



Digital entrepreneurship: An interdisciplinary structured literature review and research agenda



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ABSTRACT

This paper provides a structured literature review of digital entrepreneurship to generate insights into recent developments in the field, critique the research to date, and identify opportunities for future research. We have applied the three aspects of critical research – insight, critique, and transformative redefinition – to analyse and synthesise the literature. We distil the definitions of the key constructs and identify three research development phases corresponding to practice development. Analysis of 133 scholarly articles by discipline, time, methodology, geography and theoretical focus informs that digital entrepreneurship research has been fragmented, divergent and slow to respond to practice. However, the field is now rapidly acquiring legitimacy and an identity, growing rapidly and is becoming more interdisciplinary. We explore how established views of entrepreneurial processes and clusters are being upended in a digital world. In outlining the future of the field, a preponderance of single case study and conceptual articles need to be supplemented with longitudinal, mixed methods, multiple case study and quantitative research. More integrative research, preferably presented as dynamic models, would advance the field. Design and action research output, and collaborations with practitioners will yield practice-driven insights. This paper will facilitate an interdisciplinary dialogue for evidence-informed policy and practice.

1. Introduction

Industries and markets as varied as media, entertainment, advertising, retail, transport, and accommodation have been transformed by business model innovations, such as multi-sided digital marketplaces, social media, e-commerce, and software-as-a-service. This expanding digital economy owes its existence in large part to the entrepreneurial action enabled by digital technologies. In fact, companies that began as digital start-ups – Google, Facebook, Amazon, Alibaba, Dropbox, Uber, AirBNB – are now counted among the world's corporate giants. Indeed, the digital economy is hailed as one of the most significant economic developments since the industrial revolution, and digital entrepreneurship sits squarely at the origins of this revolution (Kraus et al., 2019; Nambisan, 2019; Zhao and Collier, 2016).

Although growing rapidly, academic research in digital entrepreneurship faces some challenges. The field's dynamic terminology is a source of confusion. As trends emerge and fade, we continue to use different terms interchangeably from an emergent vocabulary (Matlay, 2004). For example, 'internet entrepreneurship' at the inception of the field in 2000–2001 led to e- and cyber entrepreneurship around 2004 and now we seem to have settled on to digital entrepreneurship. More

significantly, multiple disciplines are involved in the digital entrepreneurial process: developing software is rooted in information systems (IS), conceptualising business models and formulating strategy are housed in management, while creating new ventures is rooted in entrepreneurship. Indeed, disciplinary boundaries in a rapidly developing field may put up an invisible wall between a scholar and a large part of their literature, leading to a less holistic knowledge base.

Digital entrepreneurship has inherited the fragmented and divergent nature of entrepreneurship and management research (Moroz and Hindle, 2012; Tranfield et al., 2003). There is little clarity or consensus on the scope, nature, and boundaries of the field. For example, the early stages of a start-up are often too fluid and unorganised to frame (Davidsson and Gordon, 2009), the scale of ambition that qualifies a firm to be entrepreneurial rather than small business is unclear (Davidsson and Gordon, 2012; Welter et al., 2017) and models of entrepreneurial process are not in harmony (Moroz and Hindle, 2012). Also, research does not always walk in lockstep with practice - academic research remains largely explanatory in its approach (Dimov, 2016), while prescriptive works, such as the Lean Startup (Blank, 2013), have mostly developed independently. Nevertheless, these challenges of confusing terminology, isolated multidisciplinary

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development, divergent scope and boundaries and less relevance to practice present many scholarly opportunities to integrate the disjointed literature and understand the digital entrepreneurship phenomena anew.

Fortunately, recent research developments provide further opportunities. Drawing on the emergent insights about the nature and characteristics of digital technologies (Kallinikos et al., 2013; Lyytinen et al., 2016; Yoo et al., 2012; Zittrain, 2006), Nambisan, 2017 Yoo et al., 2010 and Nambisan et al. (2017) assert that the inherently editable, re-combinable, re-programmable and generative nature of digital technologies impacts many aspects of innovation and entrepreneurial processes and outcomes. For instance, digital technologies enable founders to build scalable products and services which have the capacity to drive change and consequently growth. This is due to generativity which enables digital technologies to facilitate unprompted actions by large, uncoordinated audiences. Another advantage of digital technologies is the separation of content from the media which imparts flexibility and thereby encourages rapidly experimentation and learning. Further, the fluid and dynamic processes enabled by digital technologies encourage fast iterations in non-linear paths in the entrepreneurial process. And, digital technologies enable a distributed and diffused entrepreneurial agency, which encourages disintermediation and results into an increased emphasis on the eco-system, and not just the new venture team (NVT). In fact, entrepreneurial ecosystems enabled by digital affordances differ from geographic spatial clusters (Autio et al., 2017), and require different entrepreneurial skills (Nambisan and Baron, 2013), innovation processes (Nambisan et al., 2017) and governance structures (Sussan and Acs, 2017). Nambisan, 2017 calls for explicitly theorising the digital technology related concepts and constructs – *digital technology-perspective*, in order to study entrepreneurship phenomena in a digitised world. So, digital technologies are not merely a context in studying entrepreneurship. Rather, the impact of digital technologies forces a review and fresh theorising of entrepreneurship and management theories in a digitised world, thereby opening many research opportunities.

One of the opportunities arising from the challenges and recent developments in the field is to review the academic literature with an interdisciplinary approach to develop a holistic understanding of how the field has developed in the past, how the field is advancing, and what the future opportunities are for research. However, systematic reviews are mostly discipline-specific or context-focused. At one end is Kraus et al., 2019 which reviews 35 recent articles in entrepreneurship journals, and at the other is Steininger (2019) which broadly analyses information technology entrepreneurship over a 50 year timeframe. Quinones et al. (2015) focuses on the emerging economies context. Other reviews and agenda which cast a narrower focus on a particular aspect or context of digital entrepreneurship include a review of software development in start-ups (Paternoster et al., 2014), a digital-technology-focused research agenda that was limited to start-ups engaged in digital technology development rather than its application (Giones and Brem, 2017), digital entrepreneurship in the sharing economy (Richter et al., 2015, 2017), and digital academic entrepreneurship (Rippa and Secundo, 2019). So, extant reviews and agenda-setting articles leave a gap for a holistic, interdisciplinary literature review, updated to include not just digital technology context but also recent developments in the *digital technology-perspective* of entrepreneurship. Therefore, our aim is to produce a holistic, interdisciplinary, updated review and agenda that complements rather than competes with the current reviews.

To achieve this aim, we have employed a structured literature review based on a comprehensive, all-inclusive selection of literature updated to May 2019. Hence, our dataset reflects the recent burgeoning growth in this field. In fact, more than a third of the corpus was published in the last three years. In line with the focus on the policy and practice relevance (Dimov, 2016; Tranfield et al., 2003), our further aim is to not just enhance the knowledge base but also to assist in

evidence-informed decision-making by practitioners, such as government policy-makers, accelerator managers, established company executives, and entrepreneurs. Including multi- and interdisciplinary research as part of the analysis and synthesis provides breadth and depth to critically examine the past and future directions of the field. This approach is implicit in the literature search, classification of literature into primary and secondary datasets, the analysis framework, and the meta-synthesis applied in insights, critique and propositions for the future of the field.

Our aims for this review match the three objectives of critical management research (Alvesson and Deetz, 2000, pp. 17): “insight”, “critique”, and “transformative redefinition”. These three objectives are transformed into three research questions that need to be answered in a structured literature review (Massaro et al., 2016):

- 1) Insight - how is the research on digital entrepreneurship literature developing?
- 2) Critique - what is the focus and critique of the digital entrepreneurship literature?
- 3) Transformative redefinition - what is the future of digital entrepreneurship research?

To answer these research questions, we have structured the rest of this article by first proposing the definitions of key constructs (Section 2). Although we mainly distilled the definitions from the review, the upfront position helps set the research field. Next, we describe the methodology (Section 3) and answer the three research questions in Sections 4, 5 and 6. To answer the first research question, we identify three broad phases of research development and provide further insights on the articles and journals, the disciplines involved and the impact of digital entrepreneurship literature. The second research question is answered by providing the focus and critique of the extant research while highlighting the encouraging progress made more recently. To answer the third research question, we offer propositions to lay out the future of the field with implications on policy and practice. Section 7 presents a conclusion with a summary of our findings.

2. Definitions

We define the key constructs of the field at the current phase of research development. These definitions are nested, so subsequent constructs hold elements defined previously. These definitions are designed to be both generic and distinctive to serve as both a test and an adequate description of the defined construct.

Digital technologies are platforms, infrastructures or artefacts that use the power of computing on a ubiquitous public network. Nambisan, 2017 views an artefact as a component, application, or media content existing as a stand-alone product or service or as part of a platform; a platform as a set of shared digital services to host complementary offerings including artefacts; and infrastructure as digital technology tools and systems that support entrepreneurship. Current examples of artefacts are websites available on the world wide web, smartphone apps, the Internet of Things (IoT) connected devices, such as drones, home automation devices, robots, smart kitchen appliances, and wearables (von Briel et al., 2017). Examples of platforms are Apple iOS, Android, Salesforce or Atlassian developer ecosystems. And examples of infrastructure are cloud computing resources such as Amazon Web Services, social media, 3D printing, web data analytics and artificial intelligence (Rippa and Secundo, 2019). Ubiquitous network access enables network effects – as more users participate, the value of the product or service increases (Amit and Zott, 2001; Chang, 2004).

A digital startup is a firm, or an organisation within an established firm (Shane and Venkataraman, 2000), in its early stages of development and growth (Klotz et al., 2013) in which digital technologies enable at least one component of a business model in a way that is not just functional but vital to the firm. For example, in a business model

framework comprising of four components (Ojala, 2016), a digital technology lies at the heart of the new venture's business model by being implicit in the: 1) product or service; 2) value network – managing customer and partner relationships; 3) value delivery – channels used to deliver the value proposition; and/or 4) revenue model – revenue streams. A digital new venture team (NVT) is a group of people that apply their competencies to digital technologies, industry domains, and business functions such as marketing, sales, product design, software development, etc. (Kollmann et al., 2009) to enact and execute the strategy and operations (Klotz et al., 2013) of a digital startup. Finally, digital entrepreneurship is the process of creating a digital startup as a new business or within an established firm (McMullen and Dimov, 2013). We do not consider age, operating history, the size of the firm, or 'novel usage' of existing technologies, a.k.a. being innovative, carrying a level of uncertainty with a consequently high risk of failure, limited resources, multiple stakeholders with conflicting interests and desire to achieve high growth, or fast scaling by an NVT because "such boundary conditions tend to be context-specific and range in their appropriateness based on industry characteristics (complexity, technological intensity)" (Klotz et al., 2013, pp. 227).

3. Methodology

The inspiration for adopting the meta-synthesis method comes from Tranfield et al. (2003). Its evidence-informed guidance complements our study's aims with a concise set of planning steps and a rigorous procedure for conducting, reporting, and disseminating this literature review. A systematic literature review helps minimise bias in selecting the studies to review and in providing an audit trail of decisions, procedures, and the reviewers' conclusions so as to produce transparent and reproducible research. Tranfield et al. (2003) adapted methods from the medical science field, which has a more homogenous 'normal science' approach, such as its double-blind random control trials to test interventions. Tranfield et al. (2003) modified the tools to suit the realities of a practically oriented social science. As a result, their review methodology incorporates qualitative literature in the dataset and supports qualitative meta-synthesis as well as quantitative meta-analysis. The goal is to replace the higher evidence-based aims of medical science with evidence-informed policy and practice guides.

We derive further software tools-based support from Bandara et al. (2015) which views the literature review process as a qualitative study, considering the literature as a dataset, and provides specific guidance in using Excel, Endnote and NVIVO. Lastly, rules and guidelines by Massaro et al. (2016) which also builds on Tranfield et al. (2003), adds more rigour to be called a structured literature review. Massaro et al. (2016) oriented us toward searching multi- and interdisciplinary literature and conducting a methodologically inclusive review on a dataset that contains both qualitative and quantitative literature, which is particularly beneficial when dealing with an emerging research field. That said, "all research is a journey and not a strict series of events..." (Massaro et al., 2016, pp. 772), so the steps were applied in a fluid, iterative manner.

To create a dataset of relevant, high-quality literature on digital entrepreneurship without regard to discipline, we searched Google Scholar for all combinations of the terms: 'digital', 'internet', 'net', 'e-', 'cyber', or 'online' coupled with 'entrepreneurship', 'entrepreneurial', 'startup', or 'start-up'. These combinations identified articles containing phrases like 'digital entrepreneurship', 'internet startup', 'cyber entrepreneurship', etc. Dozens more phrases were further created as branches and leaves by adding terms to the stems and roots that represent the elements and themes of entrepreneurship, such as 'capital', 'financing', 'capabilities', 'team', 'ecosystem', 'network', 'strategy', 'growth', 'education', 'women', and 'minority' among many others (Kuratko et al., 2015). The articles retrieved from Google Scholar were supplemented with the same search procedure in Business Source Premier, ProQuest, and JSTOR to ensure no significant article was missed.

We did not specify a start date for the search, and we updated the corpus throughout the writing period up to May 2019 to ensure we mapped the full span of the field's development.

A working list of 275 articles was refined to ensure its relevance to digital entrepreneurship by reading the abstract. The rules used to determine an article's inclusion in the final corpus were:

- 1) The article had to be relevant to digital entrepreneurship. Many highly-cited articles were excluded because they lacked direct relevance. For example, the literature on digital business models, value creation in e-commerce, digital strategies, Agile software development, entrepreneurial marketing etc. was often set in the context of established companies. Similarly, articles related to entrepreneurship without reference to digital technology were also excluded. For example, literature on the Lean Start-up, business models, venture capital financing, and so on was often generalised to all start-ups. However, such literature does provide some valuable insights and is therefore acknowledged in this article as supporting publications. These insights were used without diluting the direct relevance of the primary dataset, which is focused on entrepreneurial firms using digital technologies.
- 2) The article must have been published in a well-regarded journal, conference, or book. The Australian Business Deans Council¹ (ABDC) Journal Quality List which is a comprehensive, global and multi-disciplinary database of journals was supplemented by The Journal Metrics² list as our benchmarks for 'well-regarded'. Exceptions were made to avoid losing significant, well-cited articles, or recent articles in relatively new journals.
- 3) Non-academic books, reports, whitepapers, and magazine articles were excluded, and conference papers and books chapters with no citations were excluded unless they were published in the last two years.

The final dataset comprised 133 articles, including 105 journal papers, 25 conference articles, and three book chapters. Appendix 1 lists the articles in this primary data-set and Appendix 2 lists the supporting publications - the secondary data-set.

We used Endnote to store the articles and Excel and NVIVO for the analysis. Each article was read in chronological order. Excel was used to extract the categorical and more structured data. NVIVO was used for coding according to the predefined categories but then added other attributes as the reading and coding evolved. A mixed-coding approach ensures researchers "enter the coding phase with some high-level coding scheme but allows it to evolve as new themes and insights are obtained from the literature" (Bandara et al., 2015). The analysis framework in Table 1 was informed by the recommendations of Tranfield et al. (2003), Bandara et al. (2015), and Massaro et al. (2016). The analysis framework is complemented with a recent, comprehensive guiding taxonomy provided by Kuratko et al. (2015) to determine and classify the focus of the articles. Inductive coding led to further categories and attributes, which helped us to develop the critique and focus of the literature and to develop a future research agenda in answer to the second and third research questions.

4. Insight

This section answers the first research question: "How is the research on digital entrepreneurship literature developing?" We provide an account of the historical evolution and development of the field, an overview of the articles, authors and disciplines and an analysis of the

¹ ABDC Journal Quality List's A*, A and B-ranked journals comprise 9%, 7% and 28.4% respectively out of the list's 2767 journals. The list is available at <https://abdc.edu.au/research/abdc-journal-list/>.

² <https://journalmetrics.scopus.com/>.

Table 1
The analysis framework for coding the articles.

Major categories	Attributes
Time Article and journal	Historical development Article type Journal quality (ABDC ranking or CiteScore) Number of authors Year published
Discipline Impact Focus on aspects of entrepreneurship theory and frameworks (Kuratko et al., 2015)	Entrepreneurship, management, information science, economics, education, telecommunications, marketing Citations per year - Schools of thought (macro/micro categories), Integrative framework, Typology of entrepreneur(s), Typology of venture, Process, Venture lifecycle
Research methodology Geographical context	Qualitative, quantitative, mixed methods, literature review, action research, conceptual, commentary The country where the empirical study was conducted or the lead author's location (in the case of non-empirical studies)
Other contexts	Other contexts such as setting (e.g., corporate, university), social (women, minorities), institutional (regulatory framework)

literature's impact. This section corresponds with the major categories – time, article and journal, discipline, and impact in the analysis framework.

4.1. Multidisciplinary evolution and phases of development

Massaro et al. (2016, pp. 774) recommend that as part of answering the first research question, one needs to ask, “What is the history of the field under review and how does the prior literature contribute to where the field is today?”. Le and Suh, 2019 qualitative historical analysis of the value propositions proffered by digital start-ups highlights the value of such a strategy in deriving insights.

Reading and analysing the literature in chronological order alerted us to changes in the various emphases in the course of literature development. The emphases were sometimes sudden and discernible but mostly subtle with fluid boundaries over time. We identified many such ‘phases’ in the course of literature development. The problem of fluid boundaries was partially eased by our practical need to limit the number of phases for the purpose of reporting. Table 2 provides three phases of development of research in the field, which is followed by a meta-synthesis. For the time-poor reader, we list five articles each in the primary data-set and supporting publications selected by their impact (by citations) and representativeness to each phase.

We find that research volume has grown rapidly through the ‘phases’, doubling in the second phase and then tripling in the third. Qualitatively speaking, research is interwoven not just with multiple disciplines but also with practice.

In the first phase, the role of internet in creating enterprise value (Amit and Zott, 2001) is mostly functional, in an environment marked by less interactive use of the technology and small number of users. Established business context is mostly assumed, as exemplified by Porter's (2001) view of a strategy for internet based on his value chain theory (Porter, 1979). A small part of the literature delves into ‘internet entrepreneurship’ which is centred on digitising existing content, sharing information and conducting transactions via the network (Kollmann et al., 2016) (e.g., Kickul and Walters, 2002). In practice, Yahoo!, eBay and Amazon exemplify the start-ups launched in this phase. Portals, directories, search engines and business as well as consumer e-commerce are the examples of business models further highlighting the emphasis on digitising content, organising information and conducting transactions.

In the second phase, ‘e-entrepreneurship’ emerges in which individual founders or NVTs conceptualise business models to digitise not just content but also processes in order to serve a growing number of (still) mostly desktop users. There is greater interactivity and the added

function of maintaining relationships. The nature of e-entrepreneurship is exemplified by the outcome “some or all of what would be physical in a traditional organization has been digitised” (Hull et al., 2007). In practice, broadband, smartphones, social media, and user-generated content began to inform our ideas about how the internet should be used (Wirtz et al., 2010) – how it should be more interactive and mobile. In practice, Facebook and other social media websites exemplify the emerging relationship function in this phase. Continuing from Baskerville et al. (2001), Crowne (2002) and Hilmola et al. (2003) in the first phase, IS scholars continued to study the unique challenges of digital start-ups (Coleman and O'Connor, 2008).

Finally, in the third phase, an exceptional shift occurs with the emergence of ‘digital entrepreneurship’. The task in this phase encompasses business model transformation in an environment of ubiquitous connectivity and saturated usage especially with tablets and smartphones. The focus shifts from individuals and NVTs to digital entrepreneurial eco-systems which encourages shared and distributed entrepreneurial agencies, processes and outcomes. In practice, Uber and AirBNB exemplify the beneficiaries of the flexibility, generative capabilities and network effects of digital technology, which first enable business model transformation and subsequently help rapidly build a customer base. Marc Andreessen³ calls this practice “software is eating the world” – industries are disrupted by start-ups with no assets or experience in the sector but which use digital applications, requiring no more than a smartphone running the start-up's programme to connect participants (e.g., car-owners and commuters in the case of Uber) at the expense of incumbents (taxi networks, owners and drivers).

The interplay of the *digital-technology perspective* with the *Lean revolution* (Blank, 2013) further characterises the third phase. The *Lean revolution* combines Agile software methodologies and manufacturing processes with experimentation and iteration. Osterwalder and Pigneur (2011), Blank (2013), and Ries (2011) explore methods and tools for rapidly conceptualising business models that incorporate iterative collaboration and reduced risk. Academic researchers have engaged with these popular practitioner methods. For example, Trim and Berbegal-Mirabent's (2012) and Ghezzi and Cavallo's (2018) rigorous analysis of business model innovation incorporates practitioner contributions. In fact, Ghezzi, 2019 inserts the Lean startup into the entrepreneurial process debates.

Recent scholarly work in IS supplies much detail on how the Lean Startup applies to digital start-ups (Duc and Abrahamsson, 2016;

³ <https://www.wsj.com/articles/SB10001424053111903480904576512250915629460>.

Table 2
Phases of development of digital entrepreneurship research.

Phase (number of articles in the primary dataset in brackets)	Years	Dominant discipline	Internet phase	Key research topics	Key articles	Key supporting publications
Internet economy (15 articles)	1993–2003	Strategic management; economics	Web 1.0	Value creation, role of internet in value chain and business models in enterprise (large business) contexts. Low impact and no thematic emphasis in literature on 'internet entrepreneurship' by individuals and teams.	Zook (2002); Feindt et al. (2002); Daly (2001); Colombo and Delmastro (2001)	Timmers (1998); Shapiro and Varian (1998); Amit and Zott (2001); Afuah and Tucci (2001)
E-entrepreneurship (31 articles)	2004–2012	Entrepreneurship	Web 2.0	Entrepreneurial process and entrepreneurial business models	Sutton (2000); Carrier et al. (2004); Fisher (2012)	Tece (2010); Ries (2011); Osterwalder and Pigneur (2003, 2011); Morris et al. (2005);
Lean revolution and digital technology-perspective (87 articles)	2013–2019	Information Sciences, entrepreneurship	Lean revolution	Entrepreneurial ecosystems; platforms, innovation, Lean and Agile methods	Forbes (2005) Nambisan, 2017; Giardino et al. (2015); Autio et al. (2017) Nambisan and Baron (2013); Ghezzi, 2019	Blank (2013); Nambisan et al. (2017); Bharadwaj et al. (2013)

Edison, 2015; Kullik et al., 2018; Pantuichina et al., 2017). For example, Bosch et al. (2013) designed a model to provide operational support to the Lean Startup process because he found it difficult to implement in its original form. Giardino et al. (2014) developed a stage-wise lifecycle model for the successful evolution of a start-up. Giardino et al. (2015) determined the key challenges in start-up software development coupled with a corresponding model (Giardino et al., 2016). This period also witnessed continuation of studies to examine the specific and unique challenges digital start-ups face, such as fast time to market and the effects of technical debt (Klotins et al., 2018; Terho et al., 2015).

4.2. Article and journals

Digital entrepreneurship has been a highly under-represented topic in quality journals through much of the field's lifetime. Further, scholarship has lagged behind practice. In fact, the earliest article in our dataset was published in 2000 (Sutton) – five years after the first wave of digital start-ups launched. The median number of authors per article across the primary dataset of 133 articles is two (average 2.5; range 1–7) with a median publishing date of June 2015 (average 2012; range 2000–2019). Fig. 1 indicates the volume of research over time and the disciplines that the articles were rooted in each year. Note that the date an article was first published online is considered the publishing date of recent articles.

4.3. Disciplines

Scholarship has generally run along disciplinary lines. However, research that integrates topics and methods across multiple disciplines has begun to appear. For example, Cukier et al. (2015) straddles IS, management, and entrepreneurship by applying the concept of maturity model that was initially built for software developers⁴ to digital start-up clusters in cities. Similarly, in explaining how digital start-ups scale rapidly due to the generativity afforded by digital technologies, Huang et al. (2017) investigates a marketing problem in an entrepreneurship setting, publishing it in an IS journal. The recent *digital technology-perspective* and *Lean revolution* is forcing digital entrepreneurship to become more interdisciplinary (e.g., Ghezzi, 2019; Ghezzi and Cavallo, 2018; Nambisan, 2017; von Briel et al., 2017) by encouraging application of IS theory to entrepreneurship and management phenomena.

We also find that digital entrepreneurship studies have used theoretical lenses from management and other social sciences, such as media, psychology, sociology and IS. A few examples of such theories are institutional voids (McAdam et al., 2019), resource bundling (Guo et al., 2016), social network (Batjargal, 2010; König et al., 2019; Srinivasan and Venkatraman, 2018), signalling (Kuester et al., 2018), population ecology (Zacharakis et al., 2003), intersectionality and socio-positionality (Dy et al., 2016, 2018), and socio-technical systems (Krotov, 2017).

4.4. Impact

According to Massaro et al. (2016), citations measure the impact of an article and can act as a proxy for its quality. However, as older articles have had more time to accumulate citations than recent articles, we also measured impact using citations per year (Massaro et al., 2016). Table 3 shows the top 10 articles ordered by citations per year (CPY).

In spite of the recent growth in the field, the impact in terms of citations highlights the field's early stage of development. The approximately 6500 citations across all the 133 articles in our primary

⁴ Capability maturity model integration (CMMI) is a process improvement programme initially aimed at government software contractors.

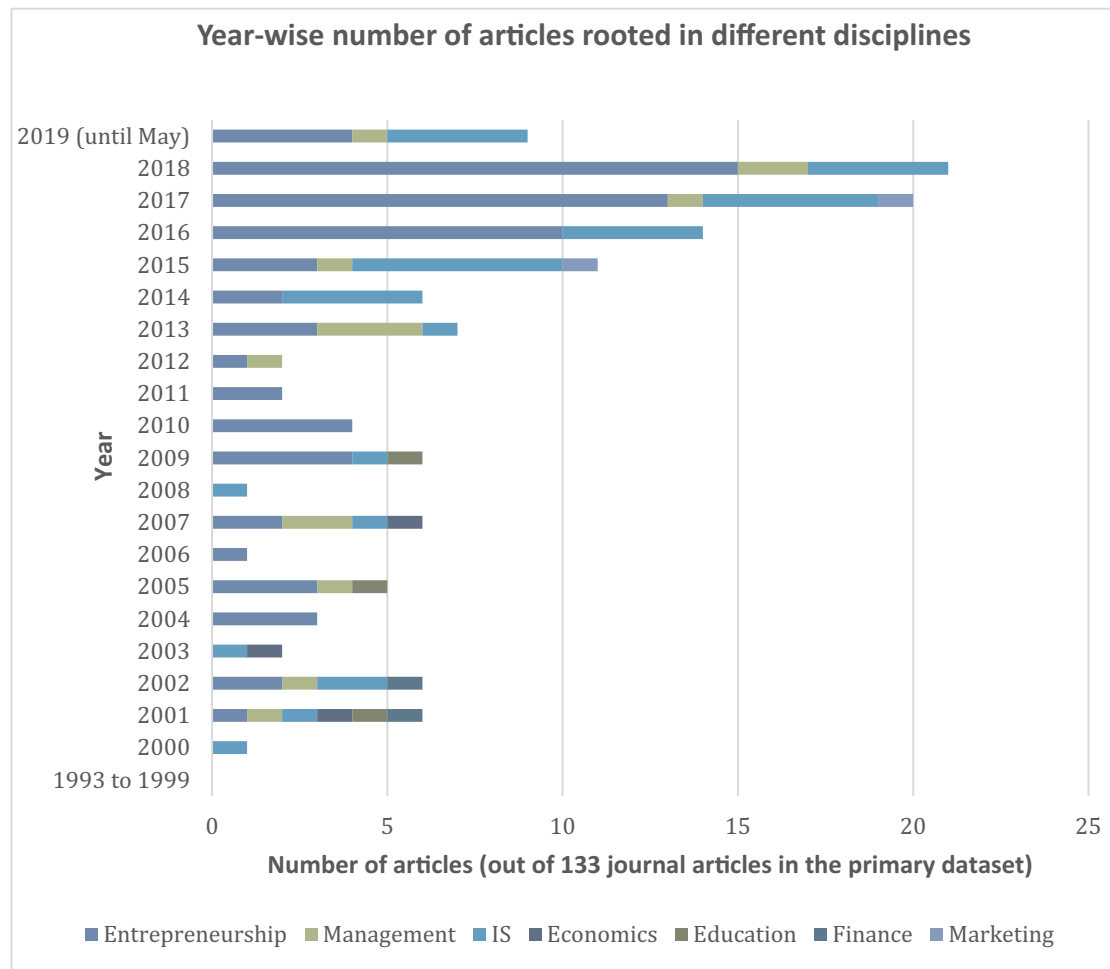


Fig. 1. Articles on digital entrepreneurship by discipline and year.

Table 3
Top 10 articles by citations per year.

Rank	Article title	Author	Year	CPY
1	Digital entrepreneurship: toward a digital technology perspective of entrepreneurship	Nambisan	2017	92
2	What do business models do?: innovation devices in technology entrepreneurship	Doganova and Eyquem-Renault	2009	74
3	Effectuation, causation, and bricolage: a behavioral comparison of emerging theories in entrepreneurship research	Fisher	2012	71
4	Entrepreneurship in innovation ecosystems: entrepreneurs' self-regulatory processes and their implications for new venture success	Nambisan and Baron	2013	43
5	Software development in startup companies: a systematic mapping study	Paternoster et al.	2014	41
6	Designing business models for the internet of things	Westerlund et al.	2014	32
7	The digital entrepreneurial ecosystem	Sussan and Acs	2017	30
8	The effects of strategic decision making on entrepreneurial self-efficacy	Forbes	2005	25
9	Software development in startup companies: the greenfield startup model	Giardino et al.	2016	25
10	Internet entrepreneurship: Social capital, human capital, and performance of Internet ventures in China	Batjargal	2007	21

dataset approximately equals the citations of just one seminal article - [Amit and Zott \(2001\)](#) on the topic of digital value creation and business models but in a non-entrepreneurship setting. However, the CPY of the top 10 articles in our primary dataset grew at a rate 90% higher than the top 10 articles in the secondary dataset over the past one year alone, indicating that digital entrepreneurship is accelerating its impact as compared to non-entrepreneurial (e.g., corporate) contexts of digital business.

5. Focus and critique

Here, we answer the second research question: “What is the focus and critique of the digital entrepreneurship literature?” In critical

management research, this task is undertaken to “counteract the dominance of taken-for-granted goals, ideas, ideologies and discourses...” ([Alvesson and Deetz, 2000](#), pp. 18). This section is organised to address the categories – theoretical focus, research methodologies and contexts - in the analysis framework.

5.1. Focus on the different aspects of entrepreneurship theory and frameworks

The framework of entrepreneurship frameworks ([Kuratko et al., 2015](#)) helped us assess the literature's theoretical focus. The “Schools of Thought” describe the macro factors that are beyond the entrepreneur's control and include the environment, finance and capital, and

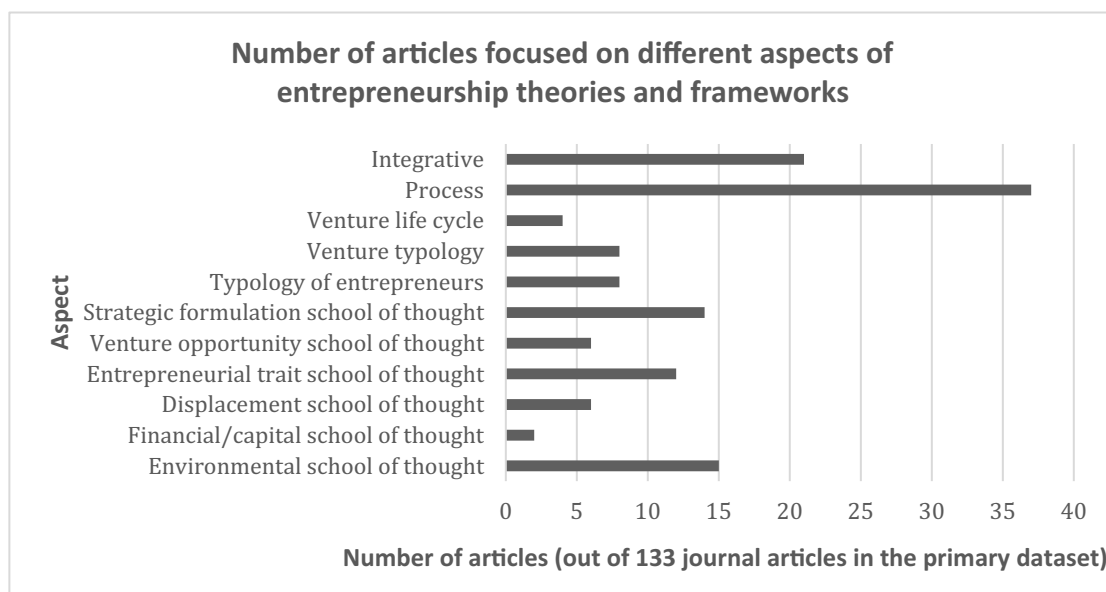


Fig. 2. Focus on aspects of entrepreneurship theories and frameworks.

displacement; the micro factors are entrepreneurial traits, venture opportunities, and strategy. Further, the “Typology of Entrepreneurs” attempts to understand entrepreneurs through their cognition and mindsets. The “Typology of Ventures” classifies new ventures according to size and their desire for growth. The “Venture Lifecycle” framework views new ventures as entities that evolve through definable stages. “Process” has a focus on sequences of activities, viewing entrepreneurship as a “journey” and not just an “act” (McMullen and Dimov, 2013). Lastly, “Integrative” frameworks bring the interactions between all these perspectives of entrepreneurship together. Fig. 2 indicates the number of articles in our primary dataset whose focus broadly match the definitions of different entrepreneurship theoretical perspectives and frameworks found in Kuratko et al. (2015).

Fortunately, digital entrepreneurship broadly covers all major aspects of entrepreneurship theories and frameworks thereby paving the way for more in-depth research in the future.

The macro factors which underpin entrepreneurship theories are environmental, financial and displacement. We have categorised a large set of articles on “ecosystem” and spatial (physical spaces) clusters within the environment school of thought. City and regional area ecosystem is significant (Cukier et al., 2015; Geissinger et al., 2019; Li et al., 2017) and Silicon Valley remains an outstanding example of how digital start-ups form in spatial clusters (Bouwman and Hulsink, 2002). Access to venture capital is a major factor in the development of such agglomerations (Zook, 2002). Examples of studies that provide valuable policy guidance pertain to the impact of government-provided broadband internet on regional (rural) entrepreneurship (Cumming and Johan, 2010), and how different industry sectors within digital entrepreneurship affect entrepreneurship rates in various regions. Both these factors appear to motivate the need for governments to target specific industry sectors for support (Zacharakis et al., 2003). At the country-level eco-systems, structural factors such as regulations and infrastructure (e.g., internet speed), are the focus with a special emphasis on challenges and opportunities in developing countries (e.g., Drouillard, 2017; Hafezieh et al., 2011; Javalgi et al., 2012; Ngoasong, 2018).

However, scholars have been careful not to blindly inherit the concepts of industrial clusters and their knowledge spillover from strategic management. In critically examining such clusters in digital contexts, Autio et al. (2017) clarifies that ‘entrepreneurial ecosystems’ are quite unique to digital entrepreneurship. Such eco-systems harness

digital affordances in combination with spatial proximity in order to enable entrepreneurial actions such as business model innovation. Digital start-ups continue to thrive in spatial clusters such as accelerators, co-working spaces and makerspaces. Unlike the mostly industry-specific clusters, entrepreneurial eco-systems are industry-agnostic, facilitating a shared knowledge base relating to start-up development rather than specialising in a specific industry. Meanwhile, other forms of environments in digital venturing are developer platforms such as Apple Appstore and Google Play, referred to as innovation eco-systems (Nambisan and Baron, 2013) while Sussan and Acs (2017) have framed digital multi-sided platforms as digital entrepreneurial eco-systems.

The financial/capital school of thought is based on the capital seeking process and remains chronically under-developed in digital entrepreneurship. Venture funding, as opposed to self-funding of digital start-ups, produces a focus on valuation and number of customers in the former and sales in the latter. So, Hamilton (2001) discusses how funding affects culture even as venture capital provides legitimacy and reputation as well (Chang, 2004).

The displacement school of thought explores the negative side of the group phenomena, in which certain people may be ‘displaced’ from their rightful place (Kuratko et al., 2015). The popular notion that digital entrepreneurship is a great leveller is demolished with findings that the offline inequality of women is being replicated in online environments because the internet does not offset the constraints of a marginalised position in society (Dy et al., 2016, 2018). However, the highly topical category of displacement is limited to only two types of displaced individuals: women entrepreneurs and those in developing countries (e.g., Hafezieh et al., 2011). Indeed, we were surprised by the presence of ‘subsistence’ entrepreneurs in digital entrepreneurship pursuing survival rather than transformative projects. But we do not consider such entrepreneurs to represent ‘displacement’ as they derive relational, hedonic, and symbolic benefits (Delacroix et al., 2019).

In research exploring the *micro* factors, entrepreneurial traits or characteristics are represented by well-defined variables for age, education, experience (Batjargal, 2007; Colombo and Delmastro, 2001; Liu et al., 2018; Ratzinger et al., 2018), proactivity, market, entrepreneurial, and strategic orientation (Hair et al., 2012; Kickul and Walters, 2002; Yu et al., 2016) and social network (Batjargal, 2010) and a frequent outcome measured is entrepreneurial intentions especially when the subjects are university students (Millman et al., 2009; Millman et al., 2010; Wang et al., 2016). Quantitatively measuring

personal traits to determine relationships with intermediate outcomes, such as entrepreneurial intentions, is much criticised (Gartner, 1988) but, in the digital entrepreneurship field, these types of studies provide diversity in an overwhelming volume of conceptual and qualitative literature. An interesting conceptualisation exploring entrepreneurial cognition (Nambisan and Baron, 2013) finds that entrepreneurs on digital platforms such as Apple's Appstore need to draw on cognitive strengths to manage divergent goals.

In recent digital entrepreneurship research, venture opportunity, strategy formulation, and entrepreneurial process are studied within the frames of business models and the Agile and Lean Startup methods. Indeed, the most-cited article in our dataset, Doganova and Eyquem-Renault (2009), investigates the role of business models in the innovation process within a digital start-up and is representative of many of the case study-based articles exploring business models (e.g., Huang, 2013; Ojala, 2016; Standing and Mattsson, 2018) as well as open innovation (Jelonek, 2015). Similarly, there is a rich, IS-rooted literature trove on software development in digital start-ups covering quality, challenges, processes, and so on.

Scholars are beginning to follow up on the call for *digital technology-perspective*. Von Briel et al. (2017) delves on how factors such as specificity and relationality describe the type of digital technology and the way it is implemented and thereby affect the extent to which a digital technology enables digital entrepreneurship. By specificity, we mean the level of rigidity in an action and the comprehensiveness of the interactions enabled by the technology and relationality refers to the set of relationships a digital technology creates (von Briel et al., 2017). Later, von Briel et al. (2018) further propose that embodiment and coupling of digital technology components affect the speed, capacity to carry out activities simultaneously, flexibility to change and adapt – pliability and generativity in the entrepreneurial process. Embodiment can be ephemeral – in a logical form such as a standalone software application or may be perpetual such as IoT devices existing in a physical state. The digital artefact's components may be loosely or tightly coupled – the degree to which the components are responsive to but not distinct from each other. Huang et al. (2017) explains how generativity helps digital start-ups to scale and grow with the help of data-driven operations in which they analyse large amount of data, instant release in which customer feedback is used to rapidly trial and modify their services, and swift transformation to find new uses of the technology developed.

There is a need for rigorous theory development with multiple case study and quantitative designs to complement the plethora of conceptual, exploratory, and single case studies. Batjargal (2007, 2010), Kollmann et al. (2009), Spiegel et al. (2015), Kuester et al. (2018), Ghezzi, 2019, Liu et al. (2018) and Ghezzi and Cavallo (2018) are exemplars of the research that is needed. We further find a glaring lack of dynamic and well-tested process models which are considered the more rigorous form of theory development (Moroz and Hindle, 2012).

Venture lifecycle frameworks propose the stages through which ventures evolve with corresponding changes in an organisation's focus and risk-return profiles from product development to sales, from tactics to strategies, and from informal systems to formal ones. The ability to make the transition to successive stages is crucial (Kuratko et al., 2015). Von Briel et al. (2017) adopts the three stages of prospecting, developing, and exploiting to identify, explore, and adapt promising ideas. He describes a progression toward scaling the offering, establishing efficient and scalable systems and routines, taking a technology to market, then selling and servicing the developed offering. Giardino et al.'s (2014) behavioral framework, born out of two case studies of failed start-ups, consists of the stage-wise evolutions of products, teams, markets, and the business and are the most comprehensive. Drori et al. (2009) examine the lifecycle of a digital start-up by focusing on its efforts to construct an identity and legitimacy. However, the proposed lifecycle models need to be replicated in empirical studies to progress further.

Although many studies delve into a type of venture or a type of entrepreneur (e.g., subsistence entrepreneur of Delacroix et al., 2019), only a few typology frameworks have been proposed. Hull et al. (2007) base their types of digital start-ups on the degree of digitisation – mild, moderate, and extreme. At a broader level, König et al., 2019 typology is based on the evolutionary patterns of business models in digital and non-digital start-ups.

Finally, integrative frameworks in entrepreneurship combine many elements of entrepreneurship and their interactions, generally with process at the centre. Kollmann (2006) propose a truly integrative framework that specifies the success factors, building blocks, and phases of development in a digital start-up, but we found no published study to have tested the conceptual framework. Only a few studies have taken an integrative approach to identifying and analysing challenges (Giardino et al., 2015; Smagalla, 2004), innovation (Zhao, 2005), life-cycle stages (Carrier et al., 2004) and success factors (deYoung, 2005; Zaheer et al., 2019) but these studies are set in static frameworks.

5.2. Geographic context

A start-up's geographic context determines the level of generosity in the environment, the presence of entrepreneurial ecosystems, the availability of trained employees and partners in the community, government policies and support, regulations, and financing opportunities. In digital start-ups, the quality of skills available, costs, and government regulation over digital infrastructure, plus the general level of technical education in the population all affect the potential performance of a digital start-up. All articles with an explicit geographic context, such as the geographic location of the research setting, were coded to that context. Papers with no geographic context, such as conceptual articles and commentaries, were coded to the lead author's country of origin. The number of articles aggregated to each continent/world region appears in Fig. 3, which shows the dominance of North America, Europe, and Australia. However, our literature search and selection strategy, which limited us to English language literature, is certainly biased to the western world, which affects the geographical findings. Further, even as a large proportion of digital entrepreneurship studies (about 83%) provide theories and perspectives at a global level, the remaining few articles present many interesting perspectives at continental (e.g., Europe), country, regional (e.g., a large area within a state or country), and city levels.

We find that geographical contexts, such as industry and market, history, social and institutional contexts (Welter, 2011) are generally ignored, although with a few significant exceptions. Beyond a country or city perspective provided by studies delving into clusters, Batjargal (2010) and Liu et al. (2018) provide a China-specific view of social capital in the form of the *guanxi* concept. A few other studies deal adequately with the geographical context, not just the topic, of their research. These include Sigfusson and Chetty (2013), who studied social networks in Iceland, Van Horne et al. (2016) who looked into the entrepreneurial process of founders in United Arab Emirates (UAE) and McAdam et al., 2019 who examined how women digital entrepreneurs deal with the socio-cultural institutional contexts in Saudi Arabia.

5.3. Other contexts

The coverage of contexts is patchy at best. Entrepreneurship within established companies - corporate entrepreneurship is only addressed in a cursory fashion. Social groups such as minorities, migrants, seniors, teenagers, etc. have never been studied. Only women digital entrepreneurs are thoroughly examined (Dy et al., 2016, 2018). Most studies of students tested the effects of outcomes such as entrepreneurial self-efficacy and entrepreneurial intentions leaving the potential for experimental and experiential learning possibilities unexplored. The exception is Daly (2001, pp. 204) who determines the advantages of student-operated digital businesses "...as an effective

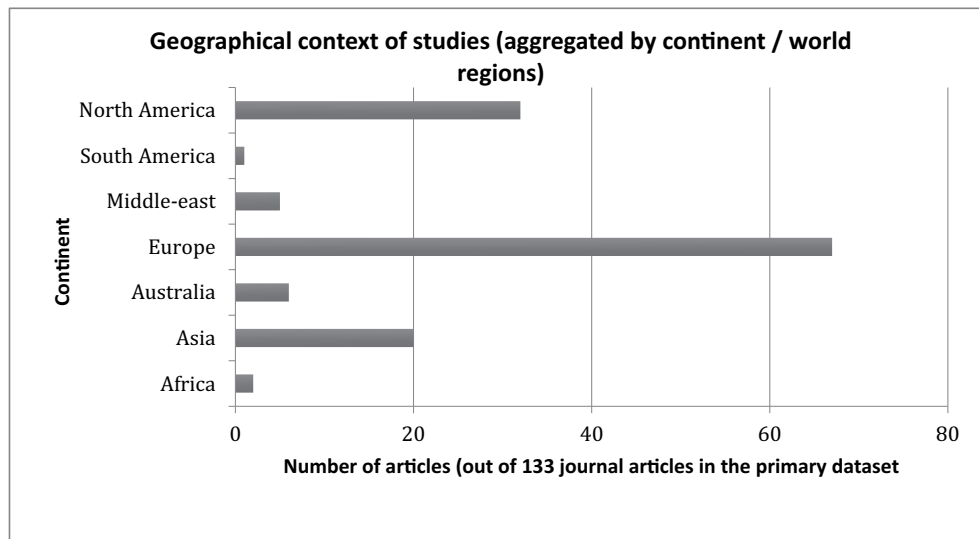


Fig. 3. Geographical context.

way to study ‘real-world’ entrepreneurship...” but unfortunately, experiential pedagogy, project-based teaching enabled by digital affordances has yet to mature.

Practitioners' reports⁵ suggest that the industry and market contexts of digital start-ups are important. In fact, digital start-ups are understood by practitioners in the industry through the lenses of the customer types, the revenue model and industry. Customer types are business to consumer (B2B), business to consumer (B2C), business to government (B2G). Revenue models can be software rental as a subscription (SaaS), commissions in operating a multi-sided marketplace, advertising on their content pages, or selling goods online from an e-commerce store. Industry sectors such as education, media, retail etc. also receive attention. However, the extant literature does not explicitly include coverage of the differences in entrepreneurial processes against such typologies. There is also a need for studies across the topics to focus on the different phases of a start-up's growth.

5.4. Methodologies

Fig. 4 shows the methodologies used in the articles of the primary dataset. The dominance of qualitative methods and conceptual articles indicates that the research field is still emerging with a propensity by the scholars to explore and discover rather than deploy, measure, or test in the positivist traditions. Case studies, especially single case studies, and interviews are the methods of choice.

Traditional entrepreneurship research has a distinct bias for quantitative methods (McDonald et al., 2015). However, the exploratory, single case study, and conceptual preferences signal that digital entrepreneurship is still embryonic compared to the overall body of entrepreneurship research. Interestingly, in a review of social entrepreneurship, Short et al. (2009) found a similar distribution of methodologies in the social entrepreneurship field when it was at about the same age. So, we are not surprised by this finding.

Multiple disciplines provide diversity in methodologies. IS-rooted studies provide examples of innovative use of data collection, such as experience reports to identify software engineering practices (written by participants after critical events as representations of their learning) (Klotins et al., 2019); business plans collected from an accelerator (König et al., 2019); and data from a start-up data platform called Crunchbase in conjunction with a survey (Le and Suh, 2019). The emergence of action and design science research, particularly insider

action research, is of particular interest. Nzembayie et al. (2019) argues the case for research with relevance to practice because, much like the entrepreneurial process in digital ventures, action research is also emergent and iterative.

Building on the insights we gained from an abductive analysis of the literature to develop a focus and a critique of the field, we find that digital entrepreneurship research is embryonic. Its theoretical perspectives still lack depth. Its methodologies are skewed toward the exploratory rather than robust theory-building and rigorous theory testing. Its concepts and measures are often unclear while its definitions continue to evolve. And many themes and contexts are yet unexplored. In the next section, we build on the focus and critique to provide propositions on the future of the field.

6. ‘Transformative redefinitions’: the future of digital entrepreneurship

In this section, we turn to the third question – “What is the future of digital entrepreneurship research?” This last task of critical research “is the development of critical, managerially relevant knowledge and practical understandings that enable change and provide skills for new ways of operating” (Alvesson and Deetz, 2000, pp. 19). Massaro et al. (2016, pp. 776) translate this task into a literature review's need “to make normative arguments about what future research paths and questions work toward potential implications for practice, education, policy and/or regulation”. We have divided this section into two subsections that contain 1) the pertinent questions for; and 2) the key aspects of an imminent new research phase.

6.1. Foundations of a fourth phase of research

Our overall analysis leads to a call for a fourth phase of research that builds on the high growth of scholarship and practice in digital entrepreneurship's third phase of development. A broad range of entrepreneurship and management-rooted theoretical perspectives using a broad range of methodologies have been studied, but there is a need for more depth. The contexts need more breadth so that research can inform policy and practice at not just global but more granular levels. Start-ups across countries, regions, industries, and even cities, have patterns of business that need to be understood. So, digital entrepreneurship contexts are far more expansive than this standard generic listing. There is also a significant call to incorporate design science and action research methods, collaborate with practitioners in

⁵ Startup Genome Report, <https://startupgenome.com/>.

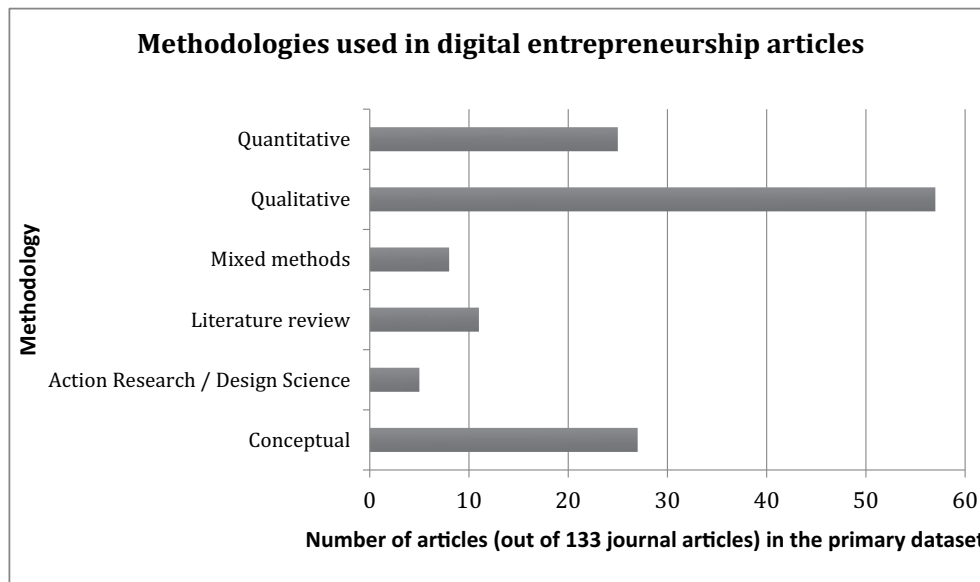


Fig. 4. Methodologies in digital entrepreneurship studies.

conceptualising the research questions, and produce output that can inform policy and practice. Table 4 provides a summary of the key research questions we believe will be important to digital entrepreneurship research in the future. Table 4 also includes the new categories of contexts that we discovered through the literature review, to complement those identified initially as part of analysis framework.

In conceptualising the research questions, we took a *digital technology-perspective* as integral to generating new theories which modify our traditional understandings of how digital start-up founders create and pursue new ventures due to the unique characteristics of digital technologies (Nambisan, 2017). Our research questions are also based on the assumption of a socio-material nature of digital technologies (Davidson and Vaast, 2010) which means that the human entrepreneur is inextricably linked with the digital technology. Even in cases of highly digitised products and services, the capabilities and resources across physical and digital domains work in tandem to create a less bounded entrepreneurial process. The result is outcomes that have physical, social, and digital characteristics. We posit that this socio-material nature of digital technologies, together with the *digital technology-perspective*, will underpin future research. In the process, recent digital entrepreneurship research is a step in the direction of Welter's (2011) call to not just contextualise theory but to 'theorise the context' - how specific contexts - digital technology in this case, affects entrepreneurship theory.

Many studies have already analysed the differences between non-digital and digital entrepreneurship in terms of founder characteristics (Colombo and Delmastro, 2001), how their business models evolve (König et al., 2019), how they tackle the regulatory environment (Dong, 2019) and how they internationalise (Leong et al., 2016). Future studies that seek to understand the differences between digital and traditional entrepreneurship need to acknowledge the extent of, the diversity of, and the ways in which digital technologies are implicated in digital entrepreneurship. For instance, the level of digitisation, the degree of specificity and relationality, and the different ways in which digital artefacts, platforms, and infrastructure are used, affect the process and outcomes of digital entrepreneurship. After all, a physical organisation and social processes form the crux of even a highly digitised start-up such as a mobile video games producer. At the other end, significant digital capabilities are required of a digital start-up even if it uses digital technologies to enable just one, albeit significant business model component.

6.2. Key aspects in the fourth phase of digital entrepreneurship research

We make propositions of how aspects such as research methods, engaging with contexts, relevance to practice and to entrepreneurship education, collaboration between research and industry, and increasing multi- and inter-disciplinarity will develop in future.

As digital entrepreneurship becomes more interdisciplinary and acquires depth, the range of research methods will expand beyond disciplinary boundaries. Action research and design science research will increase relevance to practice (Dimov, 2016; Nambisan, 2017) and have prescriptive outputs. Encouraging signs of such output can already be found: Bosch et al. (2013) integrates a design science-based development model to extend the Lean Startup while Balocco et al. (2019) provides the operationalising process to experiment and validating business model change, again to extend Lean Startup; Cukier et al. (2015) develops an ecosystem maturity model to help cities support a more vibrant start-up ecosystem; and Jiwa et al. (2005) produces an action-learning simulation for entrepreneurship education. Nzembayie et al. (2019) conducted research while founding a start-up and proposes insider action research, a research method with the aim of providing useful solutions to practice. Dellermann et al. (2017) are developing an early-stage success prediction model that combines machine learning with human heuristic decision-making. Large-scale and longitudinal research is much needed. New sources of data such as start-up databases have emerged. One such database, Crunchbase has already been used in studies (Le and Suh, 2019; Ratzinger et al., 2018). This expansion in the range of methodologies will not just enrich digital entrepreneurship research but will affect entrepreneurship research in other contexts and topics.

However, a new and innovative mix of methodologies will require the contribution and collaboration of both multi-disciplinary scholars and practitioners - entrepreneurs, investors, ecosystem managers, and consultants. The resulting output will not only provide explanations but also combine or extend purely academic or entirely practice output so as to provide grounded technological rules that guide policy and practice (Tranfield et al., 2003). Striking examples of practitioner output are available in our dataset. For example, Bain Capital analysed the factors leading to the success of public internet companies and in the process, posit the 'rule of 126' as a measure of successful companies: they reached \$100 million in turnover with a 20% margin within six years of launch (Smagalla, 2004). Similarly, Ambler (2002), a consultant to digital start-ups, outlined Agile principles of software

Table 4
Future research questions and contexts updated to reflect future focus.

Topics of future research	Research questions	Key articles leading to future questions
Entrepreneurs and new venture teams	<p>How do prior education, professional and entrepreneurial experiences, age and gender of digital NVT members affect entrepreneurial processes and outcomes?</p> <p>What is the role of digital technology capabilities of the NVT in the entrepreneurial process and outcomes?</p> <p>How do entrepreneurs learn while creating a new digital start-up?</p> <p>Which configurations of new digital NVTs in terms of its members' education, experience and other attributes are more effective?</p> <p>What can we learn from the experiences of digital start-ups with fluid organisational boundaries such as globally dispersed NVT and offshore or outsourced organisation?</p> <p>How are the digital founders' physical networks and social media combine to enable their entrepreneurial process?</p> <p>What are the models of experiential and active learning for student-operated digital businesses?</p> <p>How do digital technology characteristics impact on the effectiveness of digital entrepreneurship experiential education?</p>	<p>Bajajrjal (2007, 2010)</p> <p>Liu et al. (2018)</p> <p>Nambisan and Baron (2013)</p> <p>Matlay and Westhead (2005, 2007)</p> <p>Ratzinger et al. (2013)</p>
Entrepreneurship education	<p>What are the models of experiential and active learning for student-operated digital businesses?</p> <p>How do digital technology characteristics impact on the effectiveness of digital entrepreneurship experiential education?</p> <p>What are the effective practices pertaining to assessments, curriculum integration, and interdisciplinary collaboration with marketing, management and IS in digital entrepreneurship experiential education?</p> <p>How do digital technology factors like degrees of specificity, relationality, embodiment and coupling interact with NVT capabilities and their decision-making logic in the entrepreneurial process?</p> <p>How do the digital affordances enable business model innovation, and entrepreneurial methods such as the Lean startup?</p> <p>How are entrepreneurial process perspectives such as effectuation, and bricolage practiced in digital technology context?</p> <p>How do digital start-ups internationalise their offerings and organisation and how does the internationalisation process differ from non-digital ventures?</p> <p>How do digital start-ups within established start-ups differ from new digital start-ups?</p> <p>How does the process of innovation in a digitised world differ from extant assumptions of innovation management such as bounded phenomena, centralised agency, and distinction between innovation process and outcomes?</p>	<p>Daly (2001)</p> <p>Millman et al. (2010)</p>
Entrepreneurial process	<p>What are the effective practices pertaining to assessments, curriculum integration, and interdisciplinary collaboration with marketing, management and IS in digital entrepreneurship experiential education?</p> <p>How do digital technology factors like degrees of specificity, relationality, embodiment and coupling interact with NVT capabilities and their decision-making logic in the entrepreneurial process?</p> <p>How do the digital affordances enable business model innovation, and entrepreneurial methods such as the Lean startup?</p> <p>How are entrepreneurial process perspectives such as effectuation, and bricolage practiced in digital technology context?</p> <p>How do digital start-ups internationalise their offerings and organisation and how does the internationalisation process differ from non-digital ventures?</p> <p>How do digital start-ups within established start-ups differ from new digital start-ups?</p> <p>How does the process of innovation in a digitised world differ from extant assumptions of innovation management such as bounded phenomena, centralised agency, and distinction between innovation process and outcomes?</p>	<p>Fisher (2012)</p> <p>Ghezzi, 2019</p> <p>König et al., 2019</p> <p>Nambisan, 2017</p> <p>Nambisan and Baron (2013)</p> <p>von Briel et al. (2017, 2018)</p> <p>Reuber and Fischer, (2011)</p>
Innovation	<p>What are the differences between spatial clusters such as industrial parks and knowledge parks and digital entrepreneurial eco-systems?</p> <p>What are the effective configurations of digital and material activities of digital start-ups in entrepreneurial ecosystems?</p> <p>What are the effective ways for governments at national, regional and city levels to encourage digital startup ecosystems? What are the benefits of such ecosystems?</p>	<p>Nambisan et al. (2017)</p>
Ecosystems	<p>What are the differences between spatial clusters such as industrial parks and knowledge parks and digital entrepreneurial eco-systems?</p> <p>What are the effective configurations of digital and material activities of digital start-ups in entrepreneurial ecosystems?</p> <p>What are the effective ways for governments at national, regional and city levels to encourage digital startup ecosystems? What are the benefits of such ecosystems?</p>	<p>Autio et al. (2017)</p> <p>Li et al. (2017)</p> <p>Sussan and Acs (2017)</p>
Societal, institutional and regulatory frameworks	<p>In what ways do the national, regional and local communities benefit from investments in digital entrepreneurship education, broadband infrastructure and ecosystems?</p> <p>What are the costs and benefits of the downstream self-employment opportunities that result from digital entrepreneurship such as the supply-side participants in multi-sided platforms like ebay, Uber, and Airtasker, developers in innovation ecosystems such as Google Play?</p> <p>To what extent and in what ways are the current institutions and mechanisms (e.g., to structure the legal organisation with a joint stock company, develop and own intellectual property with trademark and patent-granting structures, government's grants and incentives) fit digital start-ups?</p> <p>How will the legislation specific to digital products and services affect the formation and performance of digital start-ups?</p> <p>What are the requirements for new institutional and regulatory frameworks?</p> <p>How does generativity and other digital technology characteristics enable scaling and growth?</p> <p>Which methods and channels of entrepreneurial marketing will be more effective in digital start-ups?</p> <p>Do emerging practices of growth hacking reflect a digital technology-perspective of entrepreneurial marketing and what is the future of such practices?</p> <p>How do digital NVTs make decisions in choosing from a preponderance of financing modes available, such as self-financing (bootstrapping), crowdfunding, angel and venture capital?</p> <p>How can financing modes, especially the emerging modes such as crowdfunding, adapt to the needs of digital start-ups?</p>	<p>Dong, 2019</p> <p>Geissinger et al., 2019</p>
Marketing and growth	<p>What are the requirements for new institutional and regulatory frameworks?</p> <p>How does generativity and other digital technology characteristics enable scaling and growth?</p> <p>Which methods and channels of entrepreneurial marketing will be more effective in digital start-ups?</p> <p>Do emerging practices of growth hacking reflect a digital technology-perspective of entrepreneurial marketing and what is the future of such practices?</p> <p>How do digital NVTs make decisions in choosing from a preponderance of financing modes available, such as self-financing (bootstrapping), crowdfunding, angel and venture capital?</p> <p>How can financing modes, especially the emerging modes such as crowdfunding, adapt to the needs of digital start-ups?</p>	<p>Huang et al. (2017)</p> <p>Kuester et al. (2018)</p>
Financing	<p>How do digital NVTs make decisions in choosing from a preponderance of financing modes available, such as self-financing (bootstrapping), crowdfunding, angel and venture capital?</p> <p>How can financing modes, especially the emerging modes such as crowdfunding, adapt to the needs of digital start-ups?</p>	<p>Hamilton (2001)</p>

(continued on next page)

Table 4 (continued)

Topics of future research	Research questions	Key articles leading to future questions
Performance	What are the success factors at the different stages of a start-up? What are the measures and antecedents of success in digital start-ups and how can we build models to predict success? How do digital start-ups disrupt established companies? How do digital start-ups disrupt other digital companies?	Sebora et al. (2009) Lassen et al. (2018)
Contexts in digital entrepreneurship		
Theme/context category		Attributes
Industry and market		Customer model Revenue model Industry Continent, country, region, city, clusters and accelerators Elements: platform, infrastructure or artefact Level of digitisation: mild, moderate or extreme Degree of specificity and relationality Degree of embodiment and coupling Prospecting, developing and exploiting
Geographic		
Digital technology		
Digital start-up stages		

development in the digital start-up context many years before the Lean Startup revolution put some of these principles into the mainstream. Academic researchers engage with practitioners' methods as well. Bosch et al. (2013) contextualise and extends the Lean Startup method to digital start-ups, while Ghezzi, 2019 studies how the Lean Startup provides operational support to digital start-ups in their entrepreneurial process. An increasing influx of information science scholars and practitioners will lead to more solutions-oriented research. Eventually, more and better evidence-informed policy and practice will result.

As the field grows, we anticipate that more studies will explicitly target digital entrepreneurship in particular contexts as scholars have just started to do. These contexts will span: industries, such as agriculture by Mueller (2001) and banking by deYoung (2005); business model patterns, such as multi-sided marketplaces (Still et al. (2017), e-retail (Leong et al. (2016); type of digital technology such as IoT (e.g., Westerlund et al., 2014; Yu et al., 2017) and geographical locations at different levels – continent, country, regions, city and even a local cluster. Existing studies (e.g., Xiaohua et al., 2015) in the Chinese context already provide a broad understanding of digital entrepreneurship in China, but the same cannot be said for other regions. The trend to study in narrower contexts is likely to continue over the next few years. As the pace of digitisation gathers speed, many under-represented themes (Kuratko et al., 2015) will become more significant.

Further, as digital entrepreneurship scholars, our understanding of societal and institutional contexts and the effects of interventions is hazy. For example, the traditional understanding that clusters of firms in geographic regions benefit from knowledge spillovers (Gilbert et al., 2008) need to be updated to incorporate digital entrepreneurial ecosystems (Autio et al., 2017; Sussan and Acs, 2017). Few studies explore digital entrepreneurship performance issues at a regional or national level, despite calls for research at a higher level of entrepreneurship (Davidsson and Wiklund, 2007; Low and MacMillan, 1988). Additionally, more research on the social issues associated with digital entrepreneurship is needed, such as diversity, inclusion, and sustainability. Government, industry, and universities need to collaborate in a new phase of research to clarify the societal and individual effects of digital entrepreneurship and its outcomes.

Digital start-ups are well suited to experiential training (Daly, 2001) because of the adaptive learning that is inherent in the entrepreneurial process (Ghezzi, 2019; König et al., 2019). Digital technology's characteristics of flexibility and generativity are in harmony with low-cost experimentation and practical learning tools oriented toward trial-and-error. We expect that in future, student-operated digital start-ups will be used to impart learning in real-life situations or, at least, close to real life. Further, we expect to see many more innovative educational models that combine pedagogy with entrepreneurship and action or design science research methods. The thin line of investigation into digital entrepreneurship by university students in existing research stops at their intentions and attitudes toward attainability (Ahmad et al., 2016). We hope that studies on digital entrepreneurship education will be extended to the continuing development of digital start-up founders so they can learn and grow into more complex roles as their venture passes successive life stages (Zaheer et al., 2019).

Education is often associated with long-term, individual career development, and growth and is known to be a key element of the human capital that aids the entrepreneurial process (Ratzinger et al., 2018). However, the extant literature on digital entrepreneurship focuses more on firms than individuals. The start-up founder has only been used as the unit of analysis in 15 studies. Future studies need to examine the processes and outcomes of long-term, persistent, and serial entrepreneurship in the digital context to add texture and modern relevance to our current understanding of the role education plays in this emerging field.

As interdisciplinarity increases, entrepreneurship scholars will need to have a greater awareness of the intersecting disciplines in publishing, methods, and topics. For example, while book chapters or conference

proceedings in entrepreneurship and management fields do not garner much impact, in IS they do. Examples are Bosch et al. (2013) and Giardino et al. (2014). Further, IS-rooted conference papers often highlight innovative and emerging methods or topics as solutions. Dellermann et al. (2017), for instance, proposes a model based on a hybrid intelligence method that combines machine learning and human intuition to predict a start-up's chances of success. Emerging topics from conference papers are project management (Karmito et al., 2016), start-up communication (Kampf and Trapp, 2016), user entrepreneurship (Jung and Pawlowski, 2015), and more recently the Lean Startup (Duc and Abrahamsson, 2016; Edison, 2015; Terho et al., 2015). Those tackling challenges (Giardino et al., 2015) and failures (Giardino et al., 2014) in start-ups tend to be based on large empirical studies. Most have been cited many times, which indicates that scholars in interdisciplinary fields, such as digital entrepreneurship, may be losing significant insights by ignoring conference papers and book chapters even though publishing in journals does still generate more impact.

7. Conclusion

This paper reviews digital entrepreneurship using a systematic, software-tools-supported literature review technology (Bandara et al., 2015; Massaro et al., 2016; Tranfield et al., 2003). The three research questions we answer are tied together. In answering the first research question, insight “helps develop understandings of how a particular body of literature develops”, in answering the second question, critique “guides us to avoid myopia through looking at the totality”, while in answering the third research question, transformative redefinition “directs us to avoid hyper-critique and negativity” offering a positive way forward (Alvesson and Deetz, 2000, pp. 21). All three elements are necessary to develop contributions to new knowledge (Massaro et al., 2016; pp. 776–777). Our literature search was global and multi-disciplinary, and our analysis of the literature's contexts and themes was informed by a comprehensive list of theoretical perspectives (Kuratko et al., 2015) to avoid omitting any aspect of new venture creation. However, we found many gaps in the literature.

While the digital entrepreneurship literature is dynamic, it has developed along narrow and fragmented disciplinary lines. There is little consensus on the definitions of key terms or the delineations between the scope of the field's concepts, and very few themes and contexts of entrepreneurship have been explored. It is especially disappointing to find that entrepreneurship education has not been a subject of study because it could easily be advanced with the experiential learning that digital technologies enable. Moreover, there is a dearth of integrative,

dynamic frameworks to help new scholars and practitioners understand the complex entrepreneurial process.

As the field matures, there is a need for frameworks that can help researchers analyse digital start-ups at finer levels of detail, such as by their customer model, revenue model, industry, or how a digital technology has or should be implemented. Further, there is a need for a systematic inventory of the field's concepts, theories, and interconnections with other fields. Our overall analysis reveals that a broad range of theoretical perspectives and methodologies have already been studied, but depth is missing. Several overlying themes and contexts are very thinly investigated; others are entirely unexamined. There is a very strong field of literature in software development processes for start-ups, but little in the way of NVT or organisational practice.

In this review, we discussed and proposed many definitions and clarified the scope, we critiqued the extant literature, pointing out its research gaps, and outlined what remains to be done in future. All three research questions in this study were answered by taking a multi- and interdisciplinary approach, which is a key strength of this study.

Digital entrepreneurship is a small part of the overall digital business research landscape, accounting for less than 10% of the sector's overall impact – albeit, its influence is increasing. A major contribution of this study is to present the phases of development in digital entrepreneurship research within the overall literature on digital businesses. We also call for a new phase of research to fill the gaps and address the identified weaknesses in current research efforts and, in so doing, develop more relevance to practice. To that extent, we expect the research objectives in this increasingly interdisciplinary field to move beyond explanatory research. In essence, digital entrepreneurship takes all the complexity and fragmentation of entrepreneurship a step further and, yet, the inherent characteristics digital technologies offer scholars new vistas to explore, akin to Finkelstein's (2001) observation that in the internet era, “the more things change, the more they stay the same”.

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Appendix 1. Articles in the dataset

Article title	Author(s)	Year	Cits	Disc	UoA	Meth	Geo loc.
Phase 1							
The role of process in a software start-up	Sutton	2000	92	IS	Software start-ups	Qual	MA, USA
Student-operated Internet businesses: true experiential learning in entrepreneurship and retail management	Daly	2001	139	Edu	University students	Qual	USA
Technology-based entrepreneurs: does internet make a difference?	Colombo and Delmastro	2001	132	Entrep	Internet entrepreneur	Quant	Italy - North
How Internet software companies negotiate quality	Baskerville et al.	2001	127	IS	Internet software companies	Concep	USA
E-commerce and entrepreneurship in agricultural markets	Mueller	2001	49	Eco	Agribusiness firms	Concep	Germany
Internet startups: so why can't they win?	Finkelstein	2001	28	Mgmt	Internet firms	Qual	USA
E-commerce new venture performance: how funding impacts culture	Hamilton	2001	22	Fin	E-commerce ventures	Concep	USA
Identifying success factors for rapid growth in SME e-commerce	Feindt et al.	2002	245	Mgmt	SME e-commerce ventures	Qual	Germany
Grounded capital: venture financing and the geography of the Internet industry, 1994–2000	Zook	2002	236	Fin	Geographic region	Mixed	USA
Lessons in agility from Internet-based development	Ambler	2002	82	IS	Internet firms	Qual	Canada
Why software product startups fail and what to do about it ^a	Crowne	2002	76	Entrep	Software product firm	Concep	UK
A dynamic model of cyber-entrepreneurship and cluster formation: applications in the United States and in the Low Countries	Bouwman and Hulsink	2002	69	IS	Clusters	Concep	Netherlands

Recognizing new opportunities and innovations: the role of strategic orientation and proactivity in internet firms	Kickul and Walters	2002	31	Entrep	E-commerce ventures	Quant	USA
The development of venture-capital-backed internet companies: an ecosystem perspective	Zacharakis et al.	2003	130	Eco	Geographic region	Quant	USA
The value of product development lead time in software startup	Hilmola et al.	2003	29	IS	Software start-ups	Sys dyn	Finland
Phase 2							
Venture capital financing, strategic alliances, and the initial public offerings of Internet startups	Chang	2004	229	Entrep	Internet firm with IPO	Quant	%South Korea
Cyberentrepreneurship: a multiple case study	Carrier et al.	2004	127	Entrep	Internet start-ups across B2B, B2C	Qual	Montreal, Quebec, Canada
E-entrepreneurship and small e-business development: toward a comparative research agenda	Matlay	2004	65	Entrep	e-entrepreneurship	Lit rev	UK
The truth about software startups	Smagalla	2004	11	Mgmt	Publicly held software companies	Quant	USA
The effects of strategic decision making on entrepreneurial self-efficacy	Forbes	2005	342	Entrep	Start-ups in an Internet cluster	Quant	Silicon Alley, CA, USA
The performance of Internet-based business models: evidence from the banking industry	deYoung	2005	224	Mgmt	Internet-only bank start-up	Quant	USA
Virtual teams and the rise of e-entrepreneurship in Europe	Matlay and Westhead	2005	170	Entrep	Tourism start-ups	Qual	Europe
E-entrepreneurship: learning in a simulated environment	Jiwa et al.	2005	13	Edu	Student	Action	UK
Entrepreneurship and innovation in e-business: an integrative perspective	Zhao	2005	12	Entrep	Internet start-ups	Concep	Australia
What is e-entrepreneurship?—fundamentals of company founding in the net	Kollmann	2006	115	Entrep	Digital start-up	Qual	Germany
Internet entrepreneurship: Social capital, human capital, and performance of Internet ventures in China	Batjargal	2007	230	Mgmt	Digital start-up	Quant	China
Using grounded theory to understand software process improvement: a study of Irish software product companies	Coleman and O'Connor	2007	203	IS	Software product firm	Qual	Ireland
Ignorant and impatient internationalization?: the Uppsala model and internationalization patterns for Internet-related firms	Mats and Peter	2007	96	Mgmt	Internet start-ups	Qual	Sweden
Taking advantage of digital opportunities: a typology of digital entrepreneurship	Hull and Hair	2007	30	Entrep	Digital start-up	Concep	USA
Innovation and collaboration in virtual teams of e-entrepreneurs: case evidence from the European tourism industry	Matlay and Westhead	2007	23	Entrep	Tourism SMEs	Qual	Europe
Internet entrepreneurship and economic growth	Post and Pfaff	2007	3	Eco	Entrepreneurial environment in India	Concep	India
An investigation into software development process formation in software start-ups	Coleman and O'Connor	2008	46	IS	Small software start-up	Qual	Ireland
What do business models do?: innovation devices in technology entrepreneurship	Doganova and Eyquem-Renault	2009	690	Entrep	Internet start-ups	Qual	France
The life cycle of an internet firm: scripts, legitimacy, and identity	Drori	2009	98	Entrep	Internet start-ups	Qual	USA
Critical success factors for e-commerce entrepreneurship: an empirical study of Thailand	Sebora et al.	2009	76	Entrep	E-commerce entrepreneurs	Quant	Thailand
Competence of IT professionals in e-business venture teams: the effect of experience and expertise on preference structure	Kollmann et al.	2009	43	IS	eBusiness venture teams	Quant	Germany
A conceptual framework for describing online entrepreneurship	Dheeriyaa	2009	12	Entrep	Internet start-ups	Concep	USA
Educating Students for e-entrepreneurship in the UK, the USA and China	Millman et al.	2009	5	Edu	University students	Mixed	UK, USA, China
Network dynamics and new ventures in China: A longitudinal study	Batjargal	2010	48	Entrep	Internet start-ups	Quant	China
The differential impact of the internet on spurring regional entrepreneurship	Cumming and Johan	2010	42	Entrep	Geographic eco-system	Quant	Rural communities in Alberta, Canada
Digital entrepreneurship and its sociomaterial enactment ^a	Davidson and Vaast	2010	39	Entrep	Internet entrepreneurship	Qual	USA
Entrepreneurship education and students' internet entrepreneurship intentions: evidence from Chinese HEIs	Millman	2010	34	Entrep	University students	Mixed	China
International entrepreneurship in internet-enabled markets	Reuber and Fischer	2011	131	Entrep	Firms in internet-enabled markets	Lit rev	Canada
Exploration of process and competitive factors of entrepreneurship in digital space: a multiple case study in Iran	Hafezieh et al	2011	17	Entrep	Internet start-ups	Qual	Iran
Effectuation, causation, and bricolage: a behavioral comparison of emerging theories in entrepreneurship research	Fisher	2012	438	Entrep	Digital start-up	Qual	USA
Phase 3							
Entrepreneurship, muddling through, and Indian Internet-enabled SMEs	Javalgi et al.	2012	21	Mgmt	Internet firms	Qual	India
Entrepreneurship in innovation ecosystems: entrepreneurs' self-regulatory processes and their implications for new venture success	Nambisan and Baron	2013	242	Mgmt	Innovation eco-system	Concep	USA
The early stage software startup development model: a framework for operationalising lean principles in software startups ^b	Bosch et al.	2013	84	IS	Software start-ups	Qual	Sweden
A two-tier business model and its realization for entrepreneurship	Huang	2013	38	Mgmt	Internet firms	Concep	Taiwan
Market orientation in digital entrepreneurship: advantages and challenges in a Web 2.0 networked world	Hair	2013	7	Entrep	Digital start-up	Concep	USA
The role of universities as educators in the UK Internet start-up ecosystem: research opportunities. ^a	Ratzinger et al.	2013	5	Entrep	Internet start-up founders	Qual	UK
Building international entrepreneurial virtual networks in cyberspace	Sigfusson and Chetty	2013	0	Entrep	International entrepreneur	Qual	Iceland
Software development in startup companies: a systematic mapping study	Paternoster et al.	2014	178	IS	Software start-ups	Lit rev	Sweden
Designing business models for the internet of things	Westerlund et al.	2014	145	IS	Companies in IoT	Concep	Canada
Why early-stage software startups fail: a behavioral framework ^a	Giardino	2014	39	IS	Software start-ups	Qual	Italy

International entrepreneurship in the network economy: internationalization propensity and the role of entrepreneurial orientation	Kollmann and Christofor	2014	15	Entrep	Internet start-up	Quant	Germany
Everyday digital entrepreneurship: the inception, shifts, and scaling of future shaping practices ^a	Keslestyn and Henfridson	2014	4	Entrep	User entrepreneur	Qual	UK
Software startup growth: the role of dynamic capabilities, IT innovation and customer involvement ^a	Shi et al.	2014	3	IS	Software start-ups	Mixed	Australia
Key challenges in early stage software start-ups ^a	Giardino et al.	2015	25	IS	Software start-ups	Mixed	Italy and Norway
Business model development, founders' social capital and the success of early stage internet start-ups: a mixed-method study	Spiegel et al.	2015	12	IS	Internet start-up founders	Mixed	Germany
The shareconomy as a precursor for digital entrepreneurship business models	Richter et al.	2015	8	Entrep	Shareconomy	Lit rev	Finland
Business models in a new digital culture: the open long tail model	Rieple	2015	8	Mgmt	Digital start-up	Qual	Europe
A literature Review of e-entrepreneurship in emerging economies: positioning research on Latin American digital startups ^b	Quinones et al.	2015	5	Entrep	e-entrepreneurship	Lit rev	Latin America, emerging markets
The role of open innovations in the development of e-entrepreneurship ^a	Jelonek	2015	5	IS	Medium sized food processing companies	Qual	Poland
The meaning of virtual entrepreneurship in social virtual worlds.	Jung and Pawlowski	2015	5	IS	Virtual entrepreneurs in Second Life virtual world	Qual	US
Guidelines for e-startup promotion strategy	d'Avino	2015	2	Mkt	early stage start-up	Qual	Italy - Single case study for testing
Accelerating web-entrepreneurship in local incubation environments ^a	Agostinho and Lampathaki	2015	1	IS	Digital start-up	Action	Portugal and Spain
Early-stage software start-up survival: the effects of managerial actions on firm performance ^a	Shi et al.	2015	1	IS	Early stage software start-up	Quant	Australia
Unraveling legitimation strategies of Chinese Internet start-ups	Xiaohua	2015	1	Entrep	Digital firm	Qual	China
Digital entrepreneurship: toward a digital technology perspective of entrepreneurship	Nambisan	2017	129	IS	Digital start-up	Concep	USA
Software development in startup companies: the greenfield startup model	Giardino et al.	2016	69	IS	Digital start-up	Qual	Norway
Business models and opportunity creation: how IT entrepreneurs create and develop business models under uncertainty	Ojala	2016	19	Entrep	Cloud gaming start-up	Qual	Finland
Internet of things capability and alliance: entrepreneurial orientation, market orientation and product and process innovation	Xiaoyu et al.	2016	16	Entrep	IoT ventures	Quant	China
Effectuation and causation in new internet venture growth: the mediating effect of resource bundling strategy	Guo et al.	2016	7	Entrep	Internet venture	Quant	China
"Fake it until you make it": business model conceptualization in digital entrepreneurship	Standing and Mattson	2018	5	Entrep	Digital start-up	Qual	Denmark, Australia
Digital entrepreneurship of born digital and grown digital firms: comparing the effectuation process of Yihaodian and Suning ^a	Leong et al.	2016	1	Entrep	Digital start-up	Qual	China
Young entrepreneurs and the digital space: case studies from the UAE	van Horne et al.	2016	1	Entrep	Entrepreneur	Qual	UAE
Digital entrepreneurship: research and practice ^a	Zhao and Collier	2016	0	Entrep	Digital start-up	Concep	Australia
Case study of communicating digital entrepreneurship in a digital age: the beginning of 'Be my eyes'. ^a	Kampf and Trapp	2016	0	Entrep	Digital start-up - app	Qual	Denmark
A network platform for creating digital entrepreneurship in cloud environment based on big data ^a	Beyadar et al.	2016	0	IS	Cloud start-ups	Concep	Iran
Project management: model research in success rate of a digital start-up project ^a	Karmito et al.	2016	0	Entrep	Digital startup	Quant	Indonesia
Minimum viable product or multiple facet product? the role of MVP in software startups. ^a	Duc and Abrahamsson	2016	0	IS	Early stage software start-up	Qual	Norway
What drives students' cyber entrepreneurial intention: the moderating role of disciplinary difference	Wang et al.	2016	0	Entrep	University students	Quant	Taiwan
The digital entrepreneurial ecosystem	Sussan and Acs	2017	55	Entrep	Marketplaces	Concep	USA
Growing on steroids: rapidly scaling the user base of digital ventures through digital innovation	Huang et al.	2017	14	IS	Digital startup	Qual	China
A web of opportunity or the same old story? women digital entrepreneurs and intersectionality theory	Martinez Dy et al.	2017	8	Mgmt	Women digital entrepreneurs	Qual	UK
Digital affordances, spatial affordances, and the generis of entrepreneurial ecosystems	Autio et al.	2017	6	Entrep	Accelerators	Concep	UK, USA
Internet entrepreneurship and "the sharing of information" in an Internet-of-Things context: the role of interactivity, stickiness, e-satisfaction and word-of-mouth in ...	Yu et al.	2017	5	Mkt	SME	Quant	USA
Digital entrepreneurship in a resource-scarce context: a focus on entrepreneurial digital competencies	Ngoasong	2018	3	Entrep	Digital start-up	Qual	Cameroon
Digital technologies as external enablers of new venture creation in the IT hardware sector	von Briel et al.	2017	3	Entrep	IT hardware	Concep	Australia
The role of entrepreneurial knowledge as a competence in shaping Iranian students' career intentions to start a new digital business	Ahmad et al.	2017	3	Entrep	Student	Quant	Iran
Business model innovation of startups developing multisided digital platforms ^a	Still et al.	2017	2	Entrep	Digital platform start-up	Qual	Finland
Digital entrepreneurship: innovative business models for the sharing economy	Richter et al.	2017	1	Entrep	Shareconomy firm	Qual	Germany, Austria, Switzerland
Addressing voids: how digital start-ups in Kenya create market infrastructure ^b	Drouillard	2017	0	Entrep	Marketplace platform start-ups	Concep	Kenya
Finding the unicorn: predicting early stage startup success through a hybrid intelligence method. ^a	Dellerman et al.	2017	0	IS	Start-up	DSR	Germany
Are software startups applying agile practices? The state of the practice from a large survey ^a	Pantiuchina et al.	2017	0	IS	Software start-ups	Quant	Italy
Digital technology entrepreneurship: a definition and research agenda	Giones and Brem	2017	0	Entrep	Digital start-up	Concep	Denmark

Digital entrepreneurship eco-system as a new form of organising: the case of Zhongguancun	Li et al.	2017	0	Entrep	Digital entrepreneurship eco-system	Qual	China
The impact of digital start-up founders' higher education on reaching equity investment milestones	Ratzinger et al.	2018	0	Entrep	Digital start-up founder	Quant	UK
Entrepreneurship in digital platforms: a network-centric view	Srinivasan and Venkatraman	2018	0	Entrep	Digital platforms	Concep	US
Blockchain entrepreneurship opportunity in the practices of the unbanked	Larios-Hernandez	2017	0	IS	Blockchain technology	Qual	Mexico
The Internet of Things and new business opportunities	Krotov	2017	0	IS	IoT	Concep	US
Using insider action research in the study of digital entrepreneurial processes: a pragmatic design choice	Nzembayie	2017	0	Entrep	e-learning start-up	IAR	Ireland
Exploration of technical debt in start-ups ^a	Klotins et al.	2018	0	IS	Technical debt	Qual	Sweden
Ways to cross the rubicon: pivoting in software startups ^a	Terho et al.	2018	0	IS	Pivot	Qual	Finland
Digital disruptors: on the potentials and characteristics of digital knowledge intensive entrepreneurial ventures ^a	Lassen et al.	2018	0	Entrep	Digital knowledge intensive enterprises	Concep	Sweden
Company building: a new phenomenon of corporate venturing? ^a	Kullik et al.	2018	0	Mgmt	Corporate firm	Qual	Germany
A conceptual framework of Lean startup enabled internal corporate venture ^a	Edison	2018	0	IS	Lean startup	Qual	Italy
Women entrepreneurship and digital technologies: toward a research agenda ^a	Paoloni et al.	2018	0	Entrep	Women founders	Lit rev	Italy
Digital entrepreneurship and field conditions for institutional change: investigating the enabling role of cities.	Geissinger et al.	2019	0	Entrep	City	Mixed	Stockholm
Changing trends in internet startup value propositions, from the perspective of the customer.	Le and Suh	2019	0	Entrep	Internet start-ups	Quant	Korea
Software engineering in start-up companies: an analysis of 88 experience reports.	Klotins et al.	2019	0	IS	Software start-ups	Qual	Sweden
Digital subsistence entrepreneurs on Facebook	Delacroix et al.	2019	0	Entrep	Subsistence entrepreneurs	Qual	France
Digital academic entrepreneurship: the potential of digital technologies on academic entrepreneurship.	Rippa and Secundo	2019	0	Entrep	University	Lit rev	Italy
"To boldly go where no [man] has gone before" - institutional voids and the development of women's digital entrepreneurship	McAdam et al.	2019	0	Entrep	Female entrepreneur	Qual	Saudi Arabia
Moving a mountain with a teaspoon: toward a theory of digital entrepreneurship in the regulatory environment	Dong	2019	0	Entrep	Digital start-up	Qual	Netherlands
Peer-to-peer selling in online platforms: a salient business model for virtual entrepreneurship	Chandna and Salimath (2018)	2018	0	Entrep	Virtual enterprises on Etsy P2P selling platform	Quant	US
Agile business model innovation in digital entrepreneurship: Lean startup approaches	Ghezzi and Cavallo	2018	0	Entrep	Multi-sided platforms	Qual	Italy
Different patterns in the evolution of digital and non-digital ventures' business models.	König et al.	2019	0	Entrep	Digital and non-digital start-ups at early stage	Quant	Germany
Get the show on the road: go-to-market strategies for e-innovations of start-ups	Kuester et al.	2018	0	Entrep	e-innovation start-ups	Qual	Germany
Straight from the horse's mouth: founders' perspectives on achieving 'traction' in digital start-ups	Zaheer et al.	2019	0	Entrep	Digital start-up founder	Qual	Australia
Digital entrepreneurship: a research agenda on new business models for the twenty-first century	Kraus et al.	2019	0	Entrep	Digital start-up	Lit rev	France
Digital startups and the adoption and implementation of Lean startup approaches: effectuation, bricolage and opportunity creation in practice.	Ghezzi	2019	0	Entrep	Digital start-up	Mixed	Italy
Emancipation through digital entrepreneurship? A critical realist analysis	Martinez Dy et al.	2018	0	Mgmt	Female entrepreneur	Qual	UK
Researching pure digital entrepreneurship: a multimethod insider action research approach	Nzembayie et al.	2019	0	Entrep	e-learning start-up	IAR	Ireland
The digital transformation of innovation and entrepreneurship: progress, challenges and key themes	Nambisan	2019	0	Entrep	Digital innovation and entrepreneurship	Edit	USA
Exploring the determinants of digital entrepreneurship using fuzzy cognitive maps	Ladeira et al.	2019	0	Entrep	Digital entrepreneurship participant	Qual	Portugal
Editorial on generating business and social value from digital entrepreneurship and innovation	Fang et al.	2019	0	IS	Digital entrepreneurship	Edit	Hong Kong
Digital innovation and venturing: an introduction into the digitalization of entrepreneurship	Kraus et al.	2019	0	Entrep	Digital entrepreneurship	Lit rev	France
Lean business models change process in digital entrepreneurship	Balocco et al.	2019	0	Mgmt	Digital start-up	Qual - Case studies	Italy
Linking information systems and entrepreneurship: a review and agenda for IT-associated and digital entrepreneurship research	Steininger	2019	0	IS	IT entrepreneurship	Lit rev	Germany
Not all digital venture ideas are created equal: implications for venture creation processes	Von Briel et al.	2019	0	IS	Digital start-up	Concep	Australia
When guanxi meets structural holes: exploring the guanxi networks of Chinese entrepreneurs on digital platforms	Liu et al.	2018	0	IS	Digital start-up founder	Mixed	China

Cits: Google Scholar citations.

Disc: main discipline that the article is rooted in: IS: information sciences, Edu: education, Entrep: entrepreneurship, Eco: economics, Mgmt: management, Fin: finance, Mktg: marketing.

UoA: unit of analysis.

Meth: methodology: Qual: qualitative, Quant: quantitative, Concep: conceptual, Mixed: mixed methods, Lit rev: literature review, Sys dyn: system dynamics simulation, DSR: design science research, IAR: insider action research, Action: action research.

Geo. Loc: geographical location of the research setting or if not known or not empirical then the author's location.

%South Korea author but global database.

^a Conference paper/proceedings.

^b Book chapter.

Appendix 2. Supporting publications

Publication title	Authors(s)	Year	Discip
Digital entrepreneurship: doing business on the information superhighway	Rosenbaum and Cronin	1993	IS
The digital economy: promise and peril in the age of networked intelligence ^b	Tapscott	1996	Mgmt
Business models for electronic markets	Timmers	1998	Mgmt
Information rules: A strategic guide to the network economy ^b	Shapiro and Varian	1999	Eco
Getting real about virtual commerce	Evans and Wurster	1999	Mgmt
The truth about Internet business models ^c	Rayport	1999	Mgmt
Managing in the new economy ^b	Magretta	1999	Mgmt
Business models for Internet-based e-commerce: An anatomy	Mahadevan	2000	Mgmt
Value creation in e-business	Amit and Zott	2001	Mgmt
Internet business models and strategies ^b	Afuah and Tucci	2001	Mgmt
E-business model design, classification, and measurements	Dubosson-Torbay et al.	2002	IS
The net-enabled business innovation cycle and the evolution of dynamic capabilities	Zahra and George	2002	IS
Toward an understanding of Internet adoption at the marketing/entrepreneurship interface	McGowan and Durkin	2002	Mktg
Venture capital financing and the growth of startup firms	Davila et al.	2003	Fin
The disruptive nature of information technology innovations: the case of internet computing in systems development organisations	Lyytinen et al.	2003	IS
An ontology for e-business models ^a	Osterwalder and Pigneur	2003	IS
Electronic commerce and organisational innovation: aspects and opportunities	Zwass	2003	Mgmt
E-business strategies and internet business models: how the internet adds value	Lumpkin and Dess	2004	Mgmt
The entrepreneur's business model: toward a unified perspective	Morris et al.	2005	Mgmt
Business model design and the performance of entrepreneurial firms	Zott and Amit	2007	Entrep
Digital artefacts as quasi-objects: qualification, mediation and materiality	Ekbja	2009	IS
Organisational dynamic capability and innovation: an empirical examination of internet firms	Liao et al.	2009	Mgmt
Business models, business strategy and innovation	Teece	2010	Mgmt
Strategic development of business models: implications of the Web 2.0 for creating value on the internet	Wirtz et al.	2010	Mgmt
Business model generation: a handbook for visionaries, game changers, and challengers ^b	Osterwalder and Pigneur	2011	Entrep
Business model innovation in entrepreneurship	Trimmi and Berbegal-Mirabent	2012	Entrep
Organising for innovation in the digitised world	Yoo et al.	2012	IS
Research commentary-the new organising logic of digital innovation: an agenda for information systems research	Yoo et al.	2010	IS
The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses ^b	Ries	2011	Entrep
Why the Lean start-up changes everything	Blank	2013	Entrep
Digital business strategy: toward a next generation of insights.	Bharadwaj et al.	2013	IS
The generative mechanisms of digital infrastructure evolution	Henfridsson and Bygstad	2013	IS
The ambivalent ontology of business models	Kallinikos et al.	2013	IS
New venture teams: a review of the literature and roadmap for future research	Klotz et al.	2013	Entrep
Designing business models and similar strategic objects: the contribution of IS	Osterwalder et al.	2013	IS
Digital product innovation within four classes of innovation networks	Lyytinen et al.	2016	IS
The future of digital business innovation: trends and practices ^b	Morabito	2016	IS
Digital innovation management: reinventing innovation management research in a digital world	Nambisan et al.	2017	IS
Assessing value creation in digital innovation ecosystems: a social media analytics approach	Suseno et al.	2019	IS

Disc: Main discipline that the article is rooted in: IS: information sciences, Entrep: Entrepreneurship, Eco: Economics, Mgmt: Management, Fin: Finance, Mktg:

Marketing.

^a Book chapter.

^b Book.

^c Magazine article.

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