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Designing AI implications in the venture creation process

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Abstract

Purpose – The paper faces artificial intelligence issues in the venture creation process, exploring how artificial intelligence solutions intervene and forge the venture creation process. Drawing on the most recent literature on artificial intelligence and entrepreneurship, the authors propose a set of theoretical propositions.
Design/methodology/approach – The authors adopt a multiple case approach to assess propositions and analyse 4 case studies from which the authors provide (1) more detailed observation about entrepreneurial process phases influenced by artificial intelligence solutions and (2) more details about mechanics enabled by artificial intelligence.
Findings – The analysis demonstrates artificial intelligence contributes alongside the entrepreneurial process, enabling mechanisms that reduce costs or resources, generate new organizational processes but simultaneously expand the network needed for venture creation.
Originality/value – The paper adopts a deductive approach analyzing the contribution of AI-based startup offerings in changing the entrepreneurial process. Thus, the paper provides a practical view of the potentiality of artificial intelligence in enabling entrepreneurial processes through the analysis of compelling propositions and the technological ability of artificial intelligence solutions.

Keywords Artificial intelligence, Entrepreneurship, Digital technology
Paper type Research paper

Introduction

"*It is time for the entrepreneurship field to come to terms with leading-edge artificial intelligence (AI)*" state Lévesque *et al.* (2020) in their editorial paper "Pursuing impactful entrepreneurship research using artificial intelligence". Authors perceive a need to bridge the entrepreneurship research stream to the disruptive capabilities of AI, intending AI as a powerful technique for disruptive methodological approach and as a disruptive enterprise solution that questions the entrepreneurship theory.

This paper forms part of a special section "Artificial Intelligence as an Enabler for Entrepreneurs: An Integrative Perspective and Future Research Directions", guest edited by Drs Yann Truong, Dirk Schneckenberg, Martina Battisti and Rachid Jabbouri.

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In fact, the way we create new businesses is changing because of AI. New technologies are transforming the nature of the -intrinsic- uncertainty of entrepreneurial processes (McMullen and Shepherd, 2006) and their outcomes (Nambisan, 2017). With the advent of technologies, entrepreneurial processes have become less constrained, i.e. there has been a shift from "discrete, impermeable, and stable boundaries to increasingly porous and fluid boundaries" (Nambisan, 2017). Discrete, impermeable, and stable boundaries characterize traditional businesses, by contrast, the separation of physical and intangible phases is no longer necessarily true in recent businesses.

These changes blur the basic concepts of entrepreneurship to which we are accustomed; furthermore, change entrepreneurial behavior that no longer adheres to a well-defined value proposition in implementing an equally well-defined opportunity. Indeed, the entrepreneurial actions will be oriented to creating a value proposition that evolves continuously since the entrepreneurial results are subject to continuous changes and evolutions (von Briel *et al.*, 2018).

Despite the growing relevance of AI in our everyday life and behaviors, in the industrial applications, in facilitating many of the firms' operations and decision-making, few contributions are given about the role of AI in redesigning the entrepreneurial process phases.

In this vein, some authors understand the breakthrough relevance of AI, nevertheless exploring the role of digital technologies in the venture creation process (Nambisan, 2017; von Briel *et al.*, 2018; Obschonka and Audretsch, 2019; Chalmers *et al.*, 2020; May *et al.*, 2020; Elia *et al.*, 2020). Scholars, in fact, concentrated on digital technologies in general, but their studies are not explicitly related to AI.

Drawing on seminal works that discuss the role of digital technology in the entrepreneurial process, we assume that AI–as digital technology-potentially influences the venture creation process. Particularly we formulate the following research questions: how do AI solutions intervene and forge the venture creation process? More precisely, we are interested in identifying how phases of the entrepreneurial process are influenced by AI solutions.

To fill the literature gap and answer our research question, we pursue an inductive and explorative approach adopting a multiple case study (Yin, 2009). A sample of four startups is chosen to explore the topic under investigation. Startups are providers of AI solutions. We investigate their potential in changing entrepreneurial processes by analyzing the value proposition and the technological artifacts they propose. The analysis aims to explore whether AI value propositions can support entrepreneurs and young firms in business creation.

Through the study of the literature, we were able to identify the venture creation process (Chalmers *et al.*, 2020) and mechanisms (von Briel *et al.*, 2018) enabled by AI technology, identifying the most representative startups for each venture creation stage in which they intervene.

Results are illustrated by referring to the stages of the business creation process, respectively: Prospecting, Production, Development and Exploitation. The analysis demonstrates AI contributes alongside the entrepreneurial process, enabling mechanisms that reduce costs or resources, generate new organizational processes but simultaneously expand the network needed for venture creation.

With our work, we contribute to the scarce literature regarding AI as an enabler of entrepreneurial processes by illustrating the primary evidence from our case studies. Furthermore, we extend the literature by providing a more comprehensive model of the AI-driven entrepreneurial process, integrating previous contributions on the entrepreneurial process (Chalmers *et al.*, 2020; Elia *et al.*, 2020) and mechanisms (von Briel *et al.*, 2018) for the new venture creation. Thus, the paper provides a practical view of the potentiality of AI in enabling entrepreneurial processes through the analysis of compelling propositions and the technological ability of AI solutions.

The article is structured as follows: In the first section, we outline the theoretical background illustrating features of the venture creation process in the digital era and AI in the venture creation process. Thus, drawing on the literature, we formulate a set of theoretical propositions in the second section. In the third and fourth section we conduct the multiple cases analysis. The last sections deal with conclusions, implication and limitations.

Venture creation process in digital era

The creation of a business is the process that roughly begins with a business idea and culminates when the products or services based on it are sold to customers in the market. Bhave in 1994 provided a process model which also integrates sub-processes. The creation of a business begins when an opportunity is recognized (Timmons *et al.*, 1987; Gartner, 1985). The recognition can be stimulated from the outside or the inside, "*the sequences of opportunity recognition, stimulated both internally and externally, culminate in the identification of the business concept*".

The process of business creation has been analyzed and theorized by many authors (Bhave, 1994; Baron and Shane, 2007; Van Horne *et al.*, 2021; Bakker and Shepherd, 2017). Nour-Mohammad *et al.* (2012) identify these main steps: recognizing and seizing opportunities, transforming these opportunities into marketable goods or services, adding value through time and resources, taking the risk, and realizing the reward. Other authors have concentrated heavily on the opportunity identification stage as in the work of Bhave (1994) who also describes the underlying sub-processes. Opportunity identification can be stimulated by external or internal factors and both can converge into what Bhave (1994) calls business concept identification.

Van Horne *et al.* (2021) emphasize the prototyping phase, placed between two important phases, the first that must identify a set of ideas and for the optimization of the business concept; and the second by which entrepreneurs analyze the best ways to commercialize the product. Asghari and Gedeon (2010) provide a three-step process, focusing on the facilitating role of the Internet and technologies in the startup creation process. Technologies improve and accelerate the transition from one stage to the others.

More recently, Bakker and Shepherd (2017) summarized all stages into three main phases: exploration, development, and exploitation. All these conceptualizations naturally have elements in common, despite the focus on one phase or the other. The rationale is that the birth of an enterprise occurs through the identification of an opportunity; after this fundamental momentum, the construction of the business model (BM) and the definition of the organizational structure follow. Then, there is a phase in which a prototype is built and the production phase begins; the last phase is called by someone exchange (Bhave, 1994), other scholars call it expansion (Ashgari and Gedeon, 2010), business development (Baron and Shane, 2007; Gruber, 2002) realization of reward/success (Nour-Mohammad *et al.*, 2012; Van Horne *et al.*, 2021). In any case, this last phase includes all those activities aimed at launching the enterprise in the market.

It has been observed that digital technologies have an important impact on business innovation and entrepreneurship; they can act as facilitators, mediators or be the result of entrepreneurial operations or the definition of the overall BM (Elia *et al.*, 2020). Digital technologies have been defined as part of the entrepreneurial opportunity (Nambisan, 2017; Davidsson, 2015).

With this in mind, some authors (Nambisan, 2017; Recker and von Briel, 2019; Obschonka and Audretsch, 2019; Chalmers *et al.*, 2020; May *et al.*, 2020; Elia *et al.*, 2020) have questioned whether digital technologies and AI can be associated with the creation of new businesses and the discovery or creation of new entrepreneurial opportunities. With the introduction of digital technologies, the boundaries between one stage and another become increasingly blurred.

This is because new technologies have transformed the nature of the -intrinsic- uncertainty of entrepreneurial processes and their outcomes. Entrepreneurial processes have become less constrained, i.e. there has been a shift from "*discrete, impermeable, and stable boundaries to increasingly porous and fluid boundaries*" (Nambisan, 2017). The digitization of products and services and the incorporation of technology into them make entrepreneurial outcomes "*intentionally incomplete*" (Garud *et al.*, 2008). This is possible because of the reprogrammability characteristic that allows technologies to evolve and be improved even after being introduced to the market and to remain constantly in "*a state of flux*". The entrepreneurial process increasingly involves a broader, more diverse, and often evolving set of actors–a shift from a predefined focal agent to a dynamic set of agents with different goals, motivations, and capabilities (Nambisan, 2017); entrepreneurship is now seen as a more collective way (Aldrich, 2014).

Digital technologies are characterised by "generativity", through which it becomes possible to generate new business opportunities. Generativity refers to the "overall ability of a technology to produce unanticipated change driven by a large, diverse, and uncoordinated audience" (Zittrain, 2006, p. 1980). This characteristic allows for the recombination of elements and the assembly, extension, and redistribution of functionality (Yoo *et al.*, 2010). Through digital technologies new capabilities are generated that produce ripple effects whereby existing entrepreneurial opportunities are transformed and/or radically new opportunities are created. Such characteristic leads to a reconfiguration of the boundaries of the associated opportunity space (Yoo *et al.*, 2010).

In addition to generativity, technology-driven entrepreneurial activities offer a further advantage of very high scalability, as they can upgrade capabilities easily and at a low cost (Cockburn *et al.*, 2019). However, entrepreneurial actions will be oriented to create a value proposition that continuously evolves to adapt to the continuous changes and evolutions, peculiar to the digital era (Davidsson *et al.*, 2020).

For the purposes of our work, we believe it is worth adding to the process model of business creation-we use Bakker and Shepherd's (2017) -external enablers (as theorized by von Briel *et al.*, 2018) and the processes underlying the cause-and-effect relationships described by the "mechanisms" provided by Gross (2009) and von Briel *et al.* (2018). In the following paragraphs the theories are described.

von Briel *et al.* (2018) state how digital technologies are enablers for entrepreneurship, defining them according to two characteristics namely specificity and relationality. Digital technologies play a mediating role that allows them to have control over inputs, outputs, and related transformations. They can determine which resources are inputs and which are outputs. The level of specificity can vary and with it the degree of adaptability of the technologies, in fact: "at one extreme there are digital technologies with a high degree of specificity that deterministically transform a predefined set of specific inputs into specific outputs. At the other extreme are digital technologies with a low degree of specificity that accept a multitude of poorly defined or indeterminate inputs and let other actors decide how the inputs are transformed and delivered as outputs." (von Briel *et al.*, 2018).

Relationality, on the other hand, is about the structural connections of technologies; they are interdependent. Their interconnections bring out channels through which resources flow. Relationality influences the size and quality of the network and this, in turn, defines the boundaries of business processes. There are technologies that are highly relational and others at the opposite extremes that instead interact with only one other actor.

Hence, digital technologies represent external enablers of business creation. In order to describe the roles of technologies in processes, the construct of mechanisms is used.

They identify 6 types of mechanisms related to digital technologies: *compression*, *conservation*, *expansion*, *substitution, combination, and generation*.

Compression and conservation mechanisms
Compression mechanisms reduce the amount of time required to perform an action, while conservation mechanisms reduce the resources required to perform an action. The degree of specificity of digital technologies largely influences their potential to enable compression and/or conservation mechanisms during enterprise creation.

Expansion and replacement mechanisms
Expansion mechanisms increase the availability of a particular resource, while substitution mechanisms replace one resource with another. The potential of digital technologies to enable expansion and/or replacement mechanisms during venture creation is largely dependent on their relationality.

Combination and generation mechanisms
Combination mechanisms create new artifacts such as devices and features by grouping resources, while generation mechanisms create new artifacts by modifying existing ones. The potential of digital technologies to enable combination and/or generation mechanisms during business creation depends on both the specificity of the technologies and their relationality.

In the following section, we concentrate on the link between AI and the business creation process, gathering the most recent contributions for each stage of the entrepreneurial process.

Venture creation and artificial intelligence

AI is defined as "the ability of a system to correctly interpret external data, learn from that data, and use that learning to achieve specific goals and tasks through flexible adaptation" (Kaplan and Haenlein, 2019, p. 17). An AI system can be described as a set of computer-assisted systems (Von Krogh, 2018) that can "ingest human-level knowledge (e.g. through machine reading and computer vision) and use this information to automate and accelerate tasks that were previously performed only by humans" (Taddy, 2018, p. 62).

What makes AI revolutionary is that it is possible to make machines capable of performing complex actions and "reasoning," learning from mistakes, and performing functions, until now, exclusive to human intelligence. AI, in fact, is able to solve complex problems, by breaking them into a series of simple prediction tasks, through "dumb" Machine Learning algorithms (Taddy, 2018).

Unlike other technologies, an AI system is not based on programming but on learning techniques: that is, algorithms are defined that process a huge amount of data from which the system itself must derive its understanding and reasoning capabilities.

This is undoubtedly one of the reasons why in recent years there has been a strong momentum in AI applications that have attracted and are attracting significant funding from venture capitalists, as Cheng *et al.* (2019) point out.

Scholars to date have focused intensively on the study of digital technologies (May *et al.*, 2020; Yoo *et al.*, 2010; Kallinikos *et al.*, 2013; von Briel *et al.*, 2018); there are fewer contributions that deal exclusively with AI.

For this reason, our work tries to systematize the contributions about the role of AI in the venture creation process.

The first phase we analyzed–the prospecting phase–is about identifying, exploring and adapting promising ideas; the development phase, on the other hand, is where the idea becomes real through the construction of the organizational structure and the production process. The last is the exploitation phase, where companies must establish scalable routines to produce, market and distribute their offerings.

We describe the role of AI in each of these stages in the following sections.

AI in the prospection phase

AI as an "originator"; AI is seen as a method of invention, especially useful in classification and prediction tasks (Cockburn *et al.*, 2019; Brem *et al.*, 2021). It not only enables exploration of a huge range of possible solutions but also provides certainty in uncertain and unexplored contexts. AI leads to the discovery and creation of new entrepreneurial opportunities because it completely alters the actor-environment connection. Many studies that connect the disruptive power of AI to entrepreneurship focus on the prospecting process (Agrawal *et al.*, 2018; May *et al.*, 2020; Garbuio and Lin, 2019). AI leverages surprising masses of data to study phenomena and make predictions about them. Agrawal *et al.* (2018) argues that "data is the new oil"; the more data one has, the easier and cheaper it will be to make predictions and gain a competitive advantage. Chalmers *et al.* (2020) identify three ways by which entrepreneurs can obtain information and produce ideas, creating opportunities. First, they argue that there will exist high-tech startups that will use AI to seek technical solutions across complex combinatorial problem spaces (Agrawal *et al.*, 2018; LeCun *et al.*, 2015). Second, it will be possible to leverage social sentiment-based analytics (Gaspar *et al.*, 2016; Humphreys and Wang, 2018), to analyze all online and social media content useful for carping about consumer needs; or exploit advantageous information asymmetries through counterintuitive insights, again through social media exploitation (Davidsson *et al.*, 2020; Chalmers *et al.*, 2020).

AI in the development phase

AI is seen as a "facilitator"; this function is based on AI's enabling ability to integrate and combine data in new ways. The facilitator function is based on the capacity to use AI to learn about opportunities to improve processes that drive innovation, through machine learning (Brem *et al.*, 2021; Cockburn *et al.*, 2019). In this vein, AI certainly contributes to redefining organizational structures and decision-making systems. In the first case, this will happen when there is a high diffusion of AI tools that will automate many processes and help redesign business structures, as completely new ways of working will be required. Moreover, AI is a powerful tool in decision-making processes (Agrawal *et al.*, 2018). So far, certainly, the impact of AI is not yet widespread at all levels of organizational structures (Brock and Von Wangenheim, 2019); however, there are numerous areas of application for reformulating the structure of businesses. AI will augment tasks by leveraging what Huang and Rust (2018) define as mechanical and analytical intelligence and then move on to emotional and intuitive forms of intelligence that will enable the replacement of extensive job categories (Huang and Rust, 2018). In addition, many scholars have highlighted the power of AI to revolutionize business models (Garbuio and Lin, 2019; Lee *et al.*, 2019; Valter *et al.*, 2018). A business model is characterized by a system of activities or a set of interdependent activities that span the boundaries of the company (Gassmann *et al.*, 2017), and BM innovation is defined as a significant change in the company's operations and value creation, typically resulting in improved business performance (Boston Consulting Group, 2009; Lee *et al.*, 2019). Amazon, Uber, Tesla, Google have reformulated their business models, gaining a clear competitive advantage. In fact, AI is defined as the catalyst for business model innovation (Lee *et al.*, 2019). According to Lee *et al.* (2019), AI makes it possible to run pilot projects through the combination of internal and external data, and to test their effectiveness, while at the same time enabling the training of the team. The development of an AI strategy allows for a virtuous circle in which the ability to tap into large amounts of data permits the more targeted use of an application, which in turn allows for the generation of large amounts of specific data that, once again, enables the improvement of the product or service in question. The ability of companies to implement new business models also depends on the ability of managers to effectively communicate change (Lee *et al.*, 2019) and new ways of creating and capturing value, as in the case of the 7 archetypes of BMs in healthcare highlighted by Garbuio and Lin (2019). The authors argue that because of the

extreme connectedness and network effects AI enables, platforms facilitate exchanges, reduce their costs, and also allow them to scale in ways that traditional companies cannot (Garbuio and Lin, 2019). The product development process is part of the development phase. Infact, AI allows existing products to be developed incrementally, or new ones to be designed, based on insights derived from the combination and continuous analysis of internal, external, and consumer-generated data. Hutchinson (2020), speaks of self-innovating AI, i.e. capable of innovating almost autonomously. The author sheds light on the importance of incorporating AI into new or existing products, assuming that it not only helps in incremental innovations but also enables new product development (Hobday, 2000; Davenport and Ronanki, 2018; Hoornaert *et al.*, 2017). He points out that the use of diverse sources and consumer participation greatly enriches the product development process, right at the stage of finding the resources needed to create a business (e.g. through crowdsourcing platforms). Because of the relevance of the production process in this phase, in our model we divided this phase into two: the production phase and the development phase.

AI in the exploiting phase

AI will be crucial at the exploitation stage for sales and scaling. In fact, the automation of sales activities enabled by AI is considered a promising area of development for entrepreneurial companies (Chalmers *et al.*, 2020). In addition, thanks to AI tools, organizations will be able to grow rapidly without encountering many of the constraints or challenges that fledgling enterprises traditionally face. Automation can occur by completely replacing humans with AI, or by automating certain tasks in a way that frees up salespeople and allows them to focus on higher value activities (Syam and Sharma, 2018). The use of AI has been shown to enable greater customer loyalty (Bali *et al.*, 2021) by improving the relationship between salesperson and customer. Moreover, thanks to AI, new sales models have emerged (Singh *et al.*, 2019). Thus, AI would not only be able to automate repetitive and time-consuming tasks for salespeople (scheduling meetings, sending emails, for example) (Paschen *et al.*, 2020), but also provide successful roadmaps for sales peolple with proactive alert systems on the progress of negotiations or facilitate the activation of customer relationships (Singh *et al.*, 2019; Hurley, 2018). Paschen *et al.* (2020), shed light on the value AI brings to each stage of the sales process–composed by 7 steps (Dubinsky, 1981; Vishnoi *et al.*, 2018; Matthews *et al.*, 2018)-. They point out that it is of paramount importance in the prospecting phase, due to the ability to analyze both structured and unstructured data for customer segmentation and in the generation of prospect lists. AI intervenes in the pre-approach and approach phases of the sales funnel. And in addition to faster organizing activities, AI enables the creation of highly personalized communications to sales leads. Even the presentation phase is enabled by AI; for example, there are slide bots that analyze ideas and key messages and optimize content and layout accordingly. Even in overcoming objections-which a customer may raise at any stage of the sales process-AI enables sales professionals to respond to concerns much more quickly with immediate and up-to-date information enabled by AI systems. At the follow-up stage, AI facilitates upselling and cross-selling activities, it can also automate the workflows required for order processing and follow-up (Paschen *et al.*, 2020). Some authors talk about the value contribution of AI in the entire marketing process, not relegating the disruptive potential of AI only to sales functions but also to the planning and strategic marketing functions. Vishnoi *et al.* (2018) argue that AI marketing will assist organizations in strategic customer engagement tasks from lead generation, nurturing, and follow up to segmentation, sales to customer service and satisfaction (Fowler, 2018; Verma *et al.*, 2021). Davenport *et al.* (2020) also suggest how important AI is in enabling the sales and marketing process; in addition, AI can predict what customers want to buy and also the price to charge for that product based on the data analyzed and predictions built on it. Verma *et al.* (2021), in a recent

article, discuss how AI facilitates the marketing mix. For example, in the choice of distribution leverage and in distribution itself (drones for deliveries, cobots for packaging, IoT for ordering, for example); in promotion due to the possibility of the extreme personalization of messages; in the choice of product attributes and the evaluation of customer feedback and sentiment; and so on.

Based on these assumptions, we propose the following theoretical speculations.

Theoretical proposition

We propose theoretical speculations to analyze the contributions of AI in the venture creation process. AI is a digital technology with its own peculiarities. Unlike other technologies, an AI system is not based on programming but on learning techniques: algorithms process a huge amount of data and generate data from which they derive understanding and reasoning capabilities (Taddy, 2018). As described in the literature paragraph, a recent group of scholars discusses digital technologies or more specifically on AI, considering their potential in being enablers, originators or facilitators of the entrepreneurial process. Starting from von Briel *et al.* (2018) we reflect on AI mechanisms with respect to their contribution to the venture creation process and we develop propositions. We consider, in fact, enabling mechanisms and digital technology characteristics customizing reflections on AI. Particularly, AI is a disruptive technology characterized by a high level of specificity and relationality. In regard to specificity, Taddy (2018) explains, it is crucial to understand that it is essential to use the structure of a specific context to guide the architecture of the AI you want to implement because the success or failure of an AI system is defined in a specific context. In regard to relationality AI is closely related to a huge amount of data (Kallinikos and Constantiou, 2015) provided by a network of data providers.

Therefore, these peculiarities joined with its ability to learn autonomously may influence the venture creation process generating a set of mechanisms.

More specifically, the high specificity of AI allows it to automate the execution of specific actions and improve their efficiency (compression mechanisms), freeing actors and resources that would normally be required to perform these actions to do other things (conservation mechanisms) (Leonardi, 2011). Thus, AI induces compression and conservation mechanisms reducing the amount of time that is required to perform an action, whereas conservation mechanisms reduce the resources that are required to perform an action (von Briel *et al.*, 2018).

At the same time, the high level of relationality enables AI in adopting expansion and/or substitution mechanisms during venture creation. Expansion refers to the increasing number of actors and the volume of resources that AI requires to complete its offer. AI is supported by access to databases, big data, cloud computing facilities that require a new stakeholder network (Elia *et al.*, 2020). The relationality also enables substitution mechanisms inducing to replace one human resource with digital entities. These entities–software systems, web applications, and algorithms–are able to process data in real-time, support effective matching among involved actors, provide recommendations and comments, and interact with humans to execute routine and complex tasks useful to support the entrepreneurial processes of the ecosystem (Elia *et al.*, 2020).

Combination and/or generation mechanisms during venture creation are contingent on both the technologies' specificity and their relationality (von Briel *et al.*, 2018). Specificity and relationality should be combined together to activate the above-mentioned mechanisms. Specificity is in fact inversely related to the AI potential to enable combination and generation mechanisms because AI during the creation phase of new artifacts tends to act autonomously. When instead combined with other AI, e.g. in complex AI systems (Hutchinson, 2020), the relationality augments enable combination and generation mechanisms. The number and diversity of complementary actors with which digital

technologies can connect increases, the technologies' potential to enable the creation of new resource combinations increases, as does their potential to stimulate dynamic and collective resource modification through these actors (Zittrain, 2006).

Described mechanisms might be relevant during specific phases of the venture creation process. Referring to the extant literature of AI in the venture creation process we propose the following proposition that combines the logic of mechanism with those of the venture creation process (Figure 1).

P1. AI supports venture creation during the prospecting phase through compression, conservation or substitution mechanisms.

The prospecting phase refers to the information searching for idea generation or idea realization. In this phase AI analyses and elaborates data in a short time (compression) sometimes reducing human resources required to solve combinatorial problems in technology startups or analyze consumers' needs in market startups (conservation). In some cases AI may induce the substitution of certain actors, such as market research agencies, to analyze market opportunity (substitution) before realizing the idea.

P2. AI supports venture creation during the production phase through generation, combination and expansion mechanisms

The production phase refers to idea production. AI allows existing products to be developed incrementally, or new ones to be designed, based on insights derived from the combination and continuous analysis of internal, external, and consumer-generated data. Generation or combination of mechanisms enabled by AI contribute to creating new artifacts, such as devices, functionalities, and BMs. In that phase, AI may operate autonomously creating something new (substitution) or operate together with external partners, external devices and software (expansion). Hutchinson (2020) illustrates some examples of innovations produced by AI alone or in collaboration with partners. However, he specifies the autonomy of AI in operating to create something new is strictly related to a large amount of data. Such storage of data is sometimes not typical of nascent startups, but incumbent firms.

P3. AI supports venture creation during the developing phase through conservation, substitution and generation mechanisms.

The developing phase refers to organizational processes and structures and to decision-making. AI may induce a new division of labor for routine tasks to be automated (e.g. in the case of a financial adviser, investment selection) substituting tasks performed by humans or reducing human resources usually required for tasks (Davenport and Ronanki, 2018). A new organizational structure may require other relevant figures; Chalmers *et al.* (2020) suggest trainers, who improve algorithms by adding nuance to decision making and interpretation;

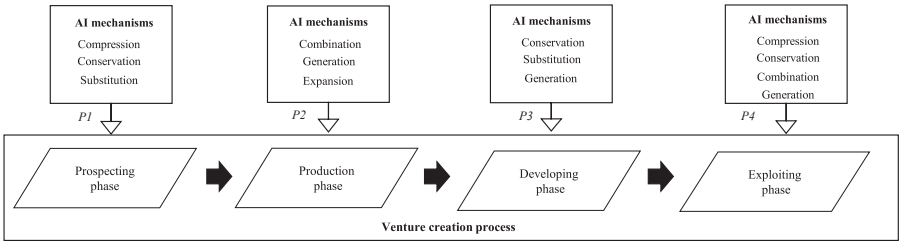

Figure 1.
The theoretical framework for AI in venture creation process

Source(s): Authors' elaboration

explainers who bridge the technical gap between AI systems and business managers; and finally, sustainers who will manage ethics and the ongoing management of the system.

P4. AI supports venture creation during the exploiting phase trough compression, conservation, combination and generation mechanisms

AI enables time compression for the entire sales process, but especially for the segmentation phase; and it conserves resources in the sense that it avoids a lengthy process for salespeople and marketers, allowing them to focus on more value-added activities.

AI enables the combination mechanisms in the exploitation phase because of the huge amount of data analyzed from numerous sources and applications. As many authors have stated about AI in the sales function, it is not possible to deliver the entire sales function to AI, but through the combination of different data sources and the experience of professional sellers, AI enables the co-execution of the sales and marketing function. In addition, AI stimulates the dynamic modification of resources, in this way AI enables generation mechanisms, providing new functionality and new ways of approaching the function (new sales models for example).

Methodology

The study has an exploratory nature; it intends to generalize theory rather than generalize results to a population (Eisenhardt, 1989; Gibbert *et al.*, 2008). We adopt, in fact, a multiple-case study (Yin, 2009) approach to validate our theoretical proposition. The multiple-case study is the most adequate for two reasons: (1) it is the best practice to answer the research question on "how" (Yin, 2009); (2) case studies facilitate the inductive gathering of new insights (Sutton, 1997), originally unknown to the researchers.

Specifically, the multiple cases may illustrate how AI intervenes and forge at different stages of the venture creation process, assessing our theoretical propositions. We refer to AI solutions recently offered by high-tech startups to analyze how AI operates. Startups, in fact, are the primary providers of AI solutions. We selected four case firms based on theoretical sampling (Eisenhardt and Graebner, 2007), considered good methodological practice in case studies (Piekkari *et al.*, 2010). Therefore, we adopted a non-probability sampling technique (Silverman, 2005) rather than a statistical sampling logic (Bryman, 2003). Therefore, instead of building a statistically representative sample, we select a group of startups whose offering is AI-based and their value proposition and technical solution support entrepreneurs in one or more phases of the entrepreneurial process.

The cases emerged from a set of AI-based startups listed by the European AI Startup Landscape (https://www.ai-startups-europe.eu/) that maps the AI startup ecosystem in Europe. The database collects over 500 startups from France, Germany and Sweden, considered as top startups from a group of associations and members of the German Entrepreneurship, the German Accelerator program, Vinnova, Sweden's Innovation Agency–appliedAI (Germany), Ignite Sweden, AI Sweden, RISE Research Institutes of Sweden (Sweden) as well as Hub France IA (France). According to Shivon Zilis' landscape of machine intelligence, startups are sorted via four categories which cluster firms on the point-of-view of companies that want to use AI in their businesses: Industry, Technology Type, Enterprise Intelligence and Enterprise Function.

To define our analysis sample, we select the list sorted for technology type to have additional information of which type of technology intended as platforms, frameworks, infrastructure or application is useful to support entrepreneurs in business creation and competitive advantage. The list is composed of 70 startups. Starting from this classification, we apply three selection criteria:

(1) startup target market comprehends entrepreneurs, or scientists or ideators;

(2) offerings contribute to supporting new firm creation (startups, spinoffs; research projects) at different stages of the venture creation;

(3) clients (startups, spinoffs, research projects) are identifiable.

Thus, we rejected startups offering solutions that support the venture creation process but support mature firms such as large companies and SMEs. Selected firms are MyDataModels, Hasty.ai, Paltarion and GetAccept. Table 1 provides the sample description.

Our analysis is based on secondary data; secondary data have become easier to collect and more accurate and more available to perform analyses of all kinds (Wamba-Taguimdje *et al.*, 2020). However, data were triangulated (Yin, 2015) from multiple sources of evidence, specifically, online video recording (founders', managers' and clients' declarations), physical artifacts and online documentation. The online video recording contains information coherent with our purposes, such as the role of AI service in supporting young firms or scientists or ideators and details on advantages in using AI tools.

Each case was treated as an independent experiment per Yin's (2009) guidance and successively crossed with other selected cases to assess the internal validity of the research (Beverland and Lindgreen, 2010; Gibbert *et al.*, 2008). Data is collected and analyzed on NVIVO. NVIVO supported us in coding data according to mechanisms and venture creation processes theorized by Chalmers *et al.* (2020) and von Briel *et al.* (2018).

Findings and proposition assessments

Empirical findings are described in light of the proposition derived from the theory. Figure 2 summarizes findings assessing the phase in which the startup operates, then mechanisms and capabilities of AI in supporting that phase.

The prospecting phase

Findings support our propositions on the role of AI in the prospecting phase of venture creation. Two cases are representative of that phase: MyDataModels and Hasty.ai.

MyDataModels develops and markets TADA, an augmented analytics platform that helps professionals understand and treat data. The platform is aimed at researchers, tech experts and business experts. Our investigations look at functions for researchers that refer to knowledge-intensive startups or projects. TADA, in fact, supports researchers during information and data searching. The solution is characterized by a genetic algorithm suited for numerical datasets with a very small number of samples. This characteristic is relevant for new ventures that do not possess a large amount of data or for certain industries that do not have large data for implementing their idea. In addition, TADA is characterized by a high level of usability; TADA does not require coding or machine learning skills. "*The advantage of TADA is that it does not require AI knowledge, but only the knowledge of its job*" Alain Blancquart (co-founder). Therefore TADA extracts key values from small data samples, exploring data in minutes (no hours or days). In other terms, AI acts with a compression mechanism during the prospecting phases. Furthermore, it leads new firms to consume less human resources and financial resources for collecting data.

Similar mechanisms are assessed in Hasty.ai. Hasty.ai supports vision AI practitioners, AI startups, developers developing best-in-class annotation tools. Hasty.ai proposes AI models that create multiple types of annotations (classification, object detection, semantic segmentation and instance segmentation). Annotations are used for training models in digital ventures or research. Hasty.ai enables customized annotation according to the user's needs, who "adopt an agile approach rather than a waterfall approach to build their models"

	Location	Founding year	Industry clients	Type of clients	Technology type	Value proposition	Offering (phisycal artifact)	Indirect interviews (online video recording)	Additional data sources
MyDataModels	Valbonne (France)	2018	Healthcare; Finance; Real Estate; Utility; Mobility; IT	Entrepreneurs; Scientists; Professionals; SMEs; Large Companies	Platforms	Analyze data and extract key value	TADA platform	Alain Blancquart (co-founder)	Publications; white papers; company website and brochures; press resources; client reviews
Hasty.ai	Berlin (Germany)	2019	Healthcare	Scientists; Entrepreneurs; SMEs; Large Companies	Applications	Train AI models that make it faster to create more annotations	Hasty App	Tristan Rouillard (CEO)	Online documentation; company website and brochures; press resources; client reviews; use cases

(*continued*)

Table 1.
Case description

Table 1.

	Location	Founding year	Industry clients	Type of clients	Technology type	Value proposition	Offering (phisycal artifact)	Indirect interviews (online video recording)	Additional data sources
Peltarion	Stockholm (Sweden)	2004	Healthcare; Insurance; Manufacturing; Retail	Scientists; SMEs; Large Companies	Platforms	Empowers anyone to design and deploy AI without a single line of code	Peltarion platform	Simon Grant (CEO Scibase–clients); Luka Crnkovic-Friis (Founder and CEO); Micah Johnson (Developer at Bubble app)	Online documentation; company website and brochures; press resources; client reviews; use cases
GetAccept	Malmö (Sweden)	2016	IT, Telecom and Media, Healthcare; Recruiting; Trasportation; Energy	Professionals; Entrepreneurs; SMEs; Large Companies	Platforms	Sales Engagement platform for the best digital remote selling experience	GetAccept platform	Mikko Honkanen (CEO and Co founder at Vainu) SAmir Smajic (Ceo and founder)	Online documentation; company website and brochures; press resources; client reviews; use cases

	Venture creation phases	Mechanisms
MyDataModels	*Prospecting & Production phase* MyDataModels develops and markets TADA, the Augmented Analytics platform that helps professionals understand and treat data. TADA does not require coding or machine learning skills and it works with small data samples. TADA uses genetic algorithms suited for numerical datasets with a very small number of samples. It helps researchers find new purposes (e.g., new drugs) for their discoveries and extend the reach of their research.	• Explore experimental data in minutes; • Train model on few historical data (one hundred records is enough) and apply it to new similar research to speed up the research cycle; • Validate research results and new products in a short time, consuming fewer human resources and financial resources.
Hasty.ai	*Prospecting phase* Hasty.ai proposes AI models that make multiple types of annotations faster (classification, object detection, semantic segmentation and instance segmentation). Hast.ai enables customized annotation according to the users needs.	• Quick and more effective annotation; • The need for human supervision decreases: with enough data, you can batch process the rest, or a specific part, of your dataset in one click; • Reduced costs for expert annotators; • No costs of annotators service providers; • Save a considerable annotation budget and enable firms to do more work in-house; • Detect potential errors automatically, reducing the need for manual quality assurance by 95%.
Peltarion	*Production & Developing phase* The Peltarion platform offers an all-in-one space for efficiently testing, comparing and realizing AI ideas. The platform's no-code environment lowers time-to-value and simplifies the AI onboarding process through intuitive guides and a graphical interface. Peltarion helps define the AI opportunities in the organization, create proof of concepts, work with your data, or build the products and services around your operationalized AI models.	• Make AI accessible and affordable to more people creating a platform where people can work with AI without needing the skills of a data scientist; • Create and develops App based on AI models; • Relieve tasks of the support team.
GetAccept	*Exploiting phase* Get Accept proposes a sales Engagement platform for the best digital remote selling experience. It personalizes and automates B2B sales processes, helping industries and departments operate faster, with lower costs, and better experiences for customers and employees.	• Automate sales and marketing tasks (email, SMS, chat, and video to keep the deal moving forward). • Personalize sales processes, • Reduce costs despite the better experiences for customers and employees.

Figure 2.
Findings

(Tristan Rouillard, CEO). Jenny Abrahamson, Software Engineer at Audere (digital health nonprofit company) affirms "*Before discovering Hasty, labeling images was labor-intensive, time-consuming, less accurate, and progression through the groundwork to build our AI detection model was much more frustrating. Hasty's approach of training the model while labeling with faster annotate-test cycles has saved Audere countless hours. The speed and ease of use have allowed us to accelerate our mission to improve global health in the world's most underserved communities*". Therefore Hasty.ai enables compression mechanisms offering quicker and more effective annotation. Furthermore, it triggers a conservation mechanism eliminating the cost of annotators service providers saving a considerable annotation budget and enabling firms to do more work in-house, automating 90% of the work after 1,000 images. It enables a substitution mechanism since the need for human supervision decreases: with enough data, firms batch process the rest, or a specific part, of your dataset in one click; while with the detective functions, Hasty App reduces the need for manual quality assurance by 95%.

The production phase

Findings partially support our propositions on AI's role in the production phase of venture creation. Two cases are representative of that phase: MyDataModels and Peltarion.

MyDataModels offer the TADA platform for providing a comprehensive service for researchers: from the information and data searching until the idea generation. Mainly it helps researchers find new purposes (e.g. new drugs) for their discoveries and extend the reach of their research. David Darmon, Department of Teaching and Research of General Medicine. Vice President Health University Côte d'Azur "*Machine Learning in medicine promises to provide composite representations of medical data to improve interpretation, analysis, and decision making. The ability of Tada to obtain excellent results on small amounts of data has been fundamental for our research*". TADA elaborates a model on a few historical data (one hundred records is enough) and applies it to new similar research to speed up the research cycle. It means triggering a combination mechanism, i.,e bundle different resources

to create new artifacts. TADA allows the resource replacement with the genetic algorithms; it avoids hiring a data scientist or establishing a partnership to receive data triggering substitution mechanisms.

Differently, the Peltarion platform supports firms in assessing other propositions. The platform empowers anyone to design and deploy AI without a single line of code. It offers an all-in-one space for efficiently testing, comparing and realizing AI ideas. The platform's no-code environment lowers time-to-value and simplifies the AI onboarding process through intuitive guides and a graphical interface. Peltarion helps define the AI opportunities in organizations, create proof of concepts, work with your data, or build the products and services around your operationalized AI models. For instance, it contributed to developing the detective pen supporting Scibase, a Swedish startup producer of medical devices. The pen recognizes atopic dermatitis using an AI model produced through Peltarion. Scibase's CEO Simon Grant declares, "*The neural net uses the data to help us find the useful answers that we are looking for. The Peltarion Platform allows us to focus on solving problems. Faster. The platform takes care of a lot of the mechanics of AI. It takes away a lot of the tricky stuff and automatically handles it. It enables us to try different datasets and experiment faster*". Again the platforms support the creation and the empowerment of App-based on Ai models without coding. Concerning mechanisms, the Peltarion platform enables the creation of new apps or devices (creation mechanisms). In specific cases where there are no experts in AI, it enables combination mechanisms to increase the number of actors/partners, enlarging the startup networks to develop apps.

The development phase

Findings support our propositions on the role of AI in the developing phase of venture creation. The Peltarion case is representative of that phase. However, all analyzed cases affect organizational processes, particularly those enabling substitutions, expansion and conservation mechanisms. The Bower case, a Swedish startup supported by Peltarion, shows how implementing a machine learning model relieves tasks of the support team. Simon Asp, Design Technologist at Bower declares, "*Bower successfully reduced the time spent on manually reviewing images by 75%, from 2 h to 18 min, freeing 2 h for one person each week!*". The quotation testifies conservation and substitution mechanisms but provides partial evidence for generation mechanisms. The cases discussed reveal that some job categories will contract or disappear, the structure of many entrepreneurial organizations will necessarily reform the AI system (Chalmers *et al.*, 2020).

The exploiting phase

Findings partially support our propositions on the role of AI in the exploiting phase of venture creation. The GetAccept case is representative of the phase. Get Accept proposes a sales Engagement platform for the best digital remote selling experience. It personalizes and automates B2B sales processes, helping industries and departments operate faster, with lower costs, and better experiences for customers and employees. The platforms support firms in efforting to "*engage buyers and sellers in a natural way within a digital world*" (Samir Smajic, CEO). The platform aims to create a shared space with clients, sellers and stakeholders. The platforms lead users to share content, collaborate and negotiate with relevant stakeholders for a more engaging and personalized digital selling experience. Mikko Honkanen–CEO and Co-founder at Vainu, a sales startup–explains that GetAccept supports the startup in implementing a "sales process systematic and data-driven, requiring Vainu's systems to be integrated for acting in real-time when their customers need". In addition, he declares to implement GetAccept to give their salespeople better conditions to communicate with, and keep track of, how their customers and prospects act in the sales process. "*With the*

help of automatic reminders and real-time insights, my sellers can now prioritize their time better and act faster in a follow-up. With live chat features, they can easily communicate with every client, throughout the entire sales process". For instance, the GetAccept CRM integration for Pipedrive, with live chat features, is Vainu's favorite because of the simplicity of sending, manage, and to archive client contracts. The Vainu case history testifies three types of mechanisms enabled by AI compression and conservation concerning the reducing time to perform actions partially automated and the reduced resources to perform tasks. However, the case shows an increasing number of activities (expansions), and consequently the generation of a new selling model (generation mechanisms).

Conclusions

AI is transforming the entrepreneurship practice and theory (Mitchell *et al.*, 2017). Our paper contributes in this vein, providing new evidence into the literature on AI-driven entrepreneurial processes. Particularly, we explore processes and mechanisms that re-form the digital era's venture creation. We have developed four propositions that guide us in building a comprehensive framework, linking enabled mechanisms connected to AI abilities with new circumstances that characterize the venture creation process. Through this model, we wanted to explain how AI intervenes in each venture creation stage by leveraging the mechanisms it triggers. Many scholars have highlighted the lack of research in this field. We continue the discussion raised recently by Chalmers *et al.* (2020), von Briel *et al.* (2018), Elia *et al.* (2020), providing new evidence. In fact, to the best of our knowledge, there are not many contributions linking theoretical models to real-life practices. To fill this gap and explore how AI intervenes in each of the phases of the entrepreneurial process, we performed a multiple case study. Our results show that although AI could potentially contribute to each of the stages of the entrepreneurial process, however, stages are blurred when involving digitals technologies and certain mechanisms characterize more phases. Table 2 synthesizes our proposed framework. Four propositions are subdivided to prove additional discussion on the link among process mechanisms. According to von Briel *et al.* (2018), the prospecting phases are characterized by compression and conservation mechanisms, reducing time for tasks and costs for certain resources. Instead of expansion mechanisms (as suggested by von Briel *et al.* (2018)), we noticed substitution mechanisms: certain human resources or providers are not required but substituted by algorithms. Expansion and combination mechanisms concern, in fact, more specifically, the production phase, together with generation mechanisms. In addition, we partially support the combination mechanisms in the exploitation since the increasing number of actors required to perform tasks is mitigated by a substitution mechanism that can co-exist when additional or specific AI competencies are required. Concerning the development phase differently from von Briel *et al.* (2018), we intend to stress a set of mechanisms (conservation, substitution and generation) that may generate a new organizational setting stimulating the adoption of an agile approach in new ventures. Finally, AI enables compression and conservation mechanisms reducing time to perform actions partially automated and reducing resources to perform tasks. However, the case shows an increasing number of activities (expansions) in the exploiting phase and consequently the generation of a new selling model (generation mechanisms).

Implications

Several implications feature the paper. First of all, there are implications for research since our work is a first attempt to systematize the contribution of AI in the different phases of the entrepreneurial process with respect to digital technologies mechanisms. In addition, this attempt offers an interesting framework for startups, digital startups, research companies

Proposition	Results	Summary
P1a. AI supports venture creation during the prospecting phase through compression mechanisms	Supported	AI acts with a compression mechanism during the prospecting phases performing data exploration a few times. AI acts with conservation mechanisms eliminating the cost of certain services or the costs of specific resources used to perform repetitive but not ordinary tasks (e.g. data searching). AI enables substitution mechanism since the need for human supervision decreases; thus, certain human resources or providers are not required but are substituted by algorithms
P1b. AI supports venture creation during the prospecting phase through conservation mechanisms	Supported	
P1c. AI supports venture creation during the prospecting phase through substitution mechanisms	Supported	
P2a. AI supports venture creation during the production phase through generation mechanisms	Supported	AI enables combination mechanisms joining raw data derived from different sources (e.g. different research departments) to train models destined to similar users. During the production phases, AI enables a creation mechanism supporting the creation of new apps, or new research results or new devices. However, AI partially supports the combination mechanisms since the increasing number of actors required to perform tasks is mitigated by a substitution mechanism that can co-exist when additional or specific AI competencies are required
P2b. AI supports venture creation during the production phase through combination mechanisms	Supported	
P2c. AI supports venture creation during the production phase through expansion mechanisms	Partially supported	
P3a. AI supports venture creation during the developing phase through conservation mechanisms	Supported	AI triggers conservation and substitution mechanisms during the developing phase reducing the time resources are deployed to implement their tasks, sometimes substituting the saved time for other core tasks. AI may also generate a new organizational setting stimulating the adoption of the agile approach.
P3b. AI supports venture creation during the developing phase through substitution mechanisms	Supported	
P3c. AI supports venture creation during the developing phase through generation mechanisms	Supported	
P4a: AI supports venture creation during the exploiting phase trough compression mechanisms	Supported	AI enables compression and conservation mechanisms reducing time to perform actions partially automated and reducing resources to perform tasks. However, the case shows an increasing number of activities (expansions) in the exploiting phase and consequently the generation of a new selling model (generation mechanisms)
P4b.A I supports venture creation during the exploiting phase trough conservation mechanisms	Supported	
P4.c AI supports venture creation during the exploiting phase trough combination mechanisms	Not supported	
P4d. AI supports venture creation during the exploiting phase trough generation mechanisms	Supported	

Table 2.
Summary

and those who want to introduce AI in their activities. It may seem intuitive how such a disruptive technology can improve the activities of a company but having a framework in which the phases of the entrepreneurial process and how AI intervenes are clearly delineated can be helpful to founders, managers and startup employees in understanding how to introduce such technology in the different phases, keeping well in mind the ways and the benefits that can be achieved.

First and foremost, it is important to understand that entrepreneurs that want to implement AI in their organizations must set up companies as data-driven enterprises, as this is the only way to use an AI-based system. Not having the data to enable AI at every stage of the business process is like not having the water to feed a plant. Even small data may be equally elaborate by AI generating interesting results in the development phase.

Other relevant implications concern new ventures or digital ventures for the relational nature of such a technology. As illustrated in the previous paragraphs, the interconnection of AI technologies in an AI system allows further and surprising advantages. It is worth underlining how important it is for a startup or an already established company to create a network of companies that adopt this technology, both for the network benefits and the analysis and prediction capacity of AI systems based on huge masses of data. The more relationships are triggered, the more resources will be used in the entrepreneurial process.

In addition, implications concern the opportunity to create an agile organizational structure further or optimize decision-making. We show that certain phases appear blurred, but specific solutions offer a complete infrastructure that helps organizations and businesses integrate machine learning from idea generation to validation through proof of concepts and final integration production systems.

Limitations and future directions

Our work is not without limitations. We considered AI services providers joined with AI services users to answer our research questions. Furthermore, that sample is composed of only European startups. It could mean not total generalizability of results. Moreover, various venture creation processes could differ according to startup types (e.g. knowledge-intensive firms vs low intensive firms). In addition, the multiple case studies are certainly a suitable methodology to explore a specific topic. Still, it is an analysis based on secondary data and deeper exploration is needed, perhaps through direct interviews.

Indeed, the literature thoroughly investigating the implications of using AI at various stages of the entrepreneurial process is still in its infancy. It can be a starting point for quantitative investigations that accurately reveal what mechanisms AI enables.

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