
Guest editorial: Artificial intelligence as an enabler for entrepreneurs: an integrative perspective and future research directions

Guest editorial

801

Introduction

In this article, we explore the potential of artificial intelligence (AI) as a general-purpose technology to enhance and augment entrepreneurial decision making and activities during the venturing process (Crafts, 2021; [Chalmers et al., 2021](#)). Entrepreneurship constitutes a vital activity for the dynamic economic evolution of countries and regions ([Reynolds, 2007](#)). Entrepreneurs create and nurture multiple critical drivers for evolving business ecosystems (Stam and Van De Ven, 2021): they innovate by introducing new products and processes in the marketplace ([Acs, 2006](#); [Acs and Audretsch, 2003](#)), play an essential role in the emergence of entirely new market categories ([Navis and Glynn, 2010](#)) and engage in opportunity exploration with significant knowledge spillovers ([Audretsch and Keilbach, 2004](#)). In their combination, these drivers contribute to the economic growth of both developed countries ([Stel et al., 2005](#)) and emerging economies ([McMillan and Woodruff, 2002](#)). Beyond the economic impact, entrepreneurs play a central role in societal transformation by bringing novel solutions to critical challenges such as environmental degradation ([Anderson, 1998](#); [Dean and McMullen, 2007](#); [Hörisch et al., 2017](#); [O'Neil and Ucbasaran, 2016](#)), and social inequalities ([Mongelli and Rullani, 2017](#); [Pathak and Muralidharan, 2018](#)). Further, entrepreneurs help develop and transfer emerging technologies from laboratories to real applications in business and societies ([Wright, 2014](#)). Therefore, it is not surprising that governments substantially promote entrepreneurial ecosystems in economic contexts and educational systems (Cao and Zhi, 2021; Stam and Van De Ven, 2021).

Despite its critical importance, the process of entrepreneurial venturing remains a highly uncertain activity (Townsend et al., 2018). Specifically, nascent entrepreneurs face substantial risks and uncertainty levels, as their venturing decisions and action often occur in ill-structured and fast-changing information environments ([Townsend and Hunt, 2019](#)). A determinant role of entrepreneurship is to explore opportunities in an undetermined future, which leaves little to no predictability about the expected outcomes based on present facts and data. Consequently, the crucial activity of entrepreneurial opportunity recognition requires a high level of imagination and creativity ([Kier and McMullen, 2018](#)). A core challenge to opportunity recognition is to make sense of potential exponentially growing and highly dispersed amounts of data to spot underlying patterns that constitute a potential business opportunity ([Baron, 2006](#)). Recognizing opportunities under uncertain conditions represents the most critical and challenging entrepreneurial task in the venturing journey (Foss and Klein, 2020).

In this light, the recent rapid advancement of AI may help cope with uncertainty by alleviating the complexity of data analysis in entrepreneurial decision making. AI provides a powerful way to automatize data interpretation, gain insights from this data and achieve intended goals ([Chalmers et al., 2021](#); Haenlein and Kaplan, 2019). AI comprises machine learning (ML), which stands for the capability of algorithms to learn from large datasets during problem-solving tasks (Taddy, 2019). AI and its inherent (ML) capabilities provide the potential to automate the most tedious tasks and augment entrepreneurial decisions



International Journal of
Entrepreneurial Behavior &
Research
Vol. 29 No. 4, 2023
pp. 801-815
© Emerald Publishing Limited
1355-2554
DOI 10.1108/IJEBR-04-2023-033

with new insights that help lower uncertainty. As a powerful general-purpose technology, AI is revolutionizing entire economic sectors and society at large, and there is little doubt that its predictive power can play a role in facilitating entrepreneurial action (Obschonka and Audretsch, 2020; Ghimire *et al.*, 2022). However, to date, entrepreneurship scholars have paid only scant attention to the role and impact of AI on the entrepreneurial venturing process.

The *IJEER* special issue on “*Artificial Intelligence as an Enabler for Entrepreneurs*” is dedicated to delivering novel insights on how entrepreneurs can use AI and ML to assist with their central tasks during the opportunity recognition and exploitation phases of venturing. In the following sections, we first review the current literature at the intersection of AI and entrepreneurship. We then develop in a second step an integrative framework that helps entrepreneurs leverage the analytic power of AI in their routine tasks and decisions. We present the articles in this special issue and explain how they advance our understanding of the impact of AI on entrepreneurship. Finally, we develop some guidance for future research avenues on this fast-evolving phenomenon on the enabling role of AI for entrepreneurial decisions and actions in highly uncertain contexts.

Artificial intelligence and the entrepreneurial process

AI does not refer to any specific technology but comprises a set of related technologies, including machine learning, deep learning, natural language processing or image recognition. AI can be understood as an encompassing label for these emerging technologies that rely on exponentially growing machine capacities to mimic and reproduce human cognition for accomplishing specific routinized tasks (Goodfellow *et al.*, 2018; Russell and Norvig, 2016). Numerous definitions for AI exist in the literature (a good one is Agrawal *et al.*, 2018). As a comprehensive review of the various definitory approaches to AI goes beyond the scope of this article, for this special issue we define *AI as the set of technologies that seeks inspiration from human intelligence to perform tasks commonly associated with the human mind*. Given the rapid evolution of AI-based technologies, this straightforward definition accommodates a wide variety of possible future developments for algorithm-enhanced decision-making in the entrepreneurship field. In this article, we primarily focus on ML techniques that learn from structured data, that is, labeled inputs such as sales figures or unstructured data, that is, unlabeled inputs such as texts, to envision what AI may be able to do to assist entrepreneurs in their core routine tasks.

In general terms, the entrepreneurial process consists of a discovery phase and an exploitation phase (Davidsson, 2006; Shane and Venkataraman, 2000). The discovery phase comprises entrepreneurial reasoning and activities to identify venture opportunities and generate ideas to seize them effectively. The exploitation phase comprises entrepreneurial reasoning and decisions to transform the formulated venturing ideas into actions. Constitutive elements of the exploitation phase consist of designing a business plan, acquiring resources, gaining legitimacy and ensuring stakeholder support to establish the new venture. Brixy *et al.* (2012) proposed that a third phase, called the “entrepreneurial” phase, consists of sustainably organizing the activities of the new entity once it is founded and has survived for more than three years in its competitive environment. We outline below several ways in which AI can assist entrepreneurs in their reasoning and decision making across these three phases of the venturing process.

Discovery phase

In the discovery phase, entrepreneurs have the intention to start a business but are not yet actively seeking to do so (Klyver, 2007). They engage in opportunity search behavior

by exploring their environment and external knowledge bases to identify potential business ideas (Klyver, 2007) and interact with their surroundings to evaluate the feasibility of the ideas (Seibert *et al.*, 2021). During the discovery phase, entrepreneurs scan and evaluate a potentially large number of ideas and dispersed data to recognize an opportunity with little to no information about future developments (Klyver, 2007). In response, successful entrepreneurs are able to leverage high levels of rational and intuitive reasoning and various cognitive abilities of curiosity, alertness and awareness (Arikan *et al.*, 2020).

Entrepreneurial creativity is an inherent part of the discovery phase as it stimulates innovativeness, proactiveness and risk-taking (Kuratko and Morris, 2018). AI can enable the creativity of entrepreneurs directly by providing them with a large range of ideas that go beyond what they can come up with themselves, but also indirectly by reducing receptive, but time-consuming tasks and freeing up time for creative explorations of entrepreneurial opportunities (Hisrich and Soltanifar, 2021).

During the discovery phase, AI systems can also help entrepreneurial decisions by enhancing opportunity-related search processes, given their ability to analyze large amounts of structured and unstructured data to see patterns imperceptible to human minds (Chalmers *et al.*, 2021). A specific application of AI to support opportunity recognition uses NLP algorithms that search and analyze textual discussions on online forums to identify product and service ideas. The AI-based algorithms help identify patterns of common characteristics or features for new products or services that become salient in forum member discussions. Agrawal *et al.* (2018) provide a related case example of the predictive power of AI supporting entrepreneurial processes in the discovery phase. The case concerns a startup that uses AI to predict the binding affinity of molecules to help pharmaceutical companies identify which molecules are most likely to become effective drugs. Their AI tool considerably reduces the time needed for manual testing of molecules, reducing overall costs and speeding up the discovery and development of new drugs. Overall, AI can assist entrepreneurs by optimizing the analysis of the exponentially increasing amount of dispersed data to identify patterns and save time with predictions of outcomes rather than manual testing of new properties. The discovery phase also involves selecting promising ideas from the larger pool of potential ideas (Brockner *et al.*, 2004). Entrepreneurs can use ML techniques to score ideas along a set of input parameters to put more weight on some attributes or features that matter for the new business (Obschonka and Audretsch, 2020). The scoring may also combine past data on product success to identify the attributes or features that are likely to match with customer expectations (Finlay, 2021).

Exploitation phase

Following the exploration phase, the exploitation phase (Bhave, 1994) is concerned with the entrepreneurial decisions and actions taken to effectively pursue and seize identified economic opportunities (Plummer *et al.*, 2007). Entrepreneurs acquire resources to build full-scale operations for the new products or services to generate future rent (Choi *et al.*, 2008). The speed and time-to-market play a critical role in the future success of any entrepreneurial venturing effort in that these factors provide entrepreneurs with first-mover advantages in their ecosystems (Lieberman and Montgomery, 1988).

Here again, AI can help speed up the processes linked to exploitation. In the era of industry 4.0, digital tools decouple labor costs from economic outputs (Chalmers *et al.*, 2021) such that the cost of scaling up a business may be drastically limited by resorting to efficient digital tools (Corvello *et al.*, 2021). At the funding stage, AI-based tools such as Brandmark and Smartwriter provide cost-efficient solutions for automating the creation of logos as well as personalized emails to promote the new products within target communities of users and attract attention from potential investors (Hisrich and Soltanifar, 2021; Mileva, 2022).

AI-based platforms can also help automate customer relationship management (CRM), such as customer acquisition (selecting and targeting customer profiles who match the new product), customer service (chatbots that answer queries and handle minor issues with product use) and aftersales service (handling queries for product replacement and repair) (Chatterjee *et al.*, 2021). Recent research suggests that integrating AI into CRM tools might be particularly relevant in times of crisis such as the Covid-19 pandemic as it helps businesses to quickly adapt to significantly changed consumer behavior (Chaudhuri *et al.*, 2022). Furthermore, NLP and sentiment analysis tools can assist with managing the online reputation of the newly established entity by monitoring online conversations about the new product or service and automating responses to complaints on social media or review platforms (Yadav and Vishwakarma, 2020). Conversational AI in the form of bots and voice assistants are other tools that have the potential to enable or optimize customer interaction (Gentsch, 2019).

The tasks described above are usually time-consuming and repetitive but essential during the venture emergence stage. The role of AI-based tools is to support entrepreneurial decision making by automating tedious and repetitive tasks so that entrepreneurs can focus on critical activities such as promoting their new venture to qualified investors and acquiring resources to start the operations. In sum, the analytic power of AI-based algorithms essentially augments entrepreneurial decisions and actions by automating tedious tasks in the exploitation phase (Raisch and Krakowski, 2021).

Entrepreneurial phase

The entrepreneurial phase involves organizing the daily routines of the newly established entity to ensure that the new product or service is delivered to customers and income flows in to cover costs (Lewis and Churchill, 1983; Scott and Bruce, 1987). Furthermore, entrepreneurs need to routinize tasks of hiring and retaining people, continued acquisition of resources and customers, gaining the trust of suppliers and establishing coherent and attractive marketing strategies (Tuazon, Bellavitis and Filatotchev, 2018).

The rapid development of deep-learning approaches in ML opens opportunities to deploy AI solutions concerning these inherent tasks in the entrepreneurial phase (Ghimire *et al.*, 2020; Upadhyay *et al.*, 2021). AI-based deep learning tools can automate a large spectrum of organizational processes across the primary functions (Brynjolfsson, Mitchell and Rock, 2018; Acemoglu and Restrepo, 2018). For example, ML tools such as PeopleDoc started automating payroll tasks and several contractual aspects of hiring and staff management processes in human resource management. In financial management, AI tools such as QuickBooks help automate bookkeeping and more basic accounting tasks that usually require tedious and repetitive manual entries. AI scans are more accurate than humans in detecting quality defaults in routinized production processes of firms. In marketing, Salesforce can automate entire processes in CRM (Manyika *et al.*, 2017). Using AI-based management tools in the venture emergence stage is particularly relevant as research is showing that the majority of new ventures tend to default within the first three to five years of operations (Aspelund *et al.*, 2005; Stenholm and Renko, 2016; Tatikonda *et al.*, 2013). In this perspective, AI tools help alleviate entrepreneurial reasoning and decision-making from low value-added daily tasks and focus on added-value tasks critical for survival and growth.

Implications of AI as enabler for entrepreneurs

Table 1 summarizes the ways AI can assist and augment entrepreneurs in their roles across the three phases of the entrepreneurial process.

Table 1.
AI across the three
phases of the
entrepreneurial
process

Venturing phases	Exemplary tasks which AI applications can execute
Discovery Phase	<i>Idea generation</i> Opportunity search using NLP to analyze contents in forums <i>Predictions of customer preferences</i> Sentiment analysis to capture the preferences of product attributes or features <i>Down selection of ideas</i> Using scoring to down select the most promising ideas for further development <i>Testing</i> Deep learning techniques to test an idea using a combination of small samples of customers and past preferences
Exploitation Phase	<i>Funding</i> Automated personalized emailing to potential investors <i>Initial market development</i> Automation of consumer queries through chatbots and product promotion in target online communities <i>Customer relations</i> Monitoring of online reputation through automated responses to concerns and issues expressed by customers
Entrepreneurial Phase	<i>Human resource management</i> Automation of payroll and personnel contracts <i>Finance</i> Automated bookkeeping and accounting <i>Marketing</i> Automation of entire CRM processes <i>Production</i> Total quality management through deep learning for default detection

As a general-purpose technology, AI transforms organization processes by automating tedious tasks and augmenting managers' roles (Chalmers *et al.*, 2021; von Krogh, 2018). Thus, it is not surprising that AI capabilities will also affect the entrepreneurial process as some of the tasks tend to share similarities with tasks in innovation management and, more generally, with the management of a newly established organization. We believe that AI can assist entrepreneurs following recent attempts to end the stalemate between automation and augmentation (Amabile, 2020; Cockburn, Henderson and Stern, 2018; Raisch and Krakowski, 2021) with the automation of tedious tasks while augmenting their role with advanced predictive capabilities. Two critical elements for entrepreneurs are time and resources: We are convinced that AI can speed up some of the most time-consuming tasks while expanding the pool of resources they can resort to through the increasing digital tools at their disposal (Gavrila and Ancillo, 2021; Kraus *et al.*, 2018).

For AI to achieve its potential as a strategic enabler, Thurai and McKendrick (2022) emphasize that AI tools need to be reliable, avoid data biases and provide ethical and moral decisions that are transparent and explainable. These issues have long been discussed in the wider business and management literature, but are worth reiterating as they apply equally to entrepreneurship. They form the building blocks that are necessary for AI to become an enabler of entrepreneurial venturing. Lastly, current entrepreneurship literature also points towards the important role of AI technological capability, dynamic capabilities as well as strategic intent in ensuring the enabling potential of AI is realized (Chaudhuri *et al.*, 2022).

Articles in this special issue

In their study titled “Artificial intelligence as an enabler for entrepreneurs: a systematic literature review and an agenda for future research”, Giuggioli and Pellegrini (2023) conducted a

systematic literature review to investigate the current research understanding of the multifaceted relationship between AI and entrepreneurship. Their study responds to the need to provide a comprehensive academic baseline for the further investigation of the impact the rapid evolution of AI has on entrepreneurial decisions and supporting the venturing journey. Using a carefully sampled dataset of 60 papers, the authors structure their findings for the AI-enabled entrepreneurial process in an interpretation scheme comprising the four dimensions of entrepreneurial opportunity, decision making, performance and education and research. The study findings surface the substantial potential that AI offers on opportunity, decision making and performance as the three constitutive phases of entrepreneurial venturing. This systematic review's resultant interpretative scheme and emerging framework provide a fine-grained view of current AI-based applications, which start to be used during the entrepreneurial phases, thereby detailing and adding substance to the promises and potentials we currently perceive for this phenomenon of interest.

In sum, while the authors systematically uncover and illustrate the potential of AI in entrepreneurship, they likewise caution for a reasonable approach to integrating AI tools as enablers for entrepreneurs, advising involved internal and external stakeholders to carefully balance the benefits and risks of automatizing tasks and decisions within the entrepreneurial venturing process. Entrepreneurs need to reflect on the degree to which they want to depend on AI-based algorithms to make judgments and add to or even replace specific decision processes in the different phases of creating a venture.

Schiavone *et al.* (2023) conducted inductive multiple case research in their study titled "*Designing AI implications in the venture creation process.*" The authors specifically inquire how AI applications and solutions change and shape the diverse phases of the venture creation journey. The study first summarizes in its theoretical background coherently how the venture creation process is impacted by the rise of digital technologies and the predictive capacities of AI. The authors emphasize in their background section that AI is the latest disruptive technology in a long line of digital-driven innovation in business. They accurately state that digital technologies improve and accelerate the transition of the exploration, development and exploitation stages in the start-up creation process. Another crucial aspect the authors discuss in the background is the generativity notion of digital technologies, which enables ventures to recombine constitutive business elements and to assemble, extend and redistribute related functionality of innovative products and services. They then introduce compression, conservation, expansion, substitution, combination and generation as crucial mechanisms related to digitally driven innovation to detail the potential role of AI in venturing processes. Finally, the authors specify the prospecting, development and exploitation phases to delineate the role of AI in building a venture for the subsequent proposition development. The authors develop four interrelated propositions, which they combine into an illustrative figure of a theoretical framework for the role of AI in the venture creation process.

In the empirical section of the study, the authors relied on a theoretical sampling logic to select four cases of European AI ventures. The case data combine interview data with archival records to triangulate the study findings. The authors follow Yin's (2009) case research model by first investigating each case separately and then combining the respective findings in a cross-case analysis. The findings primarily support the formulated propositions on how AI applications support and enhance the three constitutive phases of venture creation. In this respect, the study combines the theoretical delineation of how AI helps create ventures and provides empirically grounded evidence for the specific use cases of AI applications in the venturing process. In sum, the study helps develop a more granular and sequentially structured view of the role and usage of AI tools in venture creation and is one of the first empirical studies examining the mechanisms AI tools enable in this context.

Kulkov (2022) conducted comparative case research titled “*Next-generation business models for artificial intelligence start-ups in the healthcare industry*.” The authors look in detail at the way in which AI is changing entrepreneurial venturing in the context of global healthcare systems. Recently, AI ventures started to enhance crucial healthcare processes such as diagnostics, customized therapeutical approaches and the discovery and development of new pharmaceuticals. Against this background, the research pursues an in-depth investigation of the business model development of AI ventures within the healthcare sector. The theoretical background of the study references specifically Amit and Zott’s (2010, 2012) activity system design framework as a baseline to examine the business model design approaches used in the sampled health care firms,

The authors conducted multiple case research studies on nine European AI start-ups providing healthcare solutions. The data collection comprises semi-structured interviews with CEOs and senior managers of the sampled AI ventures. In addition, the authors collected evidence from various national and regional industrial ratings, firm presentations and websites, press articles and podcasts of leading AI managers in healthcare to triangulate the interview data. Using a narrative and cross-case analytic approach, the authors find three unique business model design elements that commonly manifest for AI healthcare start-ups, further delineated into sixteen frames and three unifying design themes.

The empirical findings show that the sampled AI firms commonly use particular design frames and parameters within the three constitutive design elements of activity system content, governance and structure. For example, narrow specialization is one commonly mentioned design frame within the activity system content element of the business model; SaaS emerged as a common approach in the activity system structure element, and physicians have been identified as a crucial element in the activity system governance element. In addition, the findings surface common design themes that AI ventures commonly refer to, such as improved healthcare access, responsiveness, and privacy. In sum, by systematically examining the business model design of AI firms in the healthcare sector, the study increases our understanding of the role of AI in transforming modern industries.

In their study titled “*Predictions through Lean Start-up? Harnessing AI-based predictions under uncertainty*”, Raneri *et al.* (2023) examine how AI-based models can help assist entrepreneurs in their day-to-day operations. The authors base their research lens on literature addressing entrepreneurial logic for actions and the emerging field of digital entrepreneurship. The research question of their study inquires how entrepreneurs can harness prediction technologies while keeping a control-based, effectual approach to developing new products. From this perspective, they develop a model for which they detail the build-measure predict-learn loop, which helps entrepreneurs benefit from AI’s predictive capacities while simultaneously retaining control over recognizing and seizing opportunities in the market. Based on a single case study dataset, the authors then develop and test a predictive model that aims to provide entrepreneurs with a digital infrastructure for automated testing in their venturing process. The findings surface that the predictive can handle uncertainty epistemologically through accelerated data gathering, ontologically by revealing prior “unknown unknowns” methodologically by accommodating causal and effectual practices. The study’s framing is insightful for the role of AI in entrepreneurship by extending established effectuation and causation perspectives with AI-based infrastructures and predictive techniques that enhance digital ventures entrepreneurs in their recurrent operations.

Interestingly, the study’s findings surface an inherent paradox in applying AI-based tools to enhance entrepreneurial decisions: One paradox lies at the core of this paper. On the one hand, AI-based tools and infrastructures can cope with the growing level of uncertainty in the

entrepreneurial decision context of digital innovation. At the same time, however, entrepreneurs risk getting stuck in pursuing optimal solutions rather than following affordable ones, which constraints their ability to deal with unexpected contingencies (Mansoori and Lackeus, 2020). This paradoxical tension opens up relevant questions for further research on balancing the augmentation vs. automation of decisions in entrepreneurial venturing and using AI-based decision technologies responsibly in a more general context [Raisch and Krakowski \(2021\)](#).

[Baek et al. \(2023\)](#) examine in their article titled “*Quality Evaluation Model of Artificial Intelligence Service for Start-ups*” options for ventures to integrate AI services into their value proposition to customers. The study responds to the lack of an effective evaluation framework to evaluate the quality of AI services, specifically in the entrepreneurial context of start-up creation. Based on a comprehensive review of existing service concepts, the authors develop a model to evaluate AI services’ quality characteristics and measures that support ventures’ development and sustainable growth trajectory. To do so, the study systematically delineates the defining characteristics of AI services, provides several illustrate examples and its inherent features already in use ([Oh et al., 2018](#)), and relies on a survey-based study to evaluate the adequacy and usefulness of the developed AI quality evaluation model. The study findings provide insights for baseline principles that enable the efficient deployment of AI services and their quality assurance in venturing processes. Furthermore, the discussion section elaborates and details the understanding and conceptualization of AI service and specifies its constituent dimensions and measurement items to evaluate customer satisfaction.

The study’s theoretical foundation offers exciting and insightful details on the potential of AI services for start-ups, elaborating on the challenges entrepreneurs currently face to efficiently leverage and integrate AI applications into their venture development. The authors specifically highlight the shortcoming of extant service quality models to capture the full capacities of AI-based service applications, as they imply the novel characteristics of super-connectivity, super-customization and super-intelligence. Consequently, the authors propose a definition of AI service “as a service that embodies intelligent abilities such as human cognition, learning, understanding and judgment in a machine that implements and provides these abilities.” The study relies on a keyword search to identify seven distinct features relating to these three characteristics, which are accurately summarized in a content-analytic table and further detailed in the related text section. The potential of AI services to help develop the customer base for ventures is finally illustrated in the study’s discussion section, with valuable and practical recommendations for practitioners on integrating the powerful features of AI tools into their start-up development. The theoretical contribution resides precisely in identifying and delineating AI services’ distinct dimensions and features in contrast to the more traditional models laid down in extant literature.

We summarize the collective contribution of the selected studies featured in this special issue in [Table 2](#) below. In their combination, the published SI contributions provide a comprehensive picture of the complex and interwoven technological and human aspects and mechanisms in deploying AI-based tools as an enabler for entrepreneurial venturing. The collective insights of the SI articles go beyond the primarily technology-focused approaches, which have been favored to date in extant AI research.

As [Table 2](#) illustrates, the selected studies in this SI provide an insightful and detailed illustration of the various potentials, drivers and conditioning factors determining the deployment of AI tools as enabling technology in entrepreneurial venturing. For example, the studies suggest that current research is still in the early phases of identifying and conceptualizing the tangible value of AI tools for the entrepreneurial venturing journey. All studies reflect in similar ways that scholars and practitioners alike face persistent

Authors	Title of study	Perspective on AI as enabler for entrepreneuring	Research question	Methodology	Contribution
Giuggioli and Pellegrini (2023)	Artificial intelligence as an enabler for entrepreneurs: a systematic literature review and an agenda for future research	<i>Conceptual:</i> Systematic literature review to investigate the current research understanding of the multi-faceted relationship between AI and entrepreneurship	What is the potential use and the impact of the rapidly advancing AI applications on entrepreneurial decisions and supporting the venturing journey?	Systematic literature review of current articles on the phenomenon of interest	The authors develop an interpretation scheme and emerging framework comprising the four dimensions of entrepreneurial opportunity, decision making, performance and education and research for the AI-enabled entrepreneurial process
Schiavone et al. (2023)	Designing AI implications in the venture creation process	<i>Process:</i> The rise of digital technologies and the predictive capacities of AI change the venture creation process. AI is the latest disruptive technology in digital-driven innovation	How do AI applications and solutions change and shape the diverse phases of the venture creation journey?	Inductive multiple case research of four European AI ventures. The case data combines interview data with archival records	The study develops a granular and sequentially structured view of the role and usage of AI tools in the prospecting, development and exploitation phases of venture creation. One of the first empirical studies examining the mechanisms AI tools enable in entrepreneurial venturing
Kulkov (2022)	Next-generation business models for artificial intelligence start-ups in the healthcare industry	<i>Design elements:</i> The study references the activity system design framework to examine business model design approaches used in the sampled care firms	How is AI changing entrepreneurial venturing in the context of global healthcare systems?	Multiple case research on nine European healthcare AI start-ups. Data comprises interviews with CEOs and complementary evidence from industrial ratings, firm presentations and websites, press articles and podcasts of leading AI healthcare managers	Identification of three unique business model design elements that commonly manifest for AI healthcare start-ups, which further delineate into sixteen frames and three unifying design themes

(continued)

Table 2.
Perspectives and contributions on AI as enabler for entrepreneuring

Authors	Title of study	Perspective on AI as enabler for entrepreneuring	Research question	Methodology	Contribution
Lecron, Raneri, Hermans and Fouss (2022)	Predictions through Lean Start-up? Harnessing AI-based predictions under uncertainty	<i>Model development:</i> Developing Build-Measure Predict-Learn Loop, which helps entrepreneurs benefit from AI's predictive capacities while retaining control over recognizing opportunities	How can entrepreneurs harness prediction technologies while keeping a control-based, effectual approach to developing new products?	Single case study dataset to develop and test predictive model providing entrepreneurs with digital infrastructure for automated testing	Shedding light on the role of AI in entrepreneurship by extending established effectuation and causation perspectives with AI-based infrastructures and predictive techniques. Revealing paradoxical tension on balancing the AI-based augmentation vs automation in entrepreneurial venturing
Kim, Baek, Lim and Xiong (2022)	Quality Evaluation Model of Artificial Intelligence Service for Start-ups	<i>Model and Scale Development:</i> Systematic delineation of defining AI service characteristics to develop a model to evaluate AI services“ quality characteristics and measures that support ventures” development	What is an effective evaluation framework to evaluate the quality of AI services in the entrepreneurial context of start-up creation?	Systematic delineation of defining characteristics of AI services with subsequent survey-based study to evaluate the adequacy and usefulness of the developed AI quality evaluation model	Identifying and delineating AI services' distinct dimensions and features contrasts the more traditional models in extant literature. Further detailing understanding of AI services, its constituent dimensions and measurement items to evaluate customer satisfaction

Table 2.

questions regarding how AI's analytic and predictive capacities can reasonably be integrated into the different aspects and phases of entrepreneuring. A general conceptualization approach is to align the capacities of AI tools to the different tasks embedded in the constituent phases of venture creation. This process view makes much sense, as it helps develop a more granular perspective on which AI capacity can serve entrepreneurial reflection and action at which point in time. However, the processual conceptualization of AI's capacities does not address the changes in design and content that occur in response to augmenting or automatizing specific entrepreneurial tasks.

Another collective contribution of the SI studies is to shed light upon essential differences in process, structure, contents and model development for AI application in entrepreneuring. Specifically, the studies complement each other in providing detailed insights into critical dimensions and elements that help shape and define these four

parameters: process, structure, contents and model development. The processual view of AI as enabling tool remains incomplete without looking further into the design themes and elements of the related business models. The business model development requires specifications on effectively leveraging predictive capacities and related digital infrastructure in venture creation. Only the inclusive view on these interrelated dimensions can further advance and enrich the conceptualization of the topic of AI as enable for entrepreneurs. It becomes clear that while AI has immense potential to enhance entrepreneurial venturing, its integration requires a holistic inquiry into the various dimensions that it changes. To this end, we encourage future studies that continue to inquire about process, structure, contents and model development as the four constituent dimensions for AI application in entrepreneuring and further detail its inherent elements and interconnections.

Avenues for future research

Our selection of SI studies sheds light on the conceptual baseline and constituent dimensions of the topic of AI as an enabler for entrepreneurial venturing. It becomes clear that integrating AI into entrepreneuring is simultaneously promising and challenging, as it touches multiple aspects in the interrelated dimensions of process, structure, content and model development. Resulting from the theoretical and empirical insights of this SI, the studies suggest avenues for future research.

For example, exciting and important questions arise regarding AI-enhanced decision making and judgment in entrepreneurial venturing. How can entrepreneurs effectively and responsibly balance the tensions between the automation *vs* augmentation of entrepreneurial decision making in the different phases of venture creation? How can they reasonably judge AI's various risks and benefits by involving stakeholders and creating strategic approaches to technology integration? We likewise see the topic of AI-enhanced business model design and strategy as critical to addressing in further research. How and to which degree can AI capacities help create unique value propositions by supporting inimitable interdependencies among value creation and value capture activities? To which extent are AI-enhanced business model configurations transferable across different business contexts and industries? The access to and use of AI resources in entrepreneurial ecosystems represent a third promising avenue for further research. AI applications as a shared resource in a network of ventures lead to resource access and sharing questions amongst entrepreneurial actors. Moreover, how can entrepreneurs individually and collectively handle the power of prominent AI players influencing the dynamics of ventures in entrepreneurial ecosystems? Along these lines, we summarize these exemplary avenues for future research in [Table 3](#).

Conclusion

The main contribution of our article is an integrative perspective of essential dimensions and future research avenues for the topic of AI as an enabler for entrepreneurial venturing. We have identified and elaborated upon constituent dimensions and interrelations, which are crucial to theorize further the potentials and challenges determining the effective use of AI in entrepreneuring, and we have provided a comprehensive summary of inherent implications and future research directions for the topic. In sum, our integrative view and resultant future perspectives on AI as an enabler for entrepreneurial venturing expand and further detail this exciting and rapidly evolving phenomenon of interest.

Entrepreneurial venturing dimension	Avenues for future research	Specified research questions
AI-Enhanced Decision Making and Judgment	<i>Automation vs Augmentation</i> of entrepreneurial decision making in the different phases of venture creation <i>Judging risks and benefits of AI</i> by involving stakeholders and creating strategic approaches to technology integration	What are reasonable and responsible strategic approaches to integrating AI tools as enablers for entrepreneurs? How can internal and external stakeholders help to balance the benefits and risks of automatizing tasks and decisions within the entrepreneurial venturing process? To what degree do entrepreneurs want to depend on AI-based algorithms to make judgments and add to or replace decision processes in the different phases of venture creation?
AI-enhanced Business Model Design and Strategy	<i>AI capacity to help create unique value propositions</i> by supporting inimitable interdependencies among value creation and value capture activities <i>Transferability of AI-enhanced BM configurations</i> across different business contexts and industries	How can AI-enhanced business models foster venture growth and lead to superior performance? How does AI-based technology help shape, prototype and lock unique value creation and value capture of ventures? How can AI enhance ventures' incremental, radical, or disruptive business model innovation? To which degree can AI-enhanced business model designs be transferred amongst the ventures in entrepreneurial ecosystems?
AI resources in entrepreneurial ecosystems	<i>AI applications as a shared resource in a network of ventures</i> lead to questions of resource access and sharing amongst entrepreneurial actors <i>Power of prominent AI players</i> influencing the dynamics of ventures in entrepreneurial ecosystems	How can AI tools and resources be efficiently shared and distributed amongst the ventures in entrepreneurial ecosystems? How do prominent AI players influence and shape the integration of AI applications in ventures? How can entrepreneurs efficiently leverage AI tools' analytic and predictive power to integrate salient customer needs and expectations into venture creation?

Table 3.
Future perspectives on AI as enabler for entrepreneurial venturing – research avenues and questions

Yann Truong
Burgundy School of Business, Université Bourgogne, Dijon, France

Dirk Schneckenberg
Rennes School of Business, Rennes, France

Martina Battisti
Grenoble Ecole de Management, Grenoble, France, and

Rachid Jabbouri
Burgundy School of Business, Université Bourgogne, Dijon, France

References

- Acs, Z. (2006), "How is entrepreneurship good for economic growth", *Innovations*, Vol. 1 No. 1, pp. 97-107.
- Acs, Z.J. and Audretsch, D.B. (2003), *Innovation and Technological Change Handbook of Entrepreneurship Research*, Springer, pp. 55-79.
- Agrawal, A., Gans, J. and Goldfarb, A. (2018), *Prediction Machines: The Simple Economics of Artificial Intelligence*, Harvard Business Press.
- Anderson, A.R. (1998), "Cultivating the garden of eden: environmental entreprenering", *Journal of Organizational Change Management*, Vol. 11 No. 2, pp. 135-144.
- Aspelund, A., Berg-Utby, T. and Skjevdal, R. (2005), "Initial resources' influence on new venture survival: a longitudinal study of new technology-based firms", *Technovation*, Vol. 25 No. 11, pp. 1337-1347.
- Audretsch, D. and Keilbach, M. (2004), "Entrepreneurship capital and economic performance", *Regional Studies*, Vol. 38 No. 8, pp. 949-959.
- Baek, C.H., Kim, S.-H., Lim, S.K. and Xiong, J. (2023), "Quality evaluation model of artificial intelligence service for startups", *International Journal of Entrepreneurial Behavior & Research*, Vol. 29 No. 4, pp. 913-940.
- Baron, R.A. (2006), "Opportunity recognition as pattern recognition: how entrepreneurs 'connect the dots' to identify new business opportunities", *Academy of Management Perspectives*, Vol. 20 No. 1, pp. 104-119.
- Bhave, M.P. (1994), "A process model of entrepreneurial venture creation", *Journal of Business Venturing*, Vol. 9 No. 3, pp. 223-242.
- Brixy, U., Sternberg, R. and Stüber, H. (2012), "The selectiveness of the entrepreneurial process", *Journal of Small Business Management*, Vol. 50 No. 1, pp. 105-131.
- Brockner, J., Higgins, E.T. and Low, M.B. (2004), "Regulatory focus theory and the entrepreneurial process", *Journal of Business Venturing*, Vol. 19 No. 2, pp. 203-220.
- Chalmers, D., MacKenzie, N.G. and Carter, S. (2021), "Artificial intelligence and entrepreneurship: implications for venture creation in the fourth industrial revolution", *Entrepreneurship Theory and Practice*, Vol. 45 No. 5, pp. 1028-1053.
- Chatterjee, S., Rana, N.P., Tamilmani, K. and Sharma, A. (2021), "The effect of AI-based CRM on organization performance and competitive advantage: an empirical analysis in the B2B context", *Industrial Marketing Management*, Vol. 97, pp. 205-219.
- Chaudhuri, R., Chatterjee, S., Kraus, S. and Vrontis, D. (2022), "Assessing the AI-CRM technology capability for sustaining family businesses in times of crisis: the moderating role of strategic intent", *Journal of Family Business Management*. doi: [10.1108/JFBM-12-2021-0153](https://doi.org/10.1108/JFBM-12-2021-0153).
- Choi, Y.R., Lévesque, M. and Shepherd, D.A. (2008), "When should entrepreneurs expedite or delay opportunity exploitation?", *Journal of Business Venturing*, Vol. 23 No. 3, pp. 333-355.
- Corvello, V., De Carolis, M., Verteramo, S. and Steiber, A. (2021), "The digital transformation of entrepreneurial work", *International Journal of Entrepreneurial Behavior and Research*.
- Davidsson, P. (2006), *Nascent Entrepreneurship: Empirical Studies and Developments*, Now Publishers.
- Dean, T.J. and McMullen, J.S. (2007), "Toward a theory of sustainable entrepreneurship: reducing environmental degradation through entrepreneurial action", *Journal of Business Venturing*, Vol. 22 No. 1, pp. 50-76.
- Gavrila, S.G. and Ancillo, A.D.L. (2021), "Entrepreneurship, innovation, digitization and digital transformation toward a sustainable growth within the pandemic environment", *International Journal of Entrepreneurial Behavior and Research*, Vol. 28 No. 1, pp. 45-66.
- Gentsch, P. (2019), "Conversational AI: how (chat) bots will reshape the digital experience", *AI in Marketing, Sales and Service*, Palgrave Macmillan, Cham, pp. 81-125.

- Ghimire, A., Thapa, S., Jha, A.K., Adhikari, S. and Kumar, A. (2020), "Accelerating business growth with big data and artificial intelligence", *Paper presented at the 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC)*.
- Giuggioli, G. and Pellegrini, M.M. (2023), "Artificial intelligence as an enabler for entrepreneurs: a systematic literature review and an agenda for future research", *International Journal of Entrepreneurial Behavior and Research*, Vol. 29 No. 4, pp. 816-837.
- Goodfellow, I., Bengio, Y. and Courville, A. (2018), *Deep Learning Book*, MIT Press, Cambridge, MA.
- Hisrich, R.D. and Soltanifar, M. (2021), "Unleashing the creativity of entrepreneurs with digital technologies", in *Digital Entrepreneurship*, Springer, Cham, pp. 23-49.
- Hörisch, J., Kollat, J. and Brieger, S.A. (2017), "What influences environmental entrepreneurship? A multilevel analysis of the determinants of entrepreneurs' environmental orientation", *Small Business Economics*, Vol. 48 No. 1, pp. 47-69.
- Kier, A.S. and McMullen, J.S. (2018), "Entrepreneurial imaginativeness in new venture ideation", *Academy of Management Journal*, Vol. 61 No. 6, pp. 2265-2295.
- Klyver, K. (2007), "Shifting family involvement during the entrepreneurial process", *International Journal of Entrepreneurial Behavior and Research*.
- Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2018), "Digital entrepreneurship: a research agenda on new business models for the twenty-first century", *International Journal of Entrepreneurial Behavior and Research*, Vol. 25 No. 2, pp. 353-375.
- Kuratko, D.F. and Morris, M.H. (2018), "Examining the future trajectory of entrepreneurship", *Journal of Small Business Management*, Vol. 56 No. 1, pp. 11-23.
- Lewis, V.L. and Churchill, N.C. (1983), *The Five Stages of Small Business Growth*, University of Illinois, at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.
- Lieberman, M.B. and Montgomery, D.B. (1988), "First-mover advantages", *Strategic Management Journal*, Vol. 9 No. S1, pp. 41-58.
- McMillan, J. and Woodruff, C. (2002), "The central role of entrepreneurs in transition economies", *Journal of Economic Perspectives*, Vol. 16 No. 3, pp. 153-170.
- Mongelli, L. and Rullani, F. (2017), "Inequality and marginalisation: social innovation, social entrepreneurship and business model innovation: the common thread of the DRUID Summer Conference 2015", *Industry and Innovation*, Vol. 24 No. 5, pp. 446-467.
- Navis, C. and Glynn, M.A. (2010), "How new market categories emerge: temporal dynamics of legitimacy, identity, and entrepreneurship in satellite radio, 1990-2005", *Administrative Science Quarterly*, Vol. 55 No. 3, pp. 439-471.
- O'Neil, I. and Ucbasaran, D. (2016), "Balancing 'what matters to me' with 'what matters to them': exploring the legitimization process of environmental entrepreneurs", *Journal of Business Venturing*, Vol. 31 No. 2, pp. 133-152.
- Pathak, S. and Muralidharan, E. (2018), "Economic inequality and social entrepreneurship", *Business and Society*, Vol. 57 No. 6, pp. 1150-1190.
- Plummer, L.A., Haynie, J.M. and Godesiabo, J. (2007), "An essay on the origins of entrepreneurial opportunity", *Small Business Economics*, Vol. 28 No. 4, pp. 363-379.
- Raisch, S. and Krakowski, S. (2021), "Artificial intelligence and management: the automation-augmentation paradox", *Academy of Management Review*, Vol. 46 No. 1, pp. 192-210.
- Raneri, S., Lecron, F., Hermans, J. and Fouss, F. (2023), "Predictions through Lean startup? Harnessing AI-based predictions under uncertainty", *International Journal of Entrepreneurial Behavior & Research*, Vol. 29 No. 4, pp. 886-912.
- Reynolds, P.D. (2007), *Entrepreneurship in the United States: the Future Is Now*, Vol. 15, Springer.
- Russell, S.J. and Norvig, P. (2016), *Artificial Intelligence: A Modern Approach*, Pearson Education London.

- Schiavone, F., Pietronudo, M., Sabetta, A. and Fabian, B. (2023), "Conducted inductive multiple case research in their study titled 'Designing AI implications in the venture creation process'", *International Journal of Entrepreneurial Behavior and Research*, Vol. 29 No. 4, pp. 838-859.
- Scott, M. and Bruce, R. (1987), "Five stages of growth in small business", *Long Range Planning*, Vol. 20 No. 3, pp. 45-52.
- Seibert, S.E., Nielsen, J.D. and Kraimer, M.L. (2021), "Awakening the entrepreneur within: entrepreneurial identity aspiration and the role of displacing work events", *Journal of Applied Psychology*, Vol. 106 No. 8, p. 1224.
- Shane, S. and Venkataraman, S. (2000), "The promise of entrepreneurship as a field of research", *Academy of Management Review*, Vol. 25 No. 1, pp. 217-226.
- Stel, A.v., Carree, M. and Thurik, R. (2005), "The effect of entrepreneurial activity on national economic growth", *Small Business Economics*, Vol. 24 No. 3, pp. 311-321.
- Stenholm, P. and Renko, M. (2016), "Passionate bricoleurs and new venture survival", *Journal of Business Venturing*, Vol. 31 No. 5, pp. 595-611.
- Tatikonda, M.V., Terjesen, S.A., Patel, P.C. and Parida, V. (2013), "The role of operational capabilities in enhancing new venture survival: a longitudinal study", *Production and Operations Management*, Vol. 22 No. 6, pp. 1401-1415.
- Thurai, A. and McKendrick, J. (2022), "Overcoming the C-Suite's distrust of AI", *Harvard Business Review*, 23 March.
- Townsend, D.M. and Hunt, R.A. (2019), "Entrepreneurial action, creativity, and judgment in the age of artificial intelligence", *Journal of Business Venturing Insights*, Vol. 11, e00126.
- Upadhyay, N., Upadhyay, S. and Dwivedi, Y.K. (2021), "Theorizing artificial intelligence acceptance and digital entrepreneurship model", *International Journal of Entrepreneurial Behavior and Research*.
- von Krogh, G. (2018), "Artificial intelligence in organizations: new opportunities for phenomenon-based theorizing", *Academy of Management Discoveries*, Vol. 4 No. 4, pp. 404-409.
- Wright, M. (2014), "Academic entrepreneurship, technology transfer and society: where next?", *The Journal of Technology Transfer*, Vol. 39 No. 3, pp. 322-334.

About the authors

Dr Yann Truong Associate Professor of Innovation Management at Burgundy School of Business. His research lies at the intersection of innovation, entrepreneurship and organization theory. His work has been published amongst others in *Research Policy*, *Information and Management*, *Journal of Product Innovation Management*, *Journal of Business Research*, *European Journal of Marketing*, *Ecological Economics* and *Industrial Marketing Management*.

Dr Dirk Schneckenberg Associate Professor of Strategy and Innovation at Rennes School of Business, France. His research interests cover strategy and digital innovation, business model innovation, knowledge management, open innovation and innovating higher education. He has published four books and over 100 peer-reviewed contributions in journals and conference proceedings.

Martina Battisti is Professor to department Management and Technology. Since 2014, she is an Associate Editor of the *International Journal of Entrepreneurial Behaviour* and since 2020 of the *International Small Business Journal*. Her current research is at the intersection of entrepreneurship and psychology with a particular focus on emotional and cognitive microfoundations of entrepreneurial behavior as well as drivers and outcomes of entrepreneurial well-being and health. Beyond that, she is interested in topics related to startups, SMEs and entrepreneurship more widely. Her work has been published in leading journals including *Entrepreneurship Theory and Practice*, *British Journal of Management*, *International Small Business Journal*, *Small Business Economics*, *Journal of Business Research* and *Industrial Marketing Management*.

Dr Rachid Jabbouri Associate Professor of Strategy and Innovation at Burgundy School of Business. His research focus is on strategic management and institutional theory. His work has been published in journals such as *Industrial Marketing Management*.