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What does AI think of AI as an external enabler (EE) of entrepreneurship? An assessment through and of the EE framework

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ABSTRACT

Recent breakthroughs make Artificial Intelligence (AI) technology a particularly potent enabler of entrepreneurship. Therefore, we use the External Enablement (EE) framework to examine AI's potentials as enabler of entrepreneurship. In doing so, we involve AI – specifically ChatGPT 4.0 – to enhance the analysis beyond our personal limitations. Through this exercise we provide insights into 1) AI technologies as enablers of entrepreneurship; 2) possible improvements of the EE framework, and 3) ChatGPT's and similar AI tools' usefulness for entrepreneurship research more generally.

1. Introduction

Developments like the Global Financial Crisis, the Covid-19 pandemic, the digital technology revolution, and climate change along with its quest for sustainable transformation have forced a reawakening of interest in the role of changes to the business environment in entrepreneurship and strategy research (Ahlstrom et al., 2020; Hitt et al., 2021; Kimjeon and Davidsson, 2022). One fruit of this resurging interest is the External Enablement (EE) framework (Davidsson et al., 2020, 2022), which provides a conceptual foundation for aggregating insights about effects on entrepreneurship across technological, sociocultural, regulatory, and other changes to the business environment.

Recent technological breakthroughs make Artificial Intelligence (AI) a particularly potent potential enabler of entrepreneurial actions and success in the coming years and decades (Chalmers et al., 2021a; Obschonka and Audretsch, 2020; Giuggioli and Pellegrini, 2022; Truong et al., 2023). Therefore, we use the structure and terminology of the EE framework to systematically examine some of AI's potentials as enabler of entrepreneurship. Befitting our topic, we use the AI language model ChatGPT 4.0 as a research tool similar to expert interviews to enhance our systematic examination. Through this exercise we aim to achieve valuable insights into 1) AI technologies as enablers of entrepreneurship; 2) possible improvements of the EE framework, and 3) ChatGPT's and similar AI tools' usefulness for entrepreneurship research more generally.

2. Theoretical background and literature review

2.1. The external enablement framework

External enabler (EE) denotes non-trivial technological, regulatory, sociocultural, and other macro-environmental changes to the business environment. The EE framework assumes that all such changes offer benefits for *some* (conceivable) business ventures. To fa-

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cilitate broadened knowledge accumulation about the strategic action potentials the environment offers to entrepreneurs thus enabled, the EE framework provides conceptual tools that are relevant across all types of environmental change. Accordingly, it highlights two characteristics of EEs themselves: *Scope* (spatial, sectoral, sociodemographic, and temporal) and *Onset* (gradualness and predictability). The framework further specifies a range of *Mechanisms* through which EEs can improve ventures' supply, demand, or value appropriation. The mechanisms are assumed to have strategically important variance in *opacity* (difficulty of identifying) and *agency-intensity* (difficulty of bringing to realization) which influence the agency needed for their activation. The mechanisms contribute to three non-exclusive *EE Roles* in the entrepreneurial process: triggering (of the venture creation journey or pivoting within it), shaping (of the venture, its products, or its creation journey), and enhancing various types of outcomes (Davidsson et al., 2020, 2022; Kimjeon and Davidsson, 2022). An AI-adapted version of the framework is displayed in Fig. 1 further below. The shaded areas are the core foci of the EE framework whereas the unshaded parts depict non-core phenomena with which EEs interact. Applications of the EE framework to date have addressed enablement based on new technology and infrastructure (e.g., Chalmers et al., 2021b; Chen et al., 2020), regulatory change (Lucas et al.); the Covid-19 pandemic (e.g., Cestino-Castilla et al., 2023) and the quest for sustainability transformation (Hinderer and Kuckertz, 2022).¹

2.2. AI as external enabler of entrepreneurship

AI is defined as "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (Haenlein and Kaplan, 2019, p. 5). Thus, AI systems have the capacity to learn, improve, adapt, and make autonomous decisions, enabling them to perform complex tasks that otherwise require human intelligence and reasoning (Obschonka and Audretsch, 2020). AI is an overarching concept encompassing several technologies such as machine learning, computer vision, neural networks, language processing, and virtual agents of all sorts (Berente et al., 2021; Truong et al., 2023).

Envisaging AI to fundamentally change some of the ways entrepreneurial activities are conducted, entrepreneurship scholars have started to pay attention to this important phenomenon, resulting in an increasing number of publications at the nexus of AI and entrepreneurship (Chalmers et al., 2021a; Obschonka and Audretsch, 2020; Shepherd and Majchrzak, 2022; Townsend and Hunt, 2019). While, no prior study uses the EE framework to systematically examine the enablement potential of AI technologies, available studies reveal traces of insights about different facets of the EE framework. For example, AI enablement is argued to bring non-trivial transformations in the business environment through interconnections with other environmental changes such as social, economic, political, and regulatory (Chalmers et al., 2021a; Shepherd and Majchrzak, 2022). Earlier research portrays AI as having broad Scope and radical Onset (Obschonka and Audretsch, 2020), and to impact entrepreneurial activities and success through mechanisms included in the EE framework such as compression, resource conservation, generation (Schivone et al., 2022; Truong et al., 2023), uncertainty reduction (Townsend and Hunt, 2019) and demand expansion (Shepherd and Majchrzak, 2022). Likewise, there is some discussion about AI's potential to trigger new entrepreneurial activities (Chalmers et al., 2021a), shape existing activities (Garbuio and Lin, 2019; Shepherd and Majchrzak, 2022), and help in scaling and growth of ventures (Giuggioli and Pellegrini, 2022). This suggests that applying the EE framework to systematically examine AI as enabler of entrepreneurship is worthwhile.

3. Method

AI-based methods are increasingly being used to examine various aspects of entrepreneurship phenomena (i.e., Kaminski and Hopp, 2020; Prüfer and Prüfer, 2020). ChatGPT 4.0, a sophisticated AI-based language model developed by OpenAI, is the specific AI tool we use to help assess more broadly the potentials AI technologies offer for entrepreneurial action and success. Our approach is similar to expert interviewing (Bogner et al., 2009; von Soest, 2022) using ChatGPT 4.0 as our expert and the EE framework as the basis for our semi-structured and iterative interview.

We collected data through four iterations of training and conversation with ChatGPT 4.0. To structure the prompts, refine them, and reinforce the language model (OpenAI, 2023a), we use the EE framework as a guide to systematically generate textual data (Short and Short, 2023). Accordingly, we divided the conversation into seven themes; 1) basics of AI and EE the framework, 2) characteristics of AI as external enabler, 3) enabling mechanisms offered by AI, 4) characteristics of AI enablement mechanisms: opacity and agency-intensity, 5) AI enablement roles, 6) How AI enablement interacts with other external enablers, 7) Fit with the entrepreneurial agent (cf. Davidsson et al., 2020, 2022). We elucidate the detailed prompting process in Table A1 (appendices), which shows how prompts were refined to get more curated output.

In the initial interview phase, we developed basic prompts to familiarize ChatGPT with the fundamental constructs of the EE framework, AI, and the intersections between the two. This foundational step is essential as ChatGPT maintains contextual awareness and relies heavily on past conversational input to generate subsequent responses. Although ChatGPT generally offered relevant information, it misunderstood certain constructs such as agency-intensity, opacity, and generation mechanism in its responses, requiring some corrective prompting. At this stage we again discussed all basic prompts, initially generated textual output and models' misinterpretations, and deliberated on the next round of corrective prompting to ensure ChatGPT would gain a more accurate conceptual comprehension.

In the subsequent phase of our interaction, we conversed with ChatGPT using elaborate prompting. We made some prompts more detailed and explicit by providing additional instructions, context, and constraints. This elaborate prompting provided a more nu-

¹ The EE website (www.externalenablement.org) displays (as of June 2023) 22 application articles, including three from *Journal of Business Venturing Insights* (Chandra, 2022; Klyver and Nielsen, 2021; Weking et al., 2023).

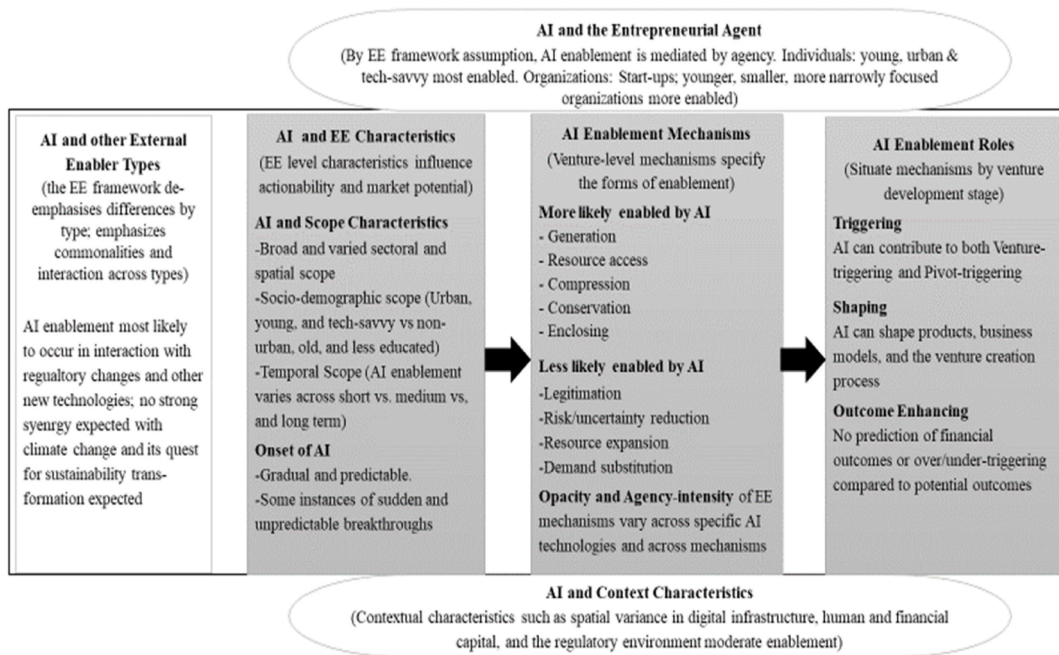


Fig. 1. AI enablement framework for entrepreneurial actions and success (adapted from Davidsson et al., 2020).

anced understanding of various themes of conversation related to AI as an enabler of entrepreneurship and filled the information gaps observed in the initial responses. Though different prompting types have varied foci in the dialogic responses, they worked synergistically and in tandem to refine and generate more relevant, accurate, and comprehensive textual output (Short and Short, 2023).

Interestingly, much like a human expert (albeit more systematically) ChatGPT maintains contextual awareness of the user's prompting history to generate more precise and adapted answers in response to refined prompts (Ouyang et al., 2022). In fact, using a competent AI tool like ChatGPT can reduce some limitations and biases of human experts (Bogner et al., 2009) but may admittedly introduce other problems (like 'hallucination', Ji et al., 2023) that are as yet not fully known or discussed in the research methods literature. To mitigate such problems and ensuring triangulation, we first opted for human verification of the validity of prompts and responses. Throughout the text generation process, both authors deliberated on the prompts and responses to improve the output quality in each iteration (Bommarito et al., 2023). In addition, we also triangulated the output by using multiple prompts with slightly different wording about the same themes. At the end of the process, we had 175 pages of transcripts available for analysis.

We adopted the Gioia approach to 1) open code the interview transcript to identify 'first order codes', 2) compare and amalgamate them into 'second order themes', and 3) and synthesize them into 'theoretical dimensions' (Gioia et al., 2013). Samples from this voluminous output and data structure are displayed in Table A2 (appendices), and major patterns are discussed below in connection to Figure (1), which summarizes our data analysis.

4. Findings

4.1. Characteristics of AI as external enabler: scope and onset

ChatGPT argues for broad AI enablement along all scope dimensions. After further probing it admits that the spatial enablement is moderated by variance in digital infrastructure, human and financial capital, and the regulatory environment. Singled out as the most enabled industries – with sensible motivations and examples – are healthcare, finance, manufacturing, transportation & logistics, energy, agriculture, and 'marketing and advertising'. The primary examples of less enabled sectors are crafts, personal services, and – less self-evidently – industries with high-stakes decision-making with significant ethical and social implications along with cultural and environmental conservation. We will come back to the latter. For each of our examples of narrower categories – sports equipment manufacturing, grocery retailing' and travel agency services – the responses detail industry-adapted enablement across various business functions.

As regards temporal Scope, ChatGPT asserts that over time AI will "continue to evolve and mature" and become "more accessible and affordable." Thus, AI does not see AI-based opportunities being exhausted any time soon! Regarding more and less enabled sociodemographic groups, the rather predictable responses point to the urban, young and tech-savvy vs. rural, older, and lower income populations. Interestingly, however, the answer reflects an ability to distinguish between merely being affected by AI vs. being entrepreneurially enabled by it.

The lengthy response to a direct question about AI's Onset arguably takes an industry-insider view, describing it as "gradual and somewhat predictable" while also alluding to some "sudden breakthroughs". We would argue that for most economic agents, awareness of AI as acutely relevant to them arose rather suddenly in late 2022 through early 2023. If so, this majority's perception of AI's On-

set as enabler arguably better reflects what the concept is meant to capture (see [Table A1](#)). Accordingly, when ChatGPT makes unprompted comments that are *de facto* about Onset it tends to emphasize AI's disruption and rapid development. That its Onset and evolution was predictable to some individuals and that this group is small is fully in line with the strategic meaningfulness of unpredictable Onset as a source of competitive advantage for those in the know.

4.2. Enabling mechanisms offered by AI as external enabler

Asked about AI's provision of EE mechanisms, ChatGPT found support that AI would provide each of the mechanisms in the EE framework to some ventures. Charged to select which mechanisms AI is *most* likely to provide, ChatGPT suggests *generation* (allowing new or improved functionality), *resource access* (improved access to existing resources), *compression* (saving time), *conservation* (saving money/other resources) (cf. [Schiavone et al., 2022](#); [Truong et al., 2023](#)) and *enclosing* (improved value appropriation). It also provides rationales for these selections. Viewed as less likely to be widely provided by AI are *legitimation* (enhanced acceptability of focal ventures or reduced acceptability of competitors), *risk/uncertainty reduction*, *resource expansion*, *demand expansion* and *demand substitution* (increase in demand for some offerings in lieu of specified others). The reasons for lower ratings tend to be that their effects are indirect, such as enjoying increased demand due to offering a better product (the likely direct mechanism being generation). The diametrical assessment of resource expansion vs. resource access demonstrates understanding of the EE framework's finer conceptual nuances. It should also be noted that when we probed for specific sub-industries like "sports equipment manufacturing" and asked ChatGPT to assess specific ventures in different industries, the suggested mechanisms were more adapted and varied.

4.3. Characteristics of AI enablement mechanisms: opacity and agency-intensity

When prompted, ChatGPT rightly points out that mechanisms vary in opacity. It asserts that enablement offered by rule-based AI systems (i.e., basic machine learning models) have low opacity because "the connection between inputs and outputs is relatively clear and intuitive". Further, these AI systems are user-friendly, operate on explicit and interpretable rules, exhibit straightforward underlying logic, possess simpler structures, and make identifying and rectifying errors easy. ChatGPT mentioned "decision tree algorithm" as an example because they have a series of easily interpretable and explicit decision rules related to if-else conditions. On the other hand, ChatGPT highlighted that "more complex AI models, such as deep neural networks, can exhibit higher opacity, as their decision-making processes are intricate and challenging". It is highly demanding to understand and interpret these AI models because they operate on highly complex structures and perform sophisticated calculations with multi-layered and interconnected nodes ([Shepherd and Majchrzak, 2022](#)). Thus, identifying the beneficial effects of these mechanisms requires "advanced technical expertise or exceptional imagination".

Agency-intensity also varies across enabling AI mechanisms. ChatGPT argued that AI systems have lower agency-intensity if they leverage prebuilt platforms, application programming interfaces (APIs) and open source AI tools from AI communities. Such "off the shelf" AI capabilities do not require significant upfront technical expertise or investments in building and maintaining the required infrastructure ([Lupp, 2022](#)). On the other hand, agency-intensity of AI enablement is high when ventures need to develop customized solutions for novel situations from scratch. To do so, they need to make substantial investments in research and development, acquiring data and talented AI experts and building AI models, experimentation, testing and deployment of AI systems.

4.4. AI enablement roles

EE Roles build on the (perceived) presence of (anticipated) EE mechanisms. It is therefore not surprising that ChatGPT can offer examples for how AI can contribute to EE Roles through a multitude of mechanisms. It is interesting to note, however, that the selection and rationales for what mechanisms are more likely to contribute to particular roles differ from earlier reasoning of what mechanisms AI is most likely to provide. ChatGPT highlights that AI can play both venture- and pivot-triggering roles by providing deeper and more personalized market insights about future potentials, thereby enhancing entrepreneurs' creativity. As expected, ChatGPT notes that AI can shape ventures as well as their offerings and processes. AI can shape ventures through flat and agile structures; efficient, data-driven and adaptable routines; and redefined organizational boundaries by facilitating external collaborations. AI-driven product shaping is exemplified with enhanced ideation, design, prototyping, and production. Accelerated decision-making, improved resource allocation and enhanced communication and collaboration exemplify process-shaping.

4.5. How AI enablement interacts with other external enablers

Prior research on entrepreneurship in response to environmental change often focuses on a single type and instance of change ([Kimjeon and Davidsson, 2022](#)). The resulting risk of over-attribution of effects makes EE interaction an important matter. ChatGPT singles out other technological developments and regulatory changes as the most important other EEs with which AI would interact (cf. [Lévesque et al., 2022](#)). Interestingly, expressions of doubt recur in several sub-conversations regarding interaction with what is likely to be the most important EE alongside AI in decades to come: climate change and its quest for sustainable transformation. This is an area where one can hope that (future) entrepreneurs demonstrate a comparatively greater ability to see and believe in potentials for AI-enhanced sustainability solutions. Without necessarily specifying entrepreneurship as a main vehicle for it, some researchers already signal greater optimism about AI as a tool for combating climate change ([Biswas, 2023](#); [Di Vaio et al., 2020](#)).

4.6. Fit with the entrepreneurial agent

Although external enablement can occur fortuitously ([Davidsson et al., 2020](#); [Denrell et al., 2015](#)), its realization more typically requires strategic deliberation. This makes fit with the entrepreneurial agent a key issue. Accordingly, related research on [Shane and Venkataraman's \(2000\)](#) individual-opportunity idea has identified 'prior knowledge' as a particularly important agent moderator

(Grégoire and Shepherd, 2012; Shane, 2000; Shepherd and DeTienne, 2005). Similarly, much of the early EE literature pursues EE-Agent interaction as a main or supplementary interest (e.g., Cestino-Castilla et al., 2023; Lucas et al.; Manocha et al., 2021; Wood et al., 2022). We have already addressed what industries and population groups ChatGPT holds to be more and less likely to benefit from AI enablement of entrepreneurship. Prompted with conceptual opposites of organization types, ChatGPT additionally concludes that “Younger, smaller, and more narrowly focused organizations, as well as de novo start-ups, might experience more significant AI-driven entrepreneurial enablement due to their agility and ability to adapt to new technologies.” This being said, the extended reasoning brings up qualitatively different challenges and potentials for the contrasted types rather than a simplistic classification of higher vs. lower enablement potential. The same holds true for individuals; for example, the advantages of youth are contrasted with the experience that comes with age (cf. ‘Prior knowledge’). The list of individual-level factors associated with varying potential for AI-based enablement is also expanded to include education (also indicating ‘prior knowledge’) and – after further prompting – various characteristics of psychological nature, which may or may not be based on solid evidence from the discipline of psychology.

5. Discussion

5.1. Insights into AI as enabler of entrepreneurship

AI comprises a diverse set of powerful and versatile technologies. Based on our conversations with ChatGPT there is little doubt that these technologies have potential for immense impact on entrepreneurship across space, sectors, and population groups. Further, because AI technologies are evolving, this enabling impact is likely to remain for a long time. A practical implication is that while AI will be a *source* of entrepreneurial enablement over considerable time, the initial ways of activating its enabling mechanisms will likely not offer sustained advantages across that time horizon. Instead, the ways of harvesting AI as a source of entrepreneurially enabling mechanisms will also have to change over time.

Although AI's impact might be contingent on the development of supplementary technologies and regulatory frameworks and vary across contexts, the potency and versatility of AI makes it capable of providing a rich palate of forms of enablement across a broad variety of ventures. This means qualitatively different types of enablement for entrepreneurial endeavors across places, industries, and varying kinds and levels of ambition.

This being said, the contextual moderation of AI's enablement implies that the impact of AI on economic organization – the *market* for AI solutions – has a more even spatial distribution than the capacity to supply such solutions. In other words, the value creation and value appropriation associated with fundamental AI development may be strongly concentrated to already advantaged regions, with less advanced regions restricted to simpler applications of ready-made AI solutions for entrepreneurial initiatives of more modest scale.

Our conversations also imply that beyond ventures applying AI technologies as a core ingredient of their products or services, AI tools like ChatGPT can aid ideation, evaluation, and decision-making in any kind of venture (see also Lupp, 2022; Short and Short, 2023). Albeit a theme we cannot develop in full here, we believe our exercise indicates that AI-enhanced application of the EE framework as a practitioner tool also has considerable potential. But ChatGPT is not an oracle that can guide practice with confidence and accuracy on context-specific questions that require deep insights into psychology, cost structures, and likely competition. For example, an important strategic question regarding EE roles is the possibility that EE mechanisms trigger greater or lesser entrepreneurial responses than their likely outcome enhancement would justify. Our exercise suggests that answering such questions is beyond language models like ChatGPT.

5.2. Insights toward improvement of the EE framework

Several observations regarding the notion of EE Scope demonstrate how engaging with AI can help refine the EE framework and its application. The contextual moderation of the spatial Scope suggested by ChatGPT reinforces an important distinction between *Scope of total impact* (of any kind) vs. *Scope of entrepreneurial enablement*. This distinction was not explicated in the original formulation of the framework (Davidsson et al., 2020). Regarding sectoral and sociodemographic Scope, our exercise similarly reminds that the greater total impact of AI in some industries and population groups than in others does not mean that entrepreneurial responses to address this impact needs to be drawn from current members of these industries or population segments.

Further, previous expositions have tended to equate greater Scope quantitatively as potential for a larger number of new ventures and/or greater growth of these ventures. ChatGPT tends to take a more nuanced stance, specifying qualitatively different venturing potentials at local, regional, national, and global levels for an enabler. In a similar fashion, ChatGPT's way of addressing temporal Scope in terms of short-term, medium-term and long-term perspectives (see Table A1) gears thinking toward different forms of venturing such as short-term, project-based entrepreneurship (Ferriani et al., 2009), ventures developed with the specific goal of being acquired (Pisoni and Onetti, 2018), and building a founder-owned venture for the long run (Lidow, 2018; Miller & Le Breton-Miller, 2005). This focus on qualitative variance may be a sounder stance in times of singular focus on unicorn stories (Kuckertz et al., 2023). That an EE has global Scope does not mean that every venture responding to it should have global ambitions. In fact, establishing a venture designed to serve a regional need or temporary cause may be more realistic, better fitting the founders' abilities and ambitions, and easier to turn profitable.

Finally, ChatGPT spontaneously suggested a distinction between *breadth* and *depth* of sectoral Scope, where the former accords with the original definition (range of industries or types of economic activities enabled) whereas the latter denotes the number of ways (processes, functions) in which the EE enables within an industry. This distinction may also be applicable to spatial and sociodemographic Scope.

5.3. Insights about AI tools' usefulness for entrepreneurship research

AI tools like ChatGPT 4.0 do not make domain-specific conceptualizations like the EE framework obsolete. Rather, combining the broad and versatile capacity of AI tools with domain-specific analysis instruments increases the analytical value of both. For example, while ChatGPT's default 'thinking' currently tends toward established organization and optimization of their current activities, the EE framework's focus on venture creation helps keeping a conversation on topic and cover aspects that could easily be neglected in an unguided conversation. Relatedly, while the ChatGPT tends to express what AI can offer in terms of capabilities (such as *learning, adaptability, advanced analytics, human-like cognition, and autonomous decision-making*; see [Table A1](#)), probing guided by the EE framework gears the emphasis directly toward specific benefits such as lowering costs, saving time, increasing demand, and making new functionality possible (EE mechanisms) and situating those in the venture creation process (EE roles).

Conversely, engaging AI tools can definitely *enhance* an analysis guided by conventional theories, models, and frameworks. Conversation with ChatGPT gives the analysis access to additional perspectives based on a much larger body of knowledge than any one individual or small group of individuals can offer, thus providing much valuable food for further thought and action. It is like having an extremely knowledgeable, admirably patient, and often impressively fast collaborator at one's disposal. For example, at the end of our first round of conversation the program was already able to produce in a matter of seconds a long and impeccably sense-making list of titles for a future research agenda.

For theorizing, disciplined imagination through thought experiments, and engagement with practitioners are two important inputs ([Shepherd and Suddaby, 2017](#)). By offering a fast and low-cost mode of theorizing between these two steps, AI tools like ChatGPT can be an excellent enhancer of theory development guided by other conceptual inputs. It allows 'testing' the boundary conditions of initial ideas against a number of applied contexts into which ChatGPT has much greater insight than the theorizing researcher. Although this may not eliminate the value of testing ideas on human practitioners, it should significantly help select and refine the ideas deemed worthy of such testing.

6. Conclusion

There is little doubt that Artificial Intelligence (AI) is a gamechanger that will have massive impact on economic and social organization in the coming decades. This arguably includes acting as one of the most important external enablers of entrepreneurship of our time. To put some flesh on the bone of that assertion, we undertook conversations with a popular, novel AI tool – ChatGPT 4.0 – guided by the External Enabler framework, addressing many of the How? What? Why? Where? When? And for Whom? Of AI as enabler of entrepreneurship.

At the current stage of development, and based on our delimited exercise, we would not claim to have found evidence of AI tools like ChatGPT being able to conceive of unique, brilliant ways of 'playing the entrepreneurship game' that no human 'grandmaster' entrepreneur or researcher would come up with (cf. [Metz, 2016](#)). Nonetheless, the wealth of insight that AI can provide is impressive. This suggests that in addition to ventures using AI significantly in their products and business models, AI will find widespread use as a 'consultant' that aids ideation, evaluation, and decision-making in any kind of venture. We also pointed to its usefulness for enhancing and refining the EE framework. In addition, our exercise yielded transferable insights into the merits of large language models like ChatGPT as a research tool, including its potential for aiding theory development not only based on the EE framework but also on other topics and starting from other conceptual bases. Thus, we have entered an era of AI-enhanced theorizing. And as long as AI enhances rather than replaces human initiative and ingenuity in entrepreneurship research and practice – challenging us to reach new heights with these new, powerful tools – ours is a time for celebration.

Author statement

The authors contributed equally and are listed alphabetically.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Per Davidsson declares that he is one of the originators of the External Enabler Framework.

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APPENDICES

Table A1
ChatGPT prompting details

Prompting themes	Prompting refinement		
	Basic prompting (<i>Asking basic questions about different aspects of the research problem</i>)	Rectified prompting (<i>rectifying responses if they stray away from the intended meaning of fundamental concepts</i>)	Elaborate prompting (<i>Extracting elaborate answers for a deeper understanding and filling information gaps</i>)
AI, external enablers, and the entrepreneurship nexus	<p>Prompted to inquire about and train the model on;</p> <ul style="list-style-type: none"> the constructs in the EE framework (e.g., Scope, Onset, Mechanisms, and Roles) and AI concepts whether and how AI enables new entrepreneurial activities 	<p>Rectified prompts to;</p> <ul style="list-style-type: none"> clarify the concept of AI characteristics differentiate demographic and sociocultural concepts, and redirect the dialogue toward new entrepreneurial activities rather than established organizations 	<p>Further probed;</p> <ul style="list-style-type: none"> differences between AI and other digital technologies salient AI characteristics and the differences among them rationales for varied enablement across venture types
AI and EE characteristics	<p>Prompted to inquire about;</p> <ul style="list-style-type: none"> AI and scope characteristics (spatial, sectoral, temporal, sociodemographic) AI and Onset characteristics (gradual/sudden, predictable/unpredictable) 	<p>Rectified prompts to;</p> <ul style="list-style-type: none"> clarify the AI enablement concept and onset and temporal scope constructs redirect the onset dialogue towards new entrepreneurial activities adjust for positive responses for sociodemographic scope characteristics 	<p>Further probed;</p> <ul style="list-style-type: none"> a nuanced understanding of most and least likely enabled industries, regions, and demographic groups. nuances of AI enablement temporal scope rationales for varied enablement across scope and onset characteristics
AI enablement mechanisms	<ul style="list-style-type: none"> Prompted to inquire about AI enablement mechanisms (e.g., compression, conservation, generation mechanisms) 	<p>Rectified prompts to;</p> <ul style="list-style-type: none"> ensure correct conceptual understanding of some enablement mechanisms clarify definitions of some misinterpreted mechanisms (e.g. generation and enclosing mechanisms) 	<p>Further probed;</p> <ul style="list-style-type: none"> nuances of most and least likely enabling mechanisms rationales for more (e.g., generation) and less likely mechanisms (e.g. legitimation) the combination potential of AI enablement mechanisms
Opacity and agency-intensity of mechanisms	<ul style="list-style-type: none"> Prompted to inquire about the opacity and agency-intensity characteristics of AI enablement mechanisms 	<p>Rectified prompts to;</p> <ul style="list-style-type: none"> ensure correct conceptual understanding of opacity and agency-intensity ensure responses are aligned with key constructs of EE 	<p>Further probed;</p> <ul style="list-style-type: none"> the nuances of low and high agency-intensity and opacity the low and high opacity of rule-based and complex AI technologies the opacity of the generation mechanism how AI can help reduce opacity and agency-intensity of AI enablement mechanisms
AI enablement roles	<p>Prompted to inquire about;</p> <ul style="list-style-type: none"> AI and broad triggering of new economic activities (venturing triggering) AI and triggering of reorientation of entrepreneurial activities in on-going startups and existing organizations (pivot triggering) AI and changes in structures, routines, processes, and products of ventures (shaping role) AI and intermediate (e.g., funding access) or final outcome enhancement (e.g., growth, profitability) 	<p>Rectified prompts to;</p> <ul style="list-style-type: none"> ensure correct conceptual understanding of the triggering concept redirect the focus to enabling role of AI enabled external conditions 	<p>Further probed;</p> <ul style="list-style-type: none"> AI-enabled mechanisms' role in enticing entrepreneurs to initiate new ventures rationales for AI triggering, shaping and outcome enhancement roles relationships between various mechanisms and the three roles rationales and examples of when AI can result in over-triggering and under-triggering
AI and other external enabler types	<ul style="list-style-type: none"> Prompted to inquire about interactions of AI and other enablers (e.g., new technologies, regulatory changes, demographic and sociocultural trends) 		<p>Further probed;</p> <ul style="list-style-type: none"> nuances of interrelationships between AI and other enablers rationales of highly related enablers (e.g., technological) and less connected enablers (e.g., natural-environmental)

(continued on next page)

Table A1 (continued)

Prompting themes	Prompting refinement		
	Basic prompting (<i>Asking basic questions about different aspects of the research problem</i>)	Rectified prompting (<i>rectifying responses if they stray away from the intended meaning of fundamental concepts</i>)	Elaborate prompting (<i>Extracting elaborate answers for a deeper understanding and filling information gaps</i>)
AI and the entrepreneurial agent	<ul style="list-style-type: none"> • Prompted to inquire about AI and individual characteristics (e.g., age, gender, education level, and type, and experience) 		Further probed; <ul style="list-style-type: none"> • rationales for AI enablement of young, educated, digitally savvy individuals • pertinent individual characteristics (age and experience) of AI enablement

Table A2
Illustration of ChatGPT-generated data

Aggregate dimensions	Second order themes	First order codes	Illustrative data quotes
AI characteristics (<i>ChatGPT terminology</i>)	Learning and adaptability	<ul style="list-style-type: none"> • Dynamic algorithms with the ability to learn and adapt • Offering versatile solutions in diverse situations 	“Traditional software is rule-based, and its behavior is determined by pre-defined instructions. AI, on the other hand, leverages machine learning algorithms to learn from data and improve its performance over time without explicit programming.” “AI systems can be designed to adapt to different domains and industries, providing versatile solutions that can be applied in various contexts, making them valuable tools for entrepreneurs and businesses facing diverse challenges.”
	Advanced Analytics	<ul style="list-style-type: none"> • AI systems possess capabilities to process and interpret vast amounts of data • AI systems can identify patterns and make accurate predictions 	“Advanced analytics capabilities of AI enable the processing and interpretation of vast amounts of data, identifying patterns and making predictions with unparalleled accuracy.”
	Human-like Cognition	<ul style="list-style-type: none"> • Mimicking in learning from experiences • Underlying AI technologies supporting mimicking 	“AI technologies possess the ability to learn from experience and adapt to new information, much like human cognition, allowing them to continuously improve and respond to changing circumstances or environments”. [Human-like cognition] “illustrates AI’s progress in mimicking human cognitive abilities, such as natural language processing and computer vision, making AI systems more intuitive and versatile”.
	Autonomy	<ul style="list-style-type: none"> • Real-time autonomous decision making • Improved decision-making quality due to versatile situation encounters 	“AI’s autonomous decision-making capabilities enable it to process vast amounts of data and make decisions in real time, allowing businesses and systems to react more quickly and effectively to emerging situations or changing conditions.” “Autonomous AI systems are designed to learn from their own experiences and the data they encounter, enhancing their decision-making capabilities over time and ensuring that they make increasingly better decisions as they encounter new situations.”
AI and EE characteristics (<i>EE Framework terminology</i>)	Spatial Scope (<i>the geographic area within which the EE provides enabling potential</i>)	<ul style="list-style-type: none"> • Regions with supportive infrastructure, regulations and ecosystem are potential beneficiaries 	“Regions most likely to be enabled for AI-driven entrepreneurial activities include technology hubs and urban centers with well-developed infrastructure, a skilled workforce, strong investment ecosystems, supportive regulatory environments, and a collaborative culture.”
	Sectoral Scope (<i>the range of types of economic activity for which the EE provides enabling potential</i>)	<ul style="list-style-type: none"> • Broad sectoral Scope • Varied enablement in different industries 	“AI has a wide sectoral scope, as it can be applied to numerous industries and sectors, ranging from healthcare and finance to manufacturing and retail, enabling entrepreneurs to leverage AI-driven solutions in various domains.”
	Temporal Scope (<i>the period during which the EE provides enabling potential</i>)	<ul style="list-style-type: none"> • Pronounced and widespread enablement overtime 	“In the short term, AI has already begun to create an enabling impact across various industries and sectors.” “In the medium term, AI is likely to continue transforming the business landscape as its capabilities improve, and its applications expand.” “Over the long term, the enabling impact of AI is expected to become even more pronounced as AI technologies continue to evolve and mature.”

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Table A2 (continued)

Aggregate dimensions	Second order themes	First order codes	Illustrative data quotes
AI enablement mechanisms (EE framework terminology)	Sociodemographic Scope (<i>the range of (sub)populations whose circumstances are potentially affected by the EE</i>)	<ul style="list-style-type: none"> • More enablement possibilities for urban dwellers with access to digital infrastructure • Younger generations with digital literacy are more likely to be enabled 	<p>“People living in urban areas often have better access to digital infrastructure, technology, and resources, making them more likely to be enabled by AI. This includes access to high-speed internet, cutting-edge devices, and educational opportunities in AI-related fields.”</p> <p>“Younger generations [...] are more comfortable with using AI-driven tools and services, and they may have a higher level of digital literacy and skills, enabling them to adapt and thrive in an AI-enabled world.”</p>
	Onset of AI (<i>how EEs first come into being [gradualness; predictability]</i>)	<ul style="list-style-type: none"> • Gradual and somewhat predictable Onset • Instances of sudden breakthroughs expedite transformations 	<p>“The impact of AI on enabling new entrepreneurial activities [in nascent or existing ventures] is likely to be gradual and somewhat predictable, although there may be instances of sudden breakthroughs or advancements that could accelerate the process.”</p> <p>“For example, the development of a ground-breaking new AI algorithm or the sudden availability of vast amounts of previously inaccessible data could accelerate the adoption and impact of AI in certain industries or sectors.”</p>
	More likely enabled by AI Generation (<i>allowing the focal venture to create new or improved artifacts</i>)	<ul style="list-style-type: none"> • Creating new business models and artifacts • Creative innovative solutions with the assistance of AI-connected devices 	<p>“AI-driven technologies offer significant opportunities for ventures to create new or improved artifacts that can meet customer needs more effectively.”</p> <p>“AI can enable the creation of new business models that were not feasible before. For example, AI-powered predictive maintenance solutions can help businesses transition from a traditional product-centric model to a service-based model.”</p> <p>“AI can enable the generation of more intelligent, connected devices that can communicate with each other and adapt to user preferences or environmental conditions. Ventures in the IoT, smart home, and smart city industries can leverage AI to create innovative solutions that improve efficiency, sustainability, and user experience.”</p>
	Resource Access (<i>the focal venture can benefit from improved access to a previously existing (type of) resource</i>)	<ul style="list-style-type: none"> • Some AI characteristics provide access to existing resources • Accessing cloud-based advanced AI computing capabilities 	<p>“AI can improve access to existing resources for ventures by providing advanced analytics, decision-making support, and optimization capabilities.”</p> <p>“The rise of cloud-based AI services allows start-ups and smaller ventures to access advanced AI capabilities without the need to invest heavily in their own hardware and software infrastructure. By utilizing these shared resources and AI-as-a-service platforms, businesses can benefit from cutting-edge AI technologies with a lower upfront investment, reducing the need for extensive internal resources.”</p>
	Enclosing (<i>the focal venture benefits from improved possibility to capture the value it creates or improved loyalty of buyers</i>)	<ul style="list-style-type: none"> • Development of customized market offerings • Enhanced ability of ventures to capture the created value 	<p>“Data-driven insights enable entrepreneurs to better understand customer preferences, allowing them to tailor their products, services, and marketing strategies to meet customer needs, ultimately leading to increased sales and customer loyalty.”</p> <p>“Automation streamlines business processes, reduces labor costs, and minimizes errors, leading to cost savings and higher profit margins, which in turn increases the venture's ability to capture value.”</p>
	Compression (<i>potential for the focal venture to reduce the amount of time it requires for an activity</i>)	<ul style="list-style-type: none"> • Expedited market entry to gain competitive advantage in evolving industries • Rapid experimentation and testing of business models and strategies 	<p>[AI-facilitated data analysis, decision making and product development] “facilitates faster market entry and increased agility, providing startups with a competitive advantage in rapidly evolving industries.”</p> <p>“AI's compression capabilities enable rapid experimentation and learning for entrepreneurs, allowing them to test and refine their business models and strategies more efficiently. By continuously learning from data and adjusting their approach, startups can stay ahead of the competition and adapt to changing market conditions more effectively.”</p>

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Table A2 (continued)

Aggregate dimensions	Second order themes	First order codes	Illustrative data quotes
	Conservation (<i>potential for the focal venture to reduce the quantity of resources it requires for an activity</i>)	<ul style="list-style-type: none"> Better usage of limited resources through automation and optimization Streamlined and optimized decision-making processes 	<p>“AI’s conservation mechanism enables startups to make better use of limited resources, such as time and capital, by automating repetitive tasks and optimizing workflows. This leads to improved operational efficiency, allowing entrepreneurs to focus on strategic activities that drive growth and innovation.”</p> <p>“The conservation mechanism enables AI to support entrepreneurial activities by streamlining and optimizing decision-making processes. By processing large amounts of data and providing actionable insights, entrepreneurs can make better-informed decisions, reducing risks and increasing the likelihood of success.”</p>
Opacity and agency-intensity of EE mechanisms (EE framework terminology)	Opacity (<i>the extent to which the benefits of an enabling mechanism for specific purposes is rather obvious vs. requires specialized knowledge and/or extraordinary imagination</i>)	<ul style="list-style-type: none"> Rule based AI systems have lower opacity Complex AI models have higher levels of opacity Leveraging complex AI models require specialized knowledge 	<p>“Some AI systems, such as rule-based systems or basic machine learning models, may have a relatively low opacity, where the connection between inputs and outputs is relatively clear and intuitive.”</p> <p>“More complex AI models, such as deep neural networks, can exhibit higher opacity, as their decision-making processes are intricate and challenging to interpret without specialized knowledge.”</p>
	Agency-Intensity (<i>the extent to which activation of an enabling mechanism requires tenacity, risk-bearing and resource investments</i>)	<ul style="list-style-type: none"> Investing in research and development and integrative capabilities Developing collaborative capabilities to ensure valuable internal and external collaborations 	<p>“Developing new products, services, or business models [generation mechanism] with AI typically requires a significant investment in research, development, and integration of AI technologies. Entrepreneurs need to possess or acquire the necessary technical expertise, as well as the resources to develop and test their AI-driven innovations.”</p> <p>“The agency-intensity of AI may be low when entrepreneurs have access to prebuilt AI tools, platforms, or APIs that require minimal technical expertise and upfront investments.”</p> <p>“Combining AI with external resources or artifacts to provide new functionality might involve efforts [combination mechanism] such as integrating AI into existing systems, collaborating with partners, or tailoring AI solutions to specific use cases.”</p>
AI enablement roles (EE framework terminology)	Venture triggering (<i>EE enticing entrepreneurs to initiate the creation of a new venture</i>)	<ul style="list-style-type: none"> Deeper insights about unserved markets and customers stimulate entrepreneurial activities Underlying AI technologies inspiring new economic activities with innovations 	<p>“AI-enhanced data analytics can identify underserved markets or customer segments by analyzing massive datasets, including consumer behavior, preferences, and demographics. By revealing these untapped opportunities, AI encourages entrepreneurs to create new products or services to address the needs of these markets, stimulating entrepreneurial activity within the economic system.”</p> <p>“AI’s ability to generate novel ideas, solutions, and designs through techniques like generative adversarial networks (GANs) and natural language processing (NLP) can inspire entrepreneurs to explore innovative business models and offerings.”</p>
	Pivot triggering (<i>EE enticing entrepreneurs to undertake a major reorientation of their emerging venture</i>)	<ul style="list-style-type: none"> Triggering major changes in business models or major products/services 	<p>“AI’s ability to process and analyze large amounts of data helps entrepreneurs make informed decisions about pivoting their business model or altering their product/service offerings, based on real-time market trends and customer feedback.”</p>
	Product shaping (<i>EE influencing the focal venture’s product(s)</i>)	<ul style="list-style-type: none"> Leveraging new technologies to improve products/services 	<p>“Many businesses within affected industries may adapt to AI-driven changes, leveraging new technologies to improve their products or services.”</p>
	Venture shaping (<i>EE influencing the focal venture’s structure, boundaries, or routines</i>)	<ul style="list-style-type: none"> Reshaping organizational structures and boundaries Facilitating task automation and communication 	<p>“AI-enabled mechanisms can help reshape organizational structures by automating routine tasks and facilitating communication across departments. This can lead to flatter, more agile organizations that can respond to market changes more effectively.”</p> <p>“AI technologies can redefine organizational boundaries by connecting businesses with external partners, vendors, and customers more seamlessly. This fosters greater collaboration and enables organizations to access new resources and competencies.”</p>
	Process shaping (<i>EE influencing the pace and/or timing of the new venture creation process</i>)	<ul style="list-style-type: none"> Quick changes in agile ventures Delayed and problematic adoption in ventures with legacy systems, cultural resistance and bureaucracy 	<p>“Younger, smaller, and more narrowly focused organizations, as well as de novo start-ups, might experience more significant AI-driven entrepreneurial enablement due to their agility and ability to adapt to new technologies.”</p> <p>“AI can help older organizations streamline processes, improve efficiency, and reduce costs. However, they may face challenges in implementing AI due to legacy systems, cultural resistance, and bureaucracy.”</p>

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Table A2 (continued)

Aggregate dimensions	Second order themes	First order codes	Illustrative data quotes
AI and other external enabler types	Outcome-enhancement (<i>EE mechanisms contribute to better outcomes for a venture than possible in the absence of the EE</i>)	<ul style="list-style-type: none"> Streamlined operations and improved value proposition leading to greater success Efficient scaling and optimized resource allocation generating higher growth Mutually influential AI and other enablers 	<p>“AI technologies help entrepreneurial firms identify market opportunities, streamline operations, and improve their value proposition, leading to better progress, funding success, and market entry.”</p> <p>“AI-enabled mechanisms facilitate efficient scaling of operations, optimize resource allocation, and identify cost-reduction opportunities, ultimately enhancing a venture's growth and profitability.”</p>
	In general		<p>“While AI can certainly impact other external enablers, such as macroeconomic swings and changes to the natural environment, its influence on new technologies, regulatory changes, and demographic and sociocultural trends is more direct and pronounced.”</p> <p>“Several external enablers can further influence the enablement of AI, as they can shape the development, adoption, and impact of AI technologies across different industries.”</p>
	Regulatory changes	<ul style="list-style-type: none"> Enactment of regulatory changes to in response to AI technologies 	<p>“Regulatory changes are often enacted as a direct response to the development and implementation of AI technologies. As AI becomes more pervasive, governments and regulatory bodies need to address potential risks and ethical concerns, such as data privacy, fairness, and accountability.”</p>
	Technological changes	<ul style="list-style-type: none"> Technological advancements driving AI evolution 	<p>“Advances in computing power, data storage, and network connectivity can drive the development of more sophisticated AI applications and accelerate their adoption.”</p>
	Sociocultural and Demographic changes	<ul style="list-style-type: none"> AI driving changes in social life 	<p>“AI technologies have the potential to change the way people live, work, and interact in their daily lives.”</p> <p>“AI-powered tools are transforming how people access information, shop, and communicate.”</p>
Macroeconomic and Natural-environmental changes	<ul style="list-style-type: none"> AI having less direct impact on macro-economic environment 	<p>“Macroeconomic conditions are influenced by a complex interplay of factors, such as fiscal and monetary policies, global trade dynamics, and geopolitical events. Although AI can contribute to productivity growth and economic development, its impact is just one among many factors that shape macroeconomic swings.”</p>	

Note: Definitions of EE terms from Davidsson et al. (2022) with some minor (shortening) alternations.

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