurship economics literature (Read et al. 2009). Third, by introducing the interactions of agents and users, this paper extends entrepreneurship research to incorporate insights of consumers' individual and social behavior in multisided platforms. Fourth, digital ecosystem integration broadens entrepreneurship ecosystems research.

The next section of this paper outlines the concept of ecosystems, digital ecosystems, and entrepreneurial ecosystems. The third section integrates the digital and entrepreneurial ecosystems and provides a  $2 \times 2$  conceptual framework resulting in four concepts in four

<sup>&</sup>lt;sup>4</sup> The strategy literature acknowledges different forms of value logic (Stabell and Fjeldstad 1998) that extends Porter's value chain logic of the firm and presents new ways of looking at firm creation approaches and different underpinning economic logics for firm creation (knowledge and network economic principles).

quadrants: digital infrastructure governance, digital user citizenship, digital entrepreneurship, and digital marketplace. The fourth section provides a theoretical framework of multisided platforms to guide our understanding of the digital entrepreneurial ecosystem. The fifth section outlines a research agenda for future research of entrepreneurship in the digital age. The conclusion is in the final section.

# 2 Background

In order to better understand entrepreneurship in the digital world, we employ the concept of an ecosystem (Mathews and Brueggemann 2015, Chapter 14). A system is a set of interacting and interdependent organizations that function together as a whole to achieve a purpose. In general, an ecosystem is a purposeful collaborating network of dynamic interacting systems that have an ever-changing set of dependencies within a given context. For discussion purposes, we can think of *external macroecosystems* natural environments of community efforts around startup ecosystems to support development and *internal or value added microecosystems* that support a firm's platform (Moore 1993).<sup>5</sup> Our focus in this paper is on the former however we discuss microecosystems too.

A biological ecosystem is defined as "...a community of living organisms in conjunction with the nonliving components of their environment, interacting as a system. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows".<sup>6</sup> This definition makes it clear that an ecosystem has living and nonliving components and a system does not. "Biological ecosystems are thought to be robust, scalable architectures that can automatically solve complex dynamic problems" (Li et al. 2012). The modeling of the system's properties is a complex process that involves both assumptions and the identification of the biological processes.<sup>7</sup>

The challenge in moving from the biological sciences to the social sciences is to identify, not only what the living and nonliving components of the ecosystem are, but much more difficult, is how this complex socioeconomic community functions. The first issue is that while in the biological sciences the system is modeled, in the social sciences it is generally just assumed. Systems constitute multiple components that work together to produce system performance.

If one is interested in the scholarly literature on systems as they relate to innovation and entrepreneurship, there are at least three approaches: System of Innovation (SI) (Nelson 1994); The Competitive Advantage of Nations (Porter 1990); Systems of Entrepreneurship (Acs et al. 2014a, 2014b). The broadest approach to economic performance at the economy level is the concept of National Systems of Innovation (NSI) (Edquist 1997; Lundvall 1992; Nelson 1994). The main theoretical underpinnings are that knowledge is a fundamental resource in the economy within which knowledge is produced and accumulates through an interactive and cumulative process of innovation that is embedded in a national institutional context, and that the context therefore matters for innovation outcomes. The term "system" connotes a set of institutions whose interactions determine the innovative performance of national firms. It is important to understand what the system means in the SI literature. According to Rosenberg and Nelson (1993 p. 4-5) the system concept, "...is that of a set of institutional actors that, together, plays the major role in influencing innovative performance." In the SI literature, systems are not created. Rather, they are inherited, evolving structures, and the key task of the researcher is to understand this structure, so the system can be manipulated to deliver improved performance.

The NSI concept is mostly about context, how institutions drive knowledge production and application and how countries differ according to their "...set of institutions..." but totally overlooks the individual agency (Acs et al. 2014a p. 477). In the NSI literature, individuals are almost treated exogenously given contextual variables and settings being the focus of academic research and policy makers. In other words, SI helped us understand where we were as nations but not how to improve our position. It is perhaps a little surprising, if not ironic, that although the NSI literature was heavily influenced by the Schumpeterian tradition, the entrepreneur remained conspicuously absent in this literature (Salter and McKelvey 2016; Winter 2016). Also see the literature on Regional Systems of Innovation that did include some aspects of entrepreneurship (Cooks et al. 1997).

 $<sup>\</sup>frac{1}{5}$  Some will call this a business ecosystem that is not bounded by space.

<sup>&</sup>lt;sup>6</sup> https://www.google.com/?gws\_rd=ssl#q=ecosystem August 4, 2014.

<sup>&</sup>lt;sup>7</sup> http://w3.marietta.edu/~biol/102/ecosystem.html October 25, 2015

The second approach to systems is associated with Michael Porter's (1990, 1998) work on clusters and the new economics of competition. While Porter was also interested in Nations and Innovation like Nelson, he took the analysis one step further. The central question to answer according to Porter is, "Why do firms in some industries achieve international success and others do not?" In addition, to understanding the role of institutions, Porter argued that firm strategy is also an important aspect of global competitiveness. To understand the environment Porter introduced the "Diamond": a concept that tied together factor conditions, demand conditions, related and supplier industries and firm strategy, structure, and rivalry. Porter argued that productivity and competitive advantage in an economy requires specialization. In the Competitive Advantage of Nation he "introduced the concept of a cluster, or group of interconnected firms, suppliers, related industries, and specialized institutions in particular fields that are present in particular locations." Porter offered a sophisticated view between agglomeration economics and competition and strategy by focusing on clusters.

The third approach to systems is associated with Acs et al. (2014a). There is a growing recognition in the entrepreneurship literature that entrepreneurship theory focused only on the entrepreneur may be too narrow.<sup>8</sup> The concept of system of entrepreneurship is based on three important premises that provide an appropriate platform for analyzing entrepreneurial ecosystems. First, entrepreneurship is fundamentally an action undertaken and driven by agents on the basis of incentives. Second, the individual action is affected by an institutional framework for entrepreneurship. Third, entrepreneurship ecosystems are complex, multifaceted structures in which many elements interact to produce systems performance, thus, the system method needs to allow the constituent elements to interact. The concept has also been applied at the regional level (Szerb et al. 2014).

At this point, it is useful to discuss the services of ecosystems or ecosystem outcomes. Whether we are talking about biological, technical, or entrepreneurial ecosystems, they all have outcomes, and the thread that cuts across all three ecosystems is the quality of sustainability through problem solving. Ecosystems can flourish. Ecosystems can also be killed if you cut off the energy and nutrients that sustain them. In the physical world, we see this in the death of coral reefs due to pollution, in the technical world, we see this through regulation, and in the social world, we see it through the death of communities due to technological change. Silicon Valley and venture capital epitomize an entrepreneurial ecosystem that produces both routine and highgrowth entrepreneurship. Each of these forms of entrepreneurship is performed within an ecosystem, and both routine and high growth therefore must be manifestations of an entrepreneurial ecosystem. Sustainability is therefore the key outcome of the ecosystem process. The next section defines the characteristics of both the Digital and Entrepreneurial ecosystems.

#### **3 Digital ecosystems**

Digital ecosystem (DE), a terminology that emerged in the early 2000s, is defined as "...a self-organizing, scalable and sustainable system composed of heterogeneous digital entities and their interrelations focusing on interactions among entities to increase system utility, gain benefits, and promote information sharing, inner and inter cooperation and system innovation" (Li et al. 2012, p. 119). DE can be applied in business, knowledge management, service, social networks, and education.

Digital ecosystems have become an important research agenda for both practitioners and scholars (Dini et al. 2011; Li et al. 2012). As the rapid advancement of digitization and the impact of digitalization<sup>9</sup> increase, the concept of digital ecosystems has been subject to an array of perspectives—ecological, economic, and technological—in its definition (Li et al. 2012), and attracted multi- and interdisciplinary discourses (Dini et al. 2011). Despite the diverging perspectives and the splintered foci from various definitions, the convergence or commonality of all the various discussions on the concept point toward two foundation pillars of DE—digital technologies and people. It is an ecosystem in that digital technologies (e.g., mobile search engine) can be viewed as the nonliving

<sup>&</sup>lt;sup>8</sup> We use the concept system of entrepreneurship and entrepreneurial ecosystem interchangeably in this paper.

<sup>&</sup>lt;sup>9</sup> Digitization is the technical process, whereas digitalization is a sociotechnological process of applying digitization techniques to broader social and institutional contexts that render digital technologies infrastructure (Tilson et al. 2010 p.3)

component, and the people who use these technologies (e.g., anyone who uses Google) are the living component, and the interactions of the living and the nonliving and the dynamic and continuous changes resulting from the interactions of these two components form the behavior of an ecosystem. Inherent in DE, the assumptions of such an ecosystem is user-driven, bottom-up, and open-source oriented (Dini et al. 2011), emphasizing the pivotal role users or people play in the ecosystem. The advancement of digital technologies has resulted in a more complex system—digital infrastructure (Tilson et al. 2010). The two foundation pillars—digital infrastructure and users—are the main focus of our discussion of digital ecosystems in relation to entrepreneurship ecosystems.

#### 3.1 Digital infrastructure

As digital technologies increasingly become more service-focus, socially embedded, and laden with intensive human interactions, a more open, inclusive, global, dynamic, and flexible view of digital infrastructure (DI) is needed in order to capture the effects of digitalization (Tilson et al. 2010). Anchored in digital technologies, DI is a socially embedded mechanical system that includes technological and human components, network, systems, and processes which generate feedback loops that are self-reinforcing (Henfridsson and Bygstad 2013; Tilson et al. 2010). DI thus links systems and networks at the global, national, regional, industry, and/or corporate levels and is constantly changing because of its diverse base of installed digital technologies and users who are designers or operators of these systems (Tilson et al. 2010). In that sense, DI does not have a single defined set of functions or strict boundaries. Rather, multiple layers of systems and processes are at work simultaneously resulting in a decentralized, shared, and distributed DI which is not subject to a single centralized stakeholder's control. In other words, there are two views of DI, both from a complex systems theory, and readers can select the scope for application of the theory. DI is a system of itself (Hussain et al. 2010). From an operational perspective, specifically information system service management, it is important that DI be treated as such. However, as infrastructure for a digital business model, DI should be considered as an interconnecting element of the digital business ecosystem. Digital infrastructure is often researched within an organizational setting or within a community of IT professionals. The term digital infrastructure is used interchangeably with information infrastructure, IT infrastructure, and e-infrastructure (Henfridsson and Bygstad 2013).

DI in practice is similar to the concept of network readiness at a country level as evidenced in the Global Information Technology Report of the World Economic Forum (Baller, Dutta, and Lanvin 2016). This annual report provides a Network Readiness Index for 139 countries in relation to four areas: environment (political and regulatory, business, and innovation), readiness (infrastructure, affordability, and skills), usage (individual, business, and government), and impact (economic and social). Notably, this index includes more than infrastructure in the measurement of innovation in the digital economy, highlighting more than infrastructure is needed for innovation and entrepreneurship. Digital divide is an important topic in the measurement of the effectiveness of DI in enabling economic activities (Hilbert 2011; Vicente and Gil-de-Bernabe 2010) but is beyond the scope of this article.

#### 3.1.1 Digital infrastructure and its governance

As the control of the distribution of DI is distributed across multiple actors such as designers, developers, and users, DI is difficult to govern (Henfridsson and Bygstad 2013). The nature of the Internet having an open access and open standards essentially allows anyone to develop and share applications on the Internet (Zittrain 2006). DI is constantly evolving, and it is therefore "a system that is never fully complete and the public and ordinary organizational members can be trusted to invent and share good uses" (Zittrain 2008, p.43). While there are standards among its members, a static set of standards is impossible to attain. Furthermore, the bottom-up nature of DI, but yet the top-down reality of most organizational structure, makes the governance of DI a specific challenge.

# 3.1.2 Digital infrastructure, innovation, and entrepreneurship

As DI is an open system, it allows participants to contribute freely with little boundaries. DI thus becomes an enabler for innovation for individual entrepreneurs as long as they are following standard interfaces (Hanseth and Lyytinen 2010; Zittrain 2006). Because of flexibility and feedback loop capabilities of DI, Internet entrepreneurs in Silicon Valley display new forms of learning by creating paths of innovation, and new innovation path creation leads to new services and products that reinforce DI as a basis for innovative activity (Henfridsson and Bygstad 2013).

# 4 Users

The second foundation pillar of digital ecosystems is users. Users, previously viewed as technologists who directly interact with digital technologies, have morphed to mean anyone who has access to digital technologies (mobile phone) because of ubiquitous computing and the increased ease of use of devices (IOT like fitness wristband). As a result, user-centered innovation proliferates as more users develop new products and services for themselves and other users (Von Hippel 2006). As an open-source based architecture, the Internet was designed to allow users' participation, and the sociotechnological consequence of digitalization allowing everyone to participate in the Web resulted in a volunteering culture. This pro-social behavior is unique in that users are providing free labor in time and effort (writing codes, writing a movie review, rating a restaurant) for their fellow users and organizations (Terranova 2000).

Researchers who focus on customers have for quite some time viewed users as co-creators in the product development process, in the service-dominant marketing process (Vargo and Lusch 2004, 2008), service ecosystems (Lusch and Nambisan 2015), and the entrepreneurial marketing context (Read et al. 2009). Users are labeled citizen-consumers (Webster and Lusch 2013). Users co-create with fellow consumers and firms further add value to the larger social context (Chandler and Vargo 2011; Von Hippel 2006; Webster and Lusch 2013). Essentially, ecosystem value co-creation is possible because of the forces of (1) the generative nature of digital ecosystems, and (2) the service-dominant logic explaining how users can maximize value extracted in user-producer dyads (Autio and Thomas 2016) being at work simultaneously. Furthermore, many of these users turned consumers participate in co-creating new products (e.g., LEGO) with organizations and companies, again collecting no wages, resulting in a class of prosumers who are motivated by a combination of cognitive and affective reasons for utilitarian or hedonic

purposes, resulting in adding value to firms that become part of firms' intellectual capital (Sussan 2012).<sup>10</sup>

#### 4.1 User entrepreneurs

Some of these users in the process of intense interactions with their community accidentally develop new products or services and become user- or accidentalentrepreneurs (Shah and Tripsas 2007). It is welldocumented that the online community is a breeding ground for entrepreneurial actions as users are motivated by the attention they receive from the community to develop new products for fellow users (Autio et al. 2013). In the user-turned entrepreneur cases, they often develop an idea as a user and tap the knowledge and creativity of the community before commercialization (Hussain et al. 2010; Shah and Tripsas 2007). Yahoo is an example.

#### 4.2 Users and business models

The philosophical foundation of users' willingness to share, contribute, volunteer time, and effort in online communities becomes the major game changing element in business models in the digitalization process (Cusumano and Goeldi 2013). In examining the literature, three types of user-intensive business models emerge that revolutionize transaction cost-based business models. First, some multisided platforms businesses rely entirely on user-generated content from the masses voluntarily (e.g., Facebook, Instagram, and Tripadvisor.com). In this model, the core competency of the business is relative to the data the business is able to collect from users, and thus, the revenue of the business is derived from advertising but not selling anything to a customer. In this model, if all the users decide not to volunteer content to the business, there is no business. Second, businesses that rely on users participating in the sharing economy by sharing their own unused tangible asset (Richter et al. 2015) like AirBnB. In this model, the core competency of the business is a multisided platform, and the revenue of the business stems from receiving a percentage of the sharing service. Third, businesses that rely on users'

<sup>&</sup>lt;sup>10</sup> At the end of 2016, Facebook had 1.9 billion active users. Snapchat that went public in 2017 had 158 million users, who spent an average of 30 min each day on the site, with an average of 18 visits per day, creating \$2.5 billon of them are under 25 years of age. Snap IPO tests unsocial network, The Wall Street Journal, March 1, 2017 p. A8.

network externalities with a combination of paid and unpaid users to generate a large enough customer installed base for a paid distributed product or service (e.g., eHarmony.com). The core competency of this type of business remains at the product itself (e.g., in eHarmony.com an algorithm of matching profiles).

#### **5 Entrepreneurial ecosystems**

Ever since the time of Schumpeter, the concepts of entrepreneurship and innovation have been intertwined with economic development. The entrepreneurial ecosystem is also a new way to contextualize the increasingly complex and interdependent social systems being created.<sup>11</sup> Following Acs et al. (2014b p.:479), we define entrepreneurial ecosystems at the socioeconomic level having properties of self-organization, scalability, and sustainability, composed of sub-systems and systems, as "...dynamic institutionally embedded interaction between entrepreneurial attitudes, abilities and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures." Entrepreneurial Ecosystems are complex socioeconomic structures that are brought to life by individual-level-action (Spigel 2015). This action is embedded in multipolar interactions between individual and institutional stakeholders. Much of the knowledge relevant for entrepreneurial action is embedded in ecosystem structures and requires individual-level-action to extract it (Autio and Levie 2015).

Their approach builds on the idea by which individual and institutional factors are combined (Henrekson and Sanandjai 2011). In their empirical specification, they combine biotic (agents) data with abiotic (institutional) components to formulate a system that links institutions and agents through an EE where each biotic and abiotic component is reinforced by the other at the country level. The system includes the stock of institutions and the stock of entrepreneurship organized into sub-systems and systems including a theory as to how they interact through the flows of knowledge (energy) and venture capital (nutrient). The nutrient of the economic ecosystem depends on knowledge, both the stock of knowledge and the flow of new knowledge as outlined in new growth theory (Romer 1990). However, as we have argued, turning knowledge into technology and technology into consumer goods is not automatic (Arrow 1962), and agency is needed to complete the production function and to fill in missing markets. The two foundational pillars—institutions and agents—are the main focus of our discussion of entrepreneurial ecosystems in relation to digital ecosystems.

# 5.1 Institutions

The first fundamental pillar of Entrepreneurial Ecosystems is institutions-the rules of the game. Of particular importance to entrepreneurship are the economic institutions in society such as the structure of property rights and the presence of effective market frameworks (North 1990). Economic institutions are important because they influence the structure of economic incentives. Without property rights, individuals will not have the incentive to invest in physical or human capital or adopt more efficient technologies (Acemoglu and Johnson 2005). Economic institutions are also important because they help to allocate resources to their most efficient uses; they determine who gets profits, revenues, and residual rights of control. When markets were highly restricted and institutions sent the wrong signals, there is little substitution between labor and capital, and technological change is minimal (Weitzman 1970).

Baumol (1990) proposed that countries' institutions create incentives and that the entrepreneurial talent is allocated to activities "with the highest private return, which need not have the highest social returns" (p. 506). Therefore, it is not possible to make inferences about externalities or overall social welfare effects based on generic measures of entrepreneurship. Universal welfare-enhancing outcomes do not automatically follow from entrepreneurial activity; indeed, such activities can generate questionable or undesirable effects. Entrepreneurial talent can be allocated among a range of choices with varying effects from wealth creation to destruction of economic welfare. If the same actor can become engaged in such alternative activities, then the mechanism through which talent is allocated has important implications for economic outcomes, and the quality of this mechanism is the key criterion in evaluating a given set of institutions with respect to growth. We follow many others, for example Hayek (1945) and Ofer (1987), in proposing that the answer rests upon the institutional

<sup>&</sup>lt;sup>11</sup> Acs et al. 2014a; Autio et al. 2012, 2015; Stam 2015; Stam and Spigel 2015.

system and the incentives that it creates for agents (Estrin et al. 2013).

# 5.2 Agents

The second pillar of entrepreneurial ecosystems is agency. A modern synthesis defines the entrepreneur as someone who specializes in taking judgmental decisions about the coordination of scarce resources (Casson 1982). The term "someone" is defined as the individual, and the term "judgmental decisions" are decisions for which no obvious correct procedure exists. Judgment is not the routine application of a standard rule. We may distinguish two types of entrepreneurial activity: at one pole, there is routine entrepreneurship, which is really a type of management, and for the rest of the spectrum, we have Schumpeterian or high-growth entrepreneurship. By routine entrepreneurship, we mean the activities involved in coordinating and executing a wellestablished ongoing concern in which the parts of the production function in use are well-known and that operates in well-established and clearly defined way. This includes what most people in entrepreneurship research study-self-employment, small business, and new or young firms. It is the next restaurant, new garage or hair dresser. It is certainly the case that replicative entrepreneurs can be of great social significance.

By high-impact entrepreneurship, we mean the activities necessary to create an innovative high-growth venture where not all the markets are well-established or clearly defined and in which the relative parts of the production function are not completely known. Innovative entrepreneurs ensure that utilization of invention contributes to increased productivity and facilitates and contributes to economic growth. The gap filling and input completing capacities are the unique characteristics of the entrepreneur. High-impact entrepreneurship is not a precise term, and by it, we imply no aspect of size of the new venture. However, it does involve an act of creativity whether it is about creating a Unicom or an app that fits on a Unicom's platform (Leibenstein 1968).

# **6** Conceptual framework

The digital entrepreneurial ecosystem (DEE) integrates two existing ecosystem literatures: the

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entrepreneurial ecosystem with its focus on agency and the role of institutions and the digital ecosystem with its focus on digital infrastructure and users. Figure 1 shows the relationship between the EE and the DE and the DEE a subset of the two larger and more complex systems. Both of these complex ecosystems cover much more ground than is needed for the DEE. For example, the entrepreneurial ecosystem includes both Schumpetrian (1934) and Kirznarian (Kirzner 1973) entrepreneurs, radical and incremental innovation as well as digital and nondigital technologies.

Similarly, the digital ecosystem includes many technologies that power the digital infrastructure of our conceptual model: more powerful chips; the Internet; the World Wide Web; broadband communications; programming languages; and operating systems, the cloud. The nature of the Internet having an open access and open standards essentially allows anyone to develop and share applications on the Internet. DI is constantly evolving, and it is therefore a system that is never fully complete. The system also includes many different types of users and co-creators of the system, as well as issues of governance. The technology itself comes from the research carried out by corporations, universities, and governments.

The intersection that we are interested in is the space where agents and users interact on multisided platforms created by Schumpeterian entrepreneurs using a broad array of digital and other technologies. Therefore, 0 < x < 1, where x is the DEE. The size of DEE depends on, and is dependent on, the *adoption, absorption, and diffusion* of digital technologies. Digital technologies have diffused faster than electricity, telephones, and mobile phones. Smartphones have reached a 40% diffusion rate in only 10 years, while it took electricity almost



Fig. 1 The integration of two ecosystems

40 years to reach a 10% diffusion rate.<sup>12</sup> Digital technology diffusion has been growing rapidly over the years and is expected to continue to expand from around 8% of GDP in 2015 to around 25% by 2030.<sup>13</sup> This space is occupied by many of the Unicorns that are matchmaker firms using digital technologies. The core competencies of these companies are their ability to match one group of customers with another group of customers by reducing the transactions cost of a match.

Figure 2 develops a universal conceptual framework and identifies the role of the living and nonliving components of an entrepreneurial ecosystem in the digital economy. The following  $2 \times 2$  diagram depicts the two dominant components—digital ecosystems and entrepreneurial ecosystems. The four quadrants of the framework from bottom left to right are digital infrastructure governance (DIG), digital user citizenship (DUC), digital entrepreneurship (DE), and digital marketplace (DM). We define DEE as follows: the DEE is the matching of digital customers (users and agents) on platforms in digital space through the creative use of digital ecosystem governance and business ecosystem management to create matchmaker value and social utility by reducing transactions cost.

Four qualifications follow our definition: first, there are two routes for entrepreneurs who have ICT skills to be digital entrepreneurs: to work within the existing digital infrastructure or create a new digital infrastructure by developing new platforms or systems. The digital entrepreneurial ecosystem approach view agents who are innovative (Acs and Audretsch 1988) and who are creative (Florida 2004) that optimize the utilization and reconfiguration of digital infrastructure in the form of new systems, new platforms, and new networks as exogenous to the model. These Schumpeterian entrepreneurs create the multisided platforms that users and agents populate. However, as Kirzner (1973, p. 81, emphasis original) points out, "... the function of the entrepreneur consists not of shifting the curves of costs or of revenues which face him, but of noticing that they have in fact shifted." Therefore, our focus is on Kirznarian entrepreneurs and not Schumpeterian entrepreneurs. Second, the digital marketplace includes all aspects of user and agent outcomes: social network-based businesses, e-commerce, e-health,



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Fig. 2 Conceptual framework of the digital entrepreneurship ecosystem

e-education, and e-government. Third, the existence of agents (entrepreneurs) and users (people using the Internet) creates a dynamic whereby companies need to develop business models that integrates millions of customers. It is only through this integration that digital business comes to life. The integration of users who do not buy anything but provide data to companies that in turn sell advertising space (Facebook) is one aspect of this interaction that exists in the digital marketplace. Fourth, the outcome of the digital entrepreneurial ecosystem is a sustainable ecosystem.

The four quadrants in Fig. 2 are interrelated in order for DEE to function and sustain. By sustainability, we mean an ecosystem continuously allowing the birth of new digital entrepreneurs to disrupt existing digital entrepreneurs. One route to sustainability is by making sure successful digital entrepreneurs are not to monopolize the digital marketplace (Read 2016). Because of the nature of the governance of digital infrastructure is open to all participants (Zittrain 2006, 2008), we argue that it is easier for digital entrepreneurs to participate in and possibly change the rule of the game than entrepreneurs who operate in a nondigital environment, and thus, DEE sustainability is highly likely to be possible. New digital entrepreneurs' participation in digital infrastructure governance happens simultaneously as they leverage digital technologies and infrastructure to create new businesses. Often digital entrepreneurship runs ahead of governance (e.g., Fintech), and digital entrepreneurs influence the process of the formation of new regulations. Regulations are almost always behind digital entrepreneurial activities (Read 2016). Another route for DEE sustainability is the increasing savviness

<sup>&</sup>lt;sup>12</sup> https://www.hausmanmarketingletter.com/innovation-adoptiondiffusion-age-social-media/

<sup>&</sup>lt;sup>13</sup> European Commission (2017).

of digital users worldwide who continuously become disruptive digital entrepreneurs. We will go into more details of the relationships of each quadrant and how they lead toward sustainable DEE.

# 6.1 Digital infrastructure governance

The first quadrant DIG addresses the coordination and governance needed in order to establish a set of shared technological standards that are related to entrepreneurial activities. In other words, the legitimization of digital infrastructure as viewed from the perspective of the entrepreneurial ecosystems. There are two routes to legitimacy in the entrepreneurial ecosystems: follow the established rules or create new rules via the manipulation of meanings, instrumentality, and regulation (Autio and Thomas 2016). Extending this, we suggest legitimacy in DEE also functions similarly. As many digital entrepreneurs and their business models are ahead of the regulators (e.g., sharing economy-based AirBnB, Lending Club), they are essentially forcing the creation of new rules (Read 2016). However, regulations are tricky as too many will stiffen innovation, particularly in Fintech in the UK (Binham 2016) and in the USA (Dexheimer and Hamilton 2016). We suggest that at the beginning of disruptive activities, DIG is likely the most open, transparent, and informal in its process toward legitimacy supporting sustainable DEE; however, when the disruptive activities reach a certain momentum, the legitimacy process will become less open, less transparent, and more formal, leading to the relationship between DIG and DEE as one that exhibits an inverted Ushape eventually with too much standardization and legitimization that will negatively impact sustainable DEE. More formally, we propose:

**Proposition 1** As digital infrastructure is decentralized and open and its governance tends to be subject to bottom-up discourse in the shaping of standards and legitimization, DIG has a positive impact on a sustainable DEE. However, the bottom-up standardization and legitimization in DIG will reach a tipping point being effectively and positively able to impact a sustainable DEE. As a result, the relationship between DIG and DEE is one of an inverted U-shape curve. Sussan and Acs

#### 6.2 Digital user citizenship

The second quadrant DUC represents the combination of users and institutions within the context of both ecosystems. As institution represents "the rules of the game", both formal and informal, this quadrant therefore addresses the explicit legitimization and implicit social norms that enable users to participate in digital society, simultaneously the participation is congruent to and supportive of entrepreneurial activities. In other words, it is the legal and social contract users formally and informally agree to in their participation in the digital environment that is related to the entrepreneurial ecosystems. Digital citizenship is a familiar terminology that simply means the ability to participate in society online (Mossberger et al. 2007). Online participation consists of many activities ranging from writing a movie review (Sussan et al. 2006) to becoming an activist. No matter what the activities, users (without nation-state restraint) have to have ICT know-how and be relatively skilled in their competent and standard use of digital technologies in order to participate and engage in acceptable conduct or etiquette consistent with the notion of digital citizenship (de Moraes and de Andrade 2015). Apart from skillset, as digital citizens continuously contribute content online, leaving digital footprint resulting in a permanent record in bytes, the issue of intellectual property, privacy, and surveillance become increasingly important (Rice and Sussan 2016) and particularly relevant to entrepreneurial activities.

There are three direct impact of DUC to a sustainable DEE. First, as user-turned digital entrepreneurs are proliferating, the higher the skillsets and contribution of digital users, the larger the pool of potential new digital entrepreneurs who are the main actors of a sustainable DEE. The second direct impact of DUC to a sustainable DEE is the more educated and the more participatory of digital users, the larger the customer base for digital entrepreneurs to be able to fill their platforms which is a key component in a DEE. Third and perhaps the most important is the more DUC involvement, the more likelihood users will be able to co-create with fellow users, vendors, and the like to add value to the chain of activities in DEE. DUC thus has a linear relationship with the sustainability of DEE. More formally, we propose the following:

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*Proposition 2a* As users engage in discourse with other users online in a wide range of activities, a highly voluntary participatory and empowered DUC will lead to more user-turned digital entrepreneurs, larger customer-base, and more value co-creation which in turn will positively impact a sustainable DEE.

The relationship of DUC and DEE however is moderated by DIG. For instance, how willingly users participate (i.e., in the form of value co-creation or user-turned entrepreneur) in activities in the DEE is subject to the governance of digital infrastructure. A society that has overpowering and hierarchical institutions will unlikely welcome users to participate in its process of new regulations formation regarding the digital economy, as a result, DIG in such a society will likely decrease DUC's positive impact on sustainable DEE. On the contrary, a society with an open institution will more likely encourage users' participation and users' feedback in new regulations formation regarding the digital economy, as a result, DIG in such a society will likely augment DUC's positive impact on a sustainable DEE. We propose:

*Proposition 2b* The more (less) open the DIG, the more (less) engagement in DUC leading to a more (less) sustainable DEE.

# 6.3 Digital marketplace

The third quadrant DM represents the combination of users and agents within the context of both ecosystems. Viewing agents who are both opportunistic and have the capability for conscious foresight (Williamson 2000), this quadrant addresses value creation in the form of a new product or service or new knowledge that are the result of entrepreneurial activities and users participation. Value created and captured in DM includes entrepreneurial activities which take place in for-profit, nonprofit, and government settings, and the results of these entrepreneurial activities are embraced by users. As such, e-government, e-transport, e-education, e-commerce, and e-social networking-based businesses— Facebook, Uber, Yelp, eHarmony, Wikipedia, and others—are value addressed in this quadrant.

DM is the key to a sustainable DEE. Continuous value co-creation between entrepreneur agents and users in DM is one main route to a sustainable DEE. As users continuously generate content and provide free labor, time, and effort to interact with and stay engaged with

other for-profit, nonprofit, and government user entities, their pro-social behavior and efforts will directly and indirectly enable entrepreneurial activities. In such a situation, entrepreneurs will optimize opportunity recognition and exploit opportunities stemming from users' participation, and at the same time, users embrace such opportunity exploitation that will allow for entrepreneurial activities. We propose:

*Proposition 3a* A DM that relies more on value cocreation between users and agents will have a more positive impact on a sustainable DEE.

Value co-creation that takes place in a DM leading to a sustainable DEE hinges on a highly skilled and participatory user population. For a digital marketplace, customer base is fluid and needs to be evolved to keep up with the fast-paced new digital offers. Evolvement of user base can be attained through the addition of new users, highly adaptive users, and increasing involvement of existing users. In essence, DUC moderates DM relationship with DEE. More formally, we propose.

*Proposition 3b* As value co-creation in DM relies on users' ability to participate, DUC thus moderates DM positive impact on sustainable DEE.

The relationship between DM and DUC is two-way interactive. While DUC increases value co-creation in DM, DM also influences DUC. How a DM is being set up impacts users' ability to co-create. Many egovernment platforms are mere top-down information rich websites with limited feedback mechanism. Even if a digital user citizen wishes to add value, they cannot. These e-government DM seeks efficiency in answering citizens' problems but not to extract potential value users create. Contrarily, Facebook's business model relies almost entirely on users providing content, and it provides a mechanism to encourage users create value. We thus propose the following relationship between DUC and DM:

*Proposition 3c* There is a two-way interaction between DUC and DM with the more engagement and participation in DUC, the more vibrant the DM and vice versa.

As evidenced in the cases of Yahoo and Google, accumulated disruptive new digital businesses within an industry call for the drafting of new regulations (Read 2016). We suggest that as the stronger the emergence of a DM in an industry, the more likely it will have influence on DIG. This leads to: *Proposition 3d* The more important the DM, the more influence it will have on DIG.

# 6.4 Digital entrepreneurship

The last quadrant DE is the combination of digital infrastructure and entrepreneurial agents within the context of both ecosystems. First, digital entrepreneurship in this quadrant includes any agent that is engaged in any sort of venture be it commercial, social, government, or corporate that uses digital technologies. In other words, the focus is on digital venturing across all social, economic, and political activities. However, we view digital entrepreneurs here as Kirznarian entrepreneurship that operate within the confines of existing platforms. In other words, they are performing activities that need digital engagement but may not in themselves be digital, for example, an Uber taxi driver. The agent leverages digital technology and seeks and acts on these opportunities within the marketplace in effect increasing efficiency by moving the economy closer to the technological frontier.

Based on the examples of Yahoo and Google, Read (2016) proposed that entrepreneurial actions simultaneously create and destroy noncompetitive monopolistic situation over time, as did Yahoo dominated the market in 2000 and then Google in 2009 emerged in the near monopolistic position. Such fast displacement of market dominance is unique in the digital economy as digital infrastructure is generative. Extending this line of argument coupled with an entrepreneur-centrality view (i.e., a network of entrepreneurs are the ones who leverage infrastructure and propose value to customers), we suggest that in the digital economy, DE continues with agents' ambitious attitude toward engaging in risktaking activities to innovate or utilize existing technologies and digital infrastructure and propose value to digital users. The impact of DE on a sustainable DEE is based on the mechanism of the continuous flow of new DE enabled by the notion that entrepreneurial activities simultaneous creates and destroys noncompetitive monopolistic situation. Therefore, we propose:

*Proposition 4a* The more DE, the more sustainable the DEE.

However, we know that not all DE become viable business models. Examples of earlier dot com failures are plenty (e.g., Peapods). The idea of "you build them, they would come" turned out to be "you build them, but

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they won't come". The web 2.0 and social web elicited the importance of the accumulation of user base for DE. This leads to our argument that for DE to positively impact sustainable DEE, active users' participation or DUC is vital. In fact, DUC is possibly a mediator from the path from DE to DEE. We propose the following:

*Proposition 4b* For DE to be able to continuously contribute to a sustainable DEE, the presence of an active and participatory DUC is necessary.

DE also needs the support of an open DIG to allow entrepreneurs to translate their ideas into action. An open, transparent, and entrepreneur-friendly institutional environment will encourage new entrepreneurs to enter the market. This leads to our proposed relationship between DE and DIG:

Proposition 4c The more open DIG, the more DE.

# 7 Matchmakers

In the digital marketplace, we find e-government, etransport, e-education, e-commerce, and e-social networking-based businesses. However, not all of these entities in the digital marketplace have the same business model. In fact, some of it is just securing services via the Internet and not in person, like renewing your driver's license online. We motivated this paper with a discussion of the growth of a new type of company, the Unicorn, which is disrupting existing businesses while creating billions of dollars in wealth. These multisided platforms are companies that operate in virtual space to help two or more different groups find each other and interact (Evans and Schmalensee 2016). They rely on digital technology and match users and agents. While we hinted at the importance of value creation by digital business, we never laid out the process of how this new business type operates in the digital entrepreneurial ecosystem. To that task we now turn.

#### 7.1 Multisided platforms

The platform age is upon us because of the development of powerful information and communication technologies that have lowered the cost and increased the reach of connecting platform sides (Acs et al. 2002). According to Evans and Schmalensee (2016), six new and rapidly improving technologies have driven matchmaker innovation by reducing the cost, increasing the speed, and expanding the scope of connections between platform sides. Six technologies help power the digital infrastructure in our conceptual model: more powerful chips; the Internet; the World Wide Web; broadband communications; programming languages; and operating systems, the cloud. Combined with the institutional structure that sets the rules for digital usage gives us digital infrastructure governance.<sup>14</sup> A well-functioning digital infrastructure makes it possible for digital business to attract users and agents to multisided platforms.

These businesses (Open Table, Facebook, Visa, Uber, and AirB&B) among others are matchmakers. A matchmaker business helps two or more different kinds of customers find each other and engage in mutual beneficial interactions: a dating service, a restaurant and dinners, taxis and riders, friends and friends, renters, and apartments (Armstrong 2006; Evans and Schmalensee 2016; Katz and Shapiro 1985). Matchmaker businesses are as old as human kind. What is new is digital technology that lowers the transactions cost of "making a match" from some large number to fractions of a penny. In transactions, cost economics firms exist to reduce transaction costs by internalizing the activities in an organization. In multisided markets, the transaction costs are reduced without taking the activities into the firm. Uber drivers and Uber riders carry out their activities in the market facilitated by a multisided platform (Coase 1937). In 2004, Jean-Charles Rochet and Jean Tirole published a paper, "Platform Competition in Two-sided Markets," that built a model of platform competition. It unveiled the determinants of price allocation and end user surplus for different governance structures. Economists call these businesses multisided platforms, because some of them actually facilitate interactions between more than two or more types of consumers.

Let us assume a simple model with sides A and B, where side A is the product supplier and side B is the end user. Let us also assume three business models, a single product platform, a reseller, and a multisided platform. A single product platform business starts with a product platform, buy inputs of various sorts from suppliers, transforming them into finished products for customers (Rong and Shi 2015). A product platform sells essential inputs to side A. Then side A sells the final product to side B. A reseller buys goods from side A and sells them to side B. An ordinary business main focus in attracting customers on side B and selling to them on profitable terms, however, they never connect side A with side B. Multisided platforms, in contrast, need to attract two or more types of customers' side A and side B (agents and users, users and users, and agents and agents) by enabling them to directly interact or transact with each other on attractive terms. Matchmakers are called multisided platforms because they usually operate a physical or virtual place that helps the different sides A and side B get together.<sup>15</sup> The multisided platform is affiliated with both sides A and B, and sides A and B are connected by the multisided platform. An important feature of most multisided platforms is that the value to customers on one side of a platform typically increases with the number of participating customers on the other side. This is known as the presence of indirect network effects.<sup>16</sup>

For a business to create a multisided platform, it needs to sign up millions of customers. Platform owners or sponsors in these industries must address the celebrated "chicken-and-egg problem" and be careful to "get both sides on board (Caillaud and Jullien 2003)." A pioneering platform is a multisided platform that is the first, or one of the first, to identify a friction and create a matchmaker to attempt to solve that friction. The pioneering platform usually is the first to solve the pricing, chicken-and-egg, necessary to ignite a platform. How do you price in a twosided market? Matchmakers face many more complex pricing problems than traditional businesses, because they must balance the interests of all sides in order to get all sides on board the platform and keep them on board and to get members of each group to interact with members of the other group (Evans and Schmalensee 2016, p. 32).

Once economist recognized multisided platforms, they started to look at how they priced. In fact, many of them charged the participants on one side of the platform prices that do not cover costs, charge nothing, or provide rewards for using the products. For example, video game console users pay marginal cost or less for consoles; credit card users do not pay for transactions and sometimes get rewards; search engines do not charge for searches; in nightclubs, women sometimes get in for free or get below-cost drinks.<sup>17</sup>

<sup>&</sup>lt;sup>14</sup> https://chillingcompetition.com/2016/08/29/competition-and-regulation-in-digital-markets/

<sup>&</sup>lt;sup>15</sup> https://hbr.org/2016/05/what-platforms-do-differently-thantraditional-businesses

<sup>&</sup>lt;sup>16</sup> http://sloanreview.mit.edu/article/strategic-decisions-formultisided-platforms/

https://hbr.org/2013/01/three-elements-of-a-successful-platform

# 7.2 Platform performance

A matchmaker business is one of the toughest business challenges, and almost everyone who tries to build one fails. In June 2007, Apple decided to manage its ecosystem to improve platform performance. Apple announced that it would allow the development of apps for the iPhone by third parties. The company released its software development kit in March 2008 and lunched its App Store in July 2008. Developers could only get their apps to users through Apple's App Store, and Apple got to decide whether to make an app available. It developed strict standards and processes for testing and reviewing apps. A year after its launch, iPhone was a two-sided platform connecting smartphone users and digital entrepreneurs in the digital marketplace (Ibid, p. 117). A similar process was followed by Google for Android phones. It turned out that third-party apps were important for getting users interested in both new smartphones: Android and Apple. The use of the smartphone installed base exploded after 2008, and by 2015, it had over three million users and thousands of apps. Americans spend 71% of their time with apps when using their smartphones (Ibid, p. 117). In 2015, Apple has the highest market cap of any in the world, at \$665 billion, and Google the second highest at \$527 billion.<sup>18</sup>

Both Apple and Google had to manage their ecosystem to succeed. They created foundational platforms that are a multisided platform that provides core services to other multisided platforms and is therefore a "platform of platforms" (Ibid, 208). IOS, Windows, and Blackberry did not do a good job of managing their ecosystems, and they never took off. From Apple's perspective, the ecosystem was the businesses, institutions, and other environmental factors that affected the value, positively or negatively, that a platform can generate for the participants of the platform. This is the internal or value added view of the ecosystem, and it is not bounded by time or space (Moore 1993). The entrepreneurial ecosystem is an external macroecosystem of community efforts around startup ecosystems to support development (Mathews and Brueggemann 2015). In both cases, the goal is performance. In the business ecosystem, the goal of the ecosystem is to increase the value of the platform. In the digital entrepreneurial ecosystem, the goal of the ecosystem is to improve the performance of the economy (Stam 2015). How to manage the digital entrepreneurial ecosystem to improve economic performance for a region is an active research area for firms, individuals, and regions (Terjesen et al. 2017).

#### 7.3 Platform competition

From both positive and normative viewpoints, twosided markets differ from the textbook treatment of multi product oligopoly or monopoly. The interaction between the two sides gives rise to strong complementarities, but the corresponding externalities are not internalized by end users, unlike in the multiproduct literature (Rochet and Tirole 2004). "The notion of competition changes dramatically with platforms. Today, Ford doesn't simply have to worry about competing with Apple or Google, it has to also figure out how to participate in Apple's ecosystem in some way so as not to be left behind like Nokia and Blackberry. Strategic considerations on recognizing competition and their key source of competitive advantage aren't straightforward anymore. We've seen this with how Android has had to repeatedly stave off competition from members of its own ecosystem, like Samsung and Amazon.".<sup>19</sup>

# 8 Research agenda

The conceptual framework for a digital entrepreneurial ecosystem-digital infrastructure governance, digital user citizenship, digital marketplace, and digital entrepreneurship-results in a set of propositions. These propositions provide guidance for a rich research agenda. First, entrepreneurship research in the digital economy needs to be expanded to include literature from other disciplines such as economics, political science, marketing, and information systems. Referencing political science literature provides the knowledge necessary to understand the nuances of digital infrastructure governance and digital user citizenship and their importance in the digital entrepreneurial ecosystems. Extant literature in digital marketing and online consumer behavior provide entrepreneurship researchers with new lenses for investigating the inner workings of consumer psychology and social psychology (consumer-to-consumer interactions as intellectual capital for a firm, see Sussan

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<sup>&</sup>lt;sup>18</sup> According to Bloomberg as of November 20, 2015.

<sup>&</sup>lt;sup>19</sup> http://platformed.info/the-future-of-competition/

2012) that motivate consumers. As a result, value created by interactions between consumers and agents allow digital entrepreneurs to capture such value in the digital marketplace. Research from management information systems literature illuminates the background necessary to understand how a system of digital technologies and infrastructure can serve as the germinating bed for digital entrepreneurs.

Second, entrepreneurship research should focus more on the digital economy toward understanding high impact, high potential, and high-growth business that is scalable and creates value using digital technologies. Many of these firms are matchmakers. Research from economics on multisided platforms should be studied and see how entrepreneurship fits into this new organization structure.

Third, while digital technologies are global, the creation of digital companies remains local. Therefore, the research agenda for understanding the digital entrepreneurial ecosystem should continue to investigate clusters, regional, as well as country comparisons. The impact of culture, legal systems, and economic development on digital infrastructure governance, digital user citizenship, digital entrepreneurship, and digital marketplace are particularly important areas that need investigation.

Fourth, while an ecosystem, entrepreneurial, or otherwise is a robust, self-organizing, and scalable architecture that can automatically solve complex dynamic problems, then what constitutes ecosystem management? What actors should be allowed to intervene? Should intervention take place at the system and/or subsystem level? A managerial approach to understanding the digital entrepreneurial ecosystem is an area that needs urgent attention.

Fifth, given that the digital marketplace has tilted in favor of empowered consumers (Rippé et al. 2015), digital entrepreneurial research needs to investigate the inner workings of the users' decision-making process, from both internal and external influences, in order to understand how entrepreneurial agents can spot such opportunities and extract and capture value from users. Understanding consumers' psychology and social psychology are thus important in digital economy. This importance aligns with prior call for more social psychology-based research in entrepreneurship (Shaver 2003).

Finally, given that the concept of digital entrepreneurship ecosystems introduced here is a multifaceted phenomenon that spans interdisciplinary knowledge, a range of research methods will be suitable to address this phenomenon. Empirical work that describes the interactions of the quadrants in the framework is particularly important. A more detailed list of research agenda is depicted in Table 1.

# 9 Conclusion

This article addresses the lack of digital economy specific research in the entrepreneurship literature. In filling such a gap, we propose a digital entrepreneurship ecosystem framework by way of integrating knowledge from management information systems and marketing. In this  $2 \times 2$  framework, we derived propositions and related research agenda to guide future research in this important topic.

This article thus adds value to entrepreneurship research in (1) situating entrepreneurship research within digital economy, (2) promoting the use of other business sub-disciplines within entrepreneurial research, (3) broadening entrepreneurial ecosystem research to another more established ecosystem research-digital ecosystem, (4) elevating digital entrepreneurs as the center of the digital economy, and (5) integrating a consumerand user-centric approach and extending the dyads of institution-agency into a triangle of institution-agencyconsumer (user) in entrepreneurial ecosystem. Our new conceptual framework of digital entrepreneurship ecosystem sheds new light on policy issues in terms of the complexity of digital infrastructure governance and its relationship with digital entrepreneurs, digital users, and digital marketplace. A socially embedded open digital governance structure raises many new questions relative to the balance of power among many stakeholders (e.g., users, entrepreneurs, industry incumbents, and regulators) whose motivation to participate in the ecosystem differs drastically. The digital user citizenship concept within the digital entrepreneurship ecosystem is also an important one to stimulate policy makers in education to re-think what digital skillsets need to be promoted in order to link skills to entrepreneurship in the digital economy.

The many research agendas suggested here also reflect that while this article has proposed a novel and important concept, it is not without limitations. As we conceptualize digital entrepreneurship, we had not considered the characteristics of the agents as compared to

Table 1 Researc	h agenda for digital entrepreneurship ecosystems		
Quadrants	Description	Propositions	Research agenda (some examples)
Digital infrastructure governance	The coordination and governance needed in order to establish a set of shared technological standards that are related to entrepreneurial activities.	I As digital infrastructure is decentralized and open and its governance tends to be subject to bottom-up dis- course in the shaping of standards and legitimizaiton, DIG has a positive impact on a sustainable DEE. However, the bottom-up standardization and legitimi- zation in DIG will reach a tipping point being effec- tively and positively able to to impact a sustainable DEE. As a result, the relationship between DIG and DEE is one of an inverted U-shaped curve.	<ul> <li>A typology of digital infrastructure governance based on formal vs. informal process and open vs. closed process within the context of digital entrepreneurship ecosystem.</li> <li>Identify barriers digital entrepreneurs face in influencing the process of digital entrepreneurs face in influencing the process of digital entrepreneurs activities that manipulate or disrupt the process of digital linfrastructure governance?</li> <li>Conceptualize the balance of power among various actors (digital entrepreneurs, incumbent industry leaders, government organization, trade organizations, and users) in digital infrastructure governance formation</li> <li>The role of digital entrepreneurs in matters such as digital privacy and digital entrepreneurs in matters and users) in digital infrastructure governance</li> </ul>
Digital user citizenship	The legal and social contract users formally and informally agree to in their participation in digital environment that is related to the entrepreneurial ecosystems.	2a As users engage in discourse with other users online in a wide range of activities, a highly voluntary participatory and empowered DUC will lead to more user-turned digital entrepreneurs, larger customer- based, and more value co-creation which in turn will positively impact a sustainable DEE.2b The more (less) open the DIG, the more (less) en- gagement in DUC leading to a more (less) sustainable DEE.	<ul> <li>Define a spectrum of voluntarism and the various dimensions of self-governed (e.g., ctiquette), self-monitored (e.g., digital privacy), and self-controlled behavior among digital user citizens and their roles in the digital entrepreneurial ecosystem.</li> <li>Empirical evidence of digital user citizen engagement and their impact on digital user citizen engagement e.g., users influence in the formation of digital privacy law, digital security, and industry standards.</li> <li>A typology of digital user citizens participation in the digital markeplace.</li> </ul>
Digital marketplace	Value creation in the form of a new product or service or new knowledge that are the results of entrepreneurial activities and users participation.	<ul> <li>3a A DM that relies more on value co-creation between users and agents will have a more positive impact on a sustainable DEE.</li> <li>3b As value co-creation in DM relies on users' ability to participate, DUC thus moderates DM positive impact on sustainable DEE.</li> <li>3c There is a two-way interaction between DUC and DM with the more engagement and participation in DUC the more vibrand the DM, the more influence it will have on DIG.</li> </ul>	<ul> <li>Conceptualize the alignment necessary for digital user citizzenship and digital entrepreneurship to an optimal digital marketplace</li> <li>A typology of the scenarios of balance and imbalance of power of digital user citizzenship and digital entrepreneurship and the result of such digital entrepreneurship and the result of such digital marketplace</li> <li>Empirical evidence of the relationship between vibrant digital marketplace and digital entrepreneurship exoting the evidence of the relationship between vibrant digital marketplace and digital entrepreneurship resulting in sustainable digital entrepreneural ecosystem</li> </ul>

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Table I (conun	led)		
Quadrants	Description	Propositions	Research agenda (some examples)
			<ul> <li>Empirical evidence of digital marketplace (e.g., Google and Facebook) influencing digital infrastructure governance (e.g., digital privacy and net neutrality) and/or digital user citizenship (e.g., digital skills).</li> </ul>
Digital entrepreneur- ship	Entrepreneurial activities that optimize the utilization and reconfiguration of digital infrastructure in the form of new systems, new platforms, and new networks.	<ul><li>4a The more DE, the more sustainable the DEE.</li><li>4b For DE to be able to continuously contribute to a sustainable DEE, the presence of an active and participatory DUC is necessary.</li><li>4c The more open DIG, the more DE.</li></ul>	<ul> <li>Empirical evidence of digital entrepreneurs who freely interact with digital infrastructure and the results of such interactions</li> <li>Conceptual and empirical model of the moderation and interaction effect of digital governance and digital user</li> </ul>
			citizenship on the path from digital entrepreneurship to

digital marketplace

those who are not in the digital environment. Further research that examines their difference in risk-taking, opportunistic, and other psychological attitudes and behavior from agents who are not from the digital environment is encouraged. When we introduce digital user citizenship, we have not addressed or discussed the indepth digital skills that are necessary to prepare for different types of digital marketplaces. A more detailed investigation of various levels of users' digital skills and their relationship to various types of markets will be an important area of research to inform how digital entrepreneurs can leverage these users' skills to develop a successful business model.

DE, digital ecosystem; DE, digital entrepreneurship; DEE, digital entrepreneurial ecosystem; DI, digital infrastructure; DIG, digital infrastructure governance; DM, digital marketplace; DUC, digital user citizenship; EE, entrepreneurial ecosystem; ICT, information and communication technologies; IT, information technology; NSI, National Systems of Innovation.

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# References

- Acemoglu, D., & Johnson, S. (2005). Unbundling institutions. Journal of PoliticalEconomy, 113(5), 949–995.
- Acs, Z. J., Astebro, T., Audretsch, D., & Robinson, D. T. (2016). Public policy to promote entrepreneurship: a call to arms. *Small Business Economics*, 47(1), 35–52.
- Acs, Z. J., & Audretsch, D. B. (1988). Innovation in large and small firms: An empirical analysis. *American Economic Review*, 78, 678–690.
- Acs, Z. J., Autio, E., & Szerb, L. (2014a). National systems of entrepreneurship: measurement issues and policy implications. *Research Policy*, 43(1), 476–494.
- Acs, Z. J., de Groot., & Nijkamp, P. (2002). The emergence of the knowledge economy: a regional perspective. *Spring*, 2002.
- Acs, Z. J., Estrin, S., Mickiewicz, T., & Szerb, L. (2017). Institutions, entrepreneurship and growth: the role of national entrepreneurial ecosystems, SSRN, https://papers.Ssrn. Com/sol3/papers2.Cfm?abstract\_id=2912453 January 2017.
- Acs, Z. J., Szerb L., & Autio, E. (2014b). Global entrepreneruship index, The GEDI Institute, Amazon, LLC.
- Aghion, P. (2017). Entrepreneurship and growth: lessons from an intellectual journey. Small Business Economics, 48(1), 9-24.

- Armstrong, M. (2006). Competition in two-sided markets. RAND Journal of Economics, 37(3), 668–691.
- Arrow, K. J. (1962). Economic welfare and the allocation of resources for invention. In R. R. Nelson (Ed.), *The rate and direction of inventive activity* (pp. 609–626). Princeton University Press: Princeton.
- Autio, E., Cleevely, M., Hart, M., Levie, J., Acs, S. J., & Szerb, L. (2012). Entrerpeneurial profile of the UK in the light of the global entrepreneurship and development index. London: Imperial College Business School.
- Autio, E., Dahlander, L., & Frederiksen, L. (2013). Information exposure, opportunity evaluation, and entrepreneurial action: an investigation of an online user community. Academy of Management Journal, 56(5), 1348–1371.
- Autio, E., Kenny, M., Mustar, P., Siegel, D. S., & Wright, M. (2015). Entrepreneurial innovation: the imortance of context. *Research Policy*, 43, 1097–1108.
- Autio, E., & Levie. (2015). Management of entrepreneurial ecosystems. London: Imperial College Business School.
- Autio, E., & Thomas, L. (2016). Tilting the playing field: Towards an endogenous strategic action theory of ecosystem creation. Forthcoming in. In S. Nambisan (Ed.), Open Innovation, Innovation Ecosystems, and Entrepreneurship: Multidisciplinary Perspectives. New Jersey: World Scientific Publishing.
- Baller, S., Dutta, S., & Lanvin, B. (Eds.). (2016). The global information technology report 2016: innovating in the digital economy. Geneva: World Economic Forum.
- Baumol, W. (1990). Entrepreneurship, Productive, Unproductive and Destructive, Journal of Political Economy.
- Binham, C. (2016). UK regulators are the most fintech friendly. Financial times. Accessed December 30, 2016 https://www. ft.com/content/ff5b0be4-7381-11e6-bf48-b372cdb1043a
- Caillaud, B., & Jullian, B. (2003). Chick and egg: competing matchmakers. RAND Journal of Economics, 34(2), 309–328.
- Casson, M. (1982). The entrepreneur: an economic theory. Lanham, MD: Rowman & Littlefield.
- Chandler, J. D., & Vargo, S. L. (2011). Contextualization and value-in-context: how context frames exchange. *Marketing Theory*, 11(1), 35–49.
- Coad, A., Frankish, J. S., Roberts, R. G., & Storey, D. J. (2016). Predicting new venture survival and growth: does the fog lift? Small Business Economics, 47(1), 217–243.
- Coase, R. (1937). The nature of the firm. *Economica, new series,* 4(16), 386-405.
- Cooks, P., Urangs, M. G., & Etxebarria, G. (1997). Regional innovation systems: institutional and organizational dimensions. *Research Policy*, 26(4–5), 475–491.
- Cusumano, M. A., & Goeldi, A. (2013). New businesses and new business models. In W. H. Dutton (Ed.), *The Oxford handbook of internet studies* (pp. 239–261). Oxford: Oxford University Press.
- Daunfeldt, A. O., & Halvarsso, D. (2015). Are high-growth firms one-hit wonders: evidence from Sweden. Small Business Economics, 44, 361–383.
- de Moraes, J. A., & de Andrade, E. B. (2015). Who are the citizens of the digital citizenship? *International Review of Information Ethics*, 23, 11.
- Dexheimer, E., & Hamilton, J. (2016) The US will regulate some Fintech companies like traditional lenders. Bllomberg. Accessed 12.30.2016 https://www.bloomberg.

com/news/articles/2016-12-02/fintech-firms-get-chance-tobe-regulated-like-wall-street-banks

- Dini, P., Iqani, M., & Mansell, R. (2011). The (im) possibility of interdisciplinary lessons from constructing a theoretical framework for digital ecosystems. *Culture, theory and critique, 52*(1), 3–27.
- Edquist, C. (1997). Systems of innovation: technologies, institutions, and organizations. Psychology Press.
- Estrin, S., Korosteleva, J., & Mickiewicz, T. (2013). Which institutions encourage entrepreneurial growth aspirations? *Journal of Business Venturing*, 28(4), 564-580.
- European Commission, Enterprise and industry directorate-general, "strategic policy forum on digital entrepreneurship", Brussels, 2017.
- Evans, D. S., & Schmalensee, R. (2016). Matchmakers: the new economics of multisided platforms. Boston: Harvard Business Review Press.
- Florida, R. (2004). The rise of the creative class. New York: Basic Books.
- Haefliger, S., Jäger, P., & Von Krogh, G. (2010). Under the radar: industry entry by user entrepreneurs. *Research Policy*, 39(9), 1198–1213.
- Hanseth, O., & Lyytinen, K. (2010). Design theory for dynamic complexity in information infrastructures: the case of building internet. *Journal of Information Technology*, 25(1), 1–19.
- Hayek, F. A. (1945). The use of knowledge in society. The American Economic Review, 519–530.
- Henfridsson, O., & Bygstad, B. (2013). The generative mechanisms of digital infrastructure evolution. *MIS Quarterly*, 37(3), 907–931.
- Henrekson, M., & Sanandjai, T. (2011). The interaction of entrepreneurship and institutions. Journal of Institutional Economics, 7(1), 47-75.
- Hilbert, M. (2011). The end justifies the definition: the manifold outlooks on the digital divide and their practical usefulness for policy-making. *Telecommunications Policy*, 35, 715–736.
- Hussain, A., Wang, H., & Nobakhti, A. (2010). Editorial: advances in complex control systems theory and applications. *IET Control Theory & Applications*, 4(2), 173–175.
- Katz, M., & Shapiro, C. (1985). Network externalities. Competition and Compatibility, American Economic Review, 75, 424–440.
- Kirzner, I. (1973). Competition & entrepreneurship. Chicago: University of Chicago Press.
- Leibenstein, H. (1968). Entrepreneurship and development. American Economic Review, 58, 72-83.
- Li, W., Badr, Y., & Biennier, F. (2012). Digital ecosystems: challenges and prospects. In proceedings of the international conference on management of Emergent Digital EcoSystems (pp. 117–122). ACM.
- Lundvall, B. A. (1992). National systems of innovation: an analytical framework. London: Pinter.
- Lusch, R. F., & Nambisan, S. (2015). Service innovation: a service-dominant logic perspective. *Mis Quarterly*, 39(1), 155–175.
- Mathews, C., & Brueggemann, R. (2015). Innovation and entrepreneurship. New York: Routledge.
- Moore, J. F., (1993). Predators and prey: a new ecology of competition, *Harvard Business Review*, 71 30, 76.
- Moritz, 2015 The fall and rise of technology juggernauts, financial times. Accessed online June 1, 2016 http://www.ft.

Springer

com/cms/s/0/6b859714-99ba-11e5-9228-87e603d47bdc. html#axzz4CiJeVWJm

- Mossberger, K., Tolbert, C. J., & McNeal, R. S. (2007). The internet, society, and participation. Boston: MIT Press.
- Nelson, R. R. (1994). National innovation systems: a comparative analysis. Oxford: Oxford University Press.
- North, D. C. (1990). Institutions, institutional change and economic performance. Cambridge University Press.
- Ofer, G. (1987). Soviet economic growth: 1928-1985. Journal of Economic Literature, 25(4), 1767–1833.
- Parker, S. (2002). The economics of self-employment. Cambridge: Cambridge University Press.
- Porter, M. (1990). *The competitive advantage of nations*. New York: Free Press.
- Porter, M. (1998) Clusters and the new economics of competition. Harvard Business Review 76(6), 77-90.
- Read, S. (2016). Organic or deliberate: a comment on "Applying the ecosystem metaphor to entrepreneurship: uses and abuses". *The Antitrust Bulletin, 61*(4), 574–579.
- Read, S., Dew, N., Sarasvathy, S. D., Song, M., & Wiltbank, R. (2009). Marketing under uncertainty: the logic of an effectual approach. *Journal of Marketing*, 73(3), 1–18.
- Rice, J. C., & Sussan, F. (2016). Digital privacy: a conceptual framework for business. Journal of Payments Strategy & Systems, 10(3), 260–266.
- Richter, C., Kraus, S., & Syrjä, P. (2015). The share economy as a precursor for digital entrepreneurship business models. *International Journal of Entrepreneurship and Small* Business, 25(1), 18-35.
- Rippé, C. B., Weisfeld-Spolter, S., Yurova, Y., & Sussan, F. (2015). Is there a global multichannel consumer? *International Marketing Review*, 32(3/4), 329-349.
- Rochet, J. C., & Tirole, J. (2004). *Defining two-sided markets*. Toulouse, France: mimeo, IDEI.
- Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98(5, Part 2), S71–S102.
- Rong, K., & Shi, Y. (2015). Business ecosystems, New York Sage Publishing.
- Rosenberg, N., & Nelson, R. (1993). Technical innovation and national systems. in R.R. Nelson, National Innovation Systems: A Comparative Analysis, Oxford, pp 3-22
- Salter, A. J., & McKelvey, M. (2016). Evolutionary Analysis of Innovation and Entrepreneurship: Sidney G. Winter-recipient of the 2015 Global award for entrepreneurship research. *Small Business Economics*, 47(1), 1-14.
- Schumpeter, J. [1934 (1911)]. The theory of economic development, Cambridge: Harvard University Press.
- Spigel, B. (2015). The relational organization of entrepreneurial ecosystem. Entrepreneurship Theory and Practice, in press.
- Shah, S. K., & Tripsas, M. (2007). The accidental entrepreneur: the emergent and collective process of user entrepreneurship. *Strategic Entrepreneurship Journal*, 1(1-2), 123–140.
- Shane, S., & Venkatraman, S. (2000). The promise of entrepreneurship as a field of research. Academy of Management Review, 25, 217–226.
- Shaver, K. (2003). The social psychology of entrepreneurial behavior. In Z. J. Acs & D. B. Audretsch (Eds.), Handbook of entrepreneurship research: an interdisciplinary survey and introduction (pp. 331–358). Boston: Kluwer Academic Publishers.

- Stabell, C. B., & Fjeldstad, Ø. D. (1998). Configuring value for competitive advantage: on chains, shops, and networks. *Strategic Management Journal*, 413–437.
- Stam, E. (2015). Entrepreneurial ecosystems and regional policy: a sympathetic critique. European Planning Studies. 1–11.
- Stam, E., & Spigel, B. (2015). Entrepreneurial ecosystems. Chapter for the SAGE Handbook for Entrepreneurship and Small Business.
- Stenholm, P., Acs, Z. J., & Wuebker, R. (2013). Exploring country level institutional arrangements on the rate and type of entrepreneurial activity. *Journal of Business Venturing*, 28(1), 176–193.
- Stone, B. (2017). The upstarts: how Uber, Airbnb, and the killer Companies of the New Silicon Valley are changing the world. Boston: Little Brown.
- Sussan, F. (2012). Consumer interaction as intellectual capital. Journal of Intellectual Capital, 13(1), 81–105.
- Sussan, F., Gould, S., & Weisfeld-Spolter, S. (2006). Location, location, location: the relative roles of virtual location, online word-of-mouth (eWOM) and advertising in the new-product adoption process. NA-Advances in Consumer Research, Volume 33.
- Szerb, L., Acs, Z. J. Ortega-Argilés, R., & Komlosi, E. (2014). The entrepreneurial ecosystem: the regional entrepreneurship and development index (May 30, 2015). Available at SSRN: http://Ssrn.Com/Abstract=2642514 or http://dx.doi. org/10.2139/ssrn.2642514
- Terjesen, S., Acs, Z J., Audretsch, D. B., Hechavarria, D., Stam, E., & White, R. (2017). Entrepreneurial ecosystems: the search for performance, *Small Business Economics*, this issue.
- Terranova, T. (2000). Free labor: Producing culture for the digital economy. Social text, 18(2), 33–58.
- Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Research commentary-digital infrastructures: the missing IS research agenda. *Information Systems Research*, 21(4), 748–759.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1–17.
- Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. Journal of the Academy of Marketing Science, 36(1), 1-10.
- Vicente, M. R., & Gil-de-Bernabé, F. (2010). Assessing the broadband gap: from the penetration divide to the quality divide. *Technological Forecasting and Social Change*, 77, 816–822.
- Von Hippel, E. (2006). Democratizing innovation. Cambridge, MA: MIT Press.
- Webster Jr., F. E., & Lusch, R. F. (2013). Elevating marketing: marketing is dead! Long live marketing! Journal of the Academy of Marketing Science, 41, 389–399.
- Weitzman, M. L. (1970). Soviet postwar economic growth and capital-labor substitution. *The American Economic Review*, 60(4), 676–692.
- Williamson, O. E. (2000). The new institutional economics: taking stock, looking ahead. *Journal of Economic Literature*, 38(3), 595-613.
- Winter, S. G. (2016). 6 in "The Economics that Might Have Been". Small Business Economics, 47(1), 15–34.
- Zittrain, J. L. (2006). The generative internet. Harvard Law Review, 2006, 1974–2040.
- Zittrain, J. (2008). The future of the internet—and how to stop it. New Haven: Yale University Press.

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