

The use and impact of AI-tools in early-stage startups

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Abstract

Purpose - While artificial intelligence (AI) is a hot topic in public debate and academic discourse, most research is still conceptual with only few insights into how AI is used in entrepreneurship practice. This study explores empirically how and with what effect early-stage IT startups utilize AI tools, with the general aim of getting a better understanding of how a new technology is adopted in the entrepreneurial process.

Design/methodology/approach - Conceptually, our study builds on the External Enabler Framework to structure the analysis. Following a mixed-method approach, we first analyze qualitative data on how AI tools are used in early-stage startups and identify the mechanisms that are facilitated. In a quantitative study, we test the effect of two identified efficiency mechanisms. Specifically, using Crunchbase data, we compare startups before and after the introduction of ChatGPT-3, focusing on (1) the number of employees and (2) the time to achieve seed funding.

Findings - Our qualitative study indicates that startups use AI mainly in the form of GenAI tools to streamline the process of venture creation, saving time and resources, and less frequently for directly shaping the offered product or the venture itself, presumably resulting from the distinct demands of different applications. While AI is considered important, it has so far not replaced human agency. Building on these results, the quantitative study confirms that startups with access to GenAI tools require fewer employees and achieve critical milestones faster, specifically securing seed funding.

Research limitations/implications – Our qualitative study is based on interviews with early-stage IT startups applying AI tools. In the quantitative study it is challenging to distinguish between AI-infused efficiency effects and investor-related supply-side effects, resulting from the hype surrounding AI. Future research is needed to explore AI's broader influence on entrepreneurial processes.

Originality/value - Our study is one of the first to uncover the use of AI tools in early-stage startups, allowing entrepreneurs to compare to others and enabling policymakers to identify changes in the start-up process, with implications for policy design. For academics, our study contributes to the discussion around AI and agency in the entrepreneurial process and provides insights into the applicability of the External Enabler Framework.

Keywords Entrepreneurship, Early-stage startups, Artificial Intelligence, Mixed-method study, Entrepreneurial agency, External Enabler Framework.

Paper type Research paper

Introduction

Although artificial intelligence (AI) has become a highly prominent topic in public debate and academic discourse, most research is conceptual, and we still have a limited understanding of how AI tools and, specifically, recently launched generative AI (GenAI) tools such as ChatGPT are used by early-stage startups and with what effects. Research on digital entrepreneurship indicates that digital technologies in general have made entrepreneurial processes spatially and temporally less bounded and involve a less clearly defined set of actors, thereby transforming the nature of uncertainty (Nambisan, 2017). The implementation of digital technologies is typically linked to the automation of tasks, scalability and increased efficiency (Jin and McElheran, 2025). Yet, with their ability to be creative and generate new content, GenAI tools have novel qualities and are likely to be applied differently. GenAI appears as a new ‘general-purpose’ technology that can assist entrepreneurs in almost all the tasks of starting a new business. Its effects on the entrepreneurial process might be even more pronounced, leading some observers to compare GenAI to a virtual co-founder (Brown, 2024).

Over the last decades, the development of AI has largely followed a steady, incremental trajectory, interspersed with significant breakthroughs and milestones that have collectively propelled the field forward (Haenlein and Kaplan, 2019). An example of such a past milestone was IBM's Deep Blue historic chess victory in 1997, which served as a catalyst for advancing AI research and application (Hsu, 1999, p. 80). Yet, the introduction and unforeseen sudden widespread adoption of ChatGPT-3 following its launch in November 2022 stands apart, not only for its technological sophistication but also for the rapidness of its adoption, surpassing one million users within just five days of its release (Abaddi, 2024, p. 1919). This unprecedented rate of adoption signifies a departure from the historical pace of progress in AI, signaling a transformative shift in how AI integrates with daily human activities (McKinsey &

Company, 2023). Haleem *et al.* (2022, p. 1) qualify this technology as a “paradigm change in information access”. While historical narratives of AI’s development often emphasize a pattern of steady progress, the advent of ChatGPT-3 exemplifies a moment of sudden, radical change (Davidsson and Sufyan, 2023). Since then, several other GenAI tools emerged that allow users to easily create new content, such as text, images, or code.

While it is generally accepted that new technologies offer opportunities for novel entrepreneurial activity (Ramoglou and Tsang, 2016), it is unclear how exactly new technologies, such as GenAI, are adopted by entrepreneurs when starting a venture and how they have an impact on the new business. Extant research considers the impact of digital technologies in general on entrepreneurial pursuits and the role of entrepreneurial agency (Nambisan, 2017), provides a conceptual overview of research fields that need further exploration (Obschonka and Audretsch, 2020), explores conceptually how AI can augment entrepreneurs in pursuing potential opportunities (Shepherd and Majchrzak, 2022), and maps its influence for the different phases of the entrepreneurial process (Giuggioli and Pellegrini, 2023), providing a fruitful basis for further research.

There are indications that the startup landscape has changed substantially with the growing power of AI systems (Weber *et al.*, 2022). The unprecedented popularity of ChatGPT and other such tools and the resulting hype around AI in general has led to a surge in entrepreneurial activity and Venture Capital funding in the United States, with 25% of total startup investment going to AI in 2023, the year following the launch of ChatGPT-3, compared to 12% in 2022 (Glasner, 2023). Consequentially, research at the intersection of AI and entrepreneurship has exploded recently (Blanco-González-Tejero *et al.*, 2023; Chalmers *et al.*, 2021; Davidsson and Sufyan, 2023; Fossen *et al.*, 2024; Kusetogullari *et al.*, 2025; Uriarte *et al.*, 2026). Still, most research is of a conceptual nature while empirical studies typically predate ChatGPT-3

and other now popular GenAI tools (Fossen *et al.*, 2024; Giuggioli and Pellegrini, 2023; Haefner *et al.*, 2023). As the introduction and widespread adoption of ChatGPT is likely to have impacted early-stage startups as well, there is a clear need to better understand the current use and effect of AI-tools in the entrepreneurial process. Against this background, this study aims to answer the following research questions: First, which and how are AI systems currently used in early-stage ventures? Secondly, how does the implementation of AI change the overall process of venture creation? Thirdly, what is the measurable impact of AI on the efficiency of the entrepreneurial process? In this paper, we do not investigate *why* certain startups adopt AI or which startups are fastest to do so as this would require a different research approach. Instead, we focus on startups with a close proximity to information technologies that can be assumed to be at the forefront of applying AI-tools.

To answer our research questions, this paper follows a mixed-method approach with an exploratory sequential design: we first collect qualitative data to identify patterns and develop hypotheses, which are then tested using quantitative data (Creswell and Plano Clark, 2018, pp. 84ff). The External Enablers Framework (EEF) (Davidsson *et al.*, 2020) forms the conceptual basis for our analysis. Specifically, we conduct a qualitative, explorative study (Study 1), comprising 14 interviews with founders of early-stage IT-startups to identify areas of AI implementation, focusing on type of AI used, roles of AI in implemented tasks, and mechanisms explaining how AI facilitates the development and success of entrepreneurial ventures. The study finds 109 cases of AI usage which are categorized into 29 individual use cases (UCs) which are mapped to their roles and mechanisms in the entrepreneurial process. Then, in study 2, building on these results, we quantitatively measure and test the impact of the introduction of ChatGPT-3 and other GenAI tools on the efficiency of the entrepreneurial process. Specifically, we analyze and compare the number of employees and the time it takes startups

to reach their first funding, as an important milestone in the entrepreneurial process, immediately before and after the introduction of ChatGPT-3.

Overall, with our comprehensive mixed-method study, we aim to contribute to a better understanding of how and with what effects AI is used in early-stage startups, and which mechanisms are relevant for moving forward in the process of setting up a new business. We also contribute to the discussion to what degree AI can replace human agency in the entrepreneurial process (Nambisan, 2017; Shepherd and Majchrzak, 2022).

The External Enabler Framework

We use the External Enabler Framework (EEF) by Davidsson *et al.* (2020) to dissect the impact of AI on entrepreneurship, structure this review and guide data analysis.

Background of the framework

The EEF was developed as a response to limitations inherent to the concept of ‘opportunity’ (Ramoglou and Gartner, 2023, p. 1528). Historically, two primary theories dominated the discourse on how entrepreneurial opportunities arise (Alvarez and Barney, 2007): The discovery theory argues that opportunities exist independently in the external world, waiting to be discovered by alert entrepreneurs (Shane, 2000, p. 451). In contrast, the creation theory posits that entrepreneurs actively construct and shape opportunities through their initiatives and actions (Alvarez and Barney, 2007, p. 132). However, both these theories almost exclusively focus on the entrepreneur and the opportunity, without adequate consideration of the broader external environment and the role of exogenous changes or shocks as the basis for such entrepreneurial opportunities (Ramoglou and Gartner, 2023, p. 1526).

Davidsson *et al.* (2020) shift the focus to external, actor-independent factors, and provide a framework to analyze their influence on venture emergence. The EEF acknowledges that

entrepreneurial opportunities are intricately linked to various external factors which can either boost or hinder their emergence and the success of startups.

The components of the framework

An "enabler" is understood as an aggregate-level phenomenon—a change in the environment that can benefit multiple emerging ventures (Davidsson *et al.*, 2020, p. 312). Such enablers span regulatory, socio-cultural, economic, and technological domains and act as a disequilibrating force, influencing entrepreneurial action and outcomes in varying degrees (Kimjeon and Davidsson, 2022). Their specific effects are contingent on the nature of both the enabler and the venture (Davidsson *et al.*, 2020, p. 313).

The EEF by Davidsson *et al.* (2020) differentiates three dimensions, each offering a distinct lens through which external influences on entrepreneurship can be viewed and understood:

1. *Characteristics of External Enablers:* The EEF classifies observable traits of the enablers, such as their scope and onset, which directly influence the strategic direction and outcomes of new ventures (McGee and Terry, 2024). The scope of an enabler, be it sectoral, spatial, temporal, or socio-demographic, determines its potential impact on the market. Onset, characterized by its suddenness and predictability, affects how swiftly and effectively ventures can capitalize on these enablers. While the emergence of AI in general has been to some degree gradual over the years, the launch of ChatGPT in late 2022 can be regarded as a breakthrough that suddenly raised the awareness of the relevance of GenAI (Davidsson and Sufyan, 2023).
2. *Mechanisms of External Enablers:* This dimension of the EEF details the cause-effect relationships that explain *how* enablers facilitate the initiation, development, and success of entrepreneurial ventures, such as Compression, Conservation, Expansion, and Generation (Davidsson *et al.*, 2020, p. 318). It captures the essence of how, for example, regulatory changes

can contribute to streamlining processes, reducing bureaucratic hurdles, and enabling faster market entry (Meurer and Davidsson, 2023, p. 4). AI technologies can be assumed to most likely facilitate the following mechanisms: “generation (allowing new or improved functionality), resource access (improved access to existing resources), compression (saving time), and conservation (saving money/other resources)” (Davidsson and Sufyan, 2023, p. 4). Mechanisms can also have a different degree of agency-intensity (Ramoglou and Tsang, 2016, p. 418), referring to the “the extent to which activation of an enabling mechanism requires tenacity, risk-bearing and resource investments” (Davidsson and Sufyan, 2023, p. 10).

3. *Roles of External Enablers*: Finally, the EEF details the roles that external enablers play, ranging from motivating entrepreneurs to start new ventures (triggering role), shaping the process of venture creation, shaping the product offering, or shaping the venture itself, to an outcome-enhancing role, where the venture directly profits from the implementation of the new technology or some other change. This list illustrates that external enablers can influence the entrepreneurial process in very different ways (Davidsson *et al.*, 2020, p. 320).

Together, these three components provide a robust framework for understanding the complexity of actor-independent events on entrepreneurship (von Briel *et al.*, 2018). Unlike the opportunity theories, the EEF highlights the different ways in which external conditions influence entrepreneurial action and outcomes, offering a comprehensive toolkit for analyzing and leveraging these dynamics for venture creation and growth (Kimjeon and Davidsson, 2022, p. 645). It is important to mention that the EEF is not a theory as such, explaining cause-effect relationships, but a framework for describing and categorizing the effect of external events on entrepreneurship. Yet, it allows us to better understand how entrepreneurs try to profit from

changes in the external environment, such as new technologies, and how their characteristics affect the way they are adopted.

The adoption of AI and the entrepreneurial process

While GenAI can be considered a relatively recent technology, the adoption and effects of IT in general have been subject of some previous research. As a broadly used model, the technology acceptance model assumes that perceived ease of use and perceived usefulness predicts the adoption of a new technology (Davis, 1989). More recently, the dynamic capabilities framework describes technology adoption as a process of sensing, seizing, and reconfiguring capacities through resource mobilization and technology integration (Teece, 2007). As the focus of our study is not on the antecedents of AI implementation but on how and with what effect early-stage startups use AI tools, we present a review of the respective literature in the following.

Concerning IT adoption in general, research typically focuses on the performance effects of IT investments while also discussing the potential benefits of IT outsourcing and cloud solutions (Jin and McElheran, 2025). The resource-based view has been instrumental in explaining such benefits as firms develop valuable organization-specific resources and capabilities over time through IT adoption and ICT skills (Nason and Wiklund, 2018). Focusing on more recent research on the use of AI technologies in venture emergence, AI's ability to automate repetitive tasks and process information at unprecedented speeds can be assumed to significantly reduce the time ventures require for various activities and allow entrepreneurs to focus on the core challenges of their ventures (Truong *et al.*, 2023, p. 803). Specifically, distinguishing between different phases of the entrepreneurial process, Truong *et al.* (2023) argue in their conceptual research that AI can drastically reduce the time and resources needed for the entire

entrepreneurial process: In the *discovery phase*, AI's capabilities in automating and enhancing the process of idea generation and opportunity identification may contribute to a significant reduction in time and resources for entrepreneurs, as AI tools allow for the analysis of vast amounts of data from online forums and databases. This may not only accelerate the opportunity search but also improve the quality of insights, identifying market trends and consumer needs that would otherwise require lengthy manual analysis. The efficiency of AI in analyzing data and predicting market responses might allow entrepreneurs to quickly pivot or refine their ideas, substantially reducing the time typically required for market research and validation. As ventures progress into the *exploitation phase*, the time and resource-saving attributes of AI become increasingly evident and impactful. Truong *et al.* (2023, pp. 803-804) illustrate how AI-driven tools might streamline critical aspects such as fundraising, market development, and customer engagement.

Von Briel *et al.* (2018) argue that the specificity of a digital technology, reflecting “the degree to which it is specialized to performing a unique task and is not redeployable to other tasks” (p. 65) affects its ability to automate the execution of specific actions and improve their efficiency. With increasing specificity of digital technologies, their potential for enabling compression and conservation mechanisms should also increase.

Concerning empirical results, a standout study by Peng *et al.* (2023) delved into the influence of a particular AI tool on the productivity of software developers. Their findings revealed a remarkable 56% acceleration in task completion when utilizing the AI tool. Turning their attention to startups, Haji and Sheehy (2023) highlighted how AI tools significantly reduce costs, streamline tasks, and save time. Similarly, research by Almansour (2023) pinpointed the automation of routine and redundant tasks within Fintech startups, particularly in the realm of customer service. Rezazadeh *et al.* (2025) suggest that startups in the growth phase use

GenAI tools to speed up product development, enhance operational efficiency, and foster sales.

Early-stage startups typically have limited resources, with employees often being their most crucial asset (Eisenmann, 2020). The outlined efficiency gains can be assumed to contribute to enhanced human productivity, potentially reducing the size of the workforce necessary to achieve important milestones in the entrepreneurial process. Brown (2024) highlights the potential synergy between GenAI and human skills, promoting a strategic and prudent use of human capital and offering not just a tool for operational efficiency but a strategic partner that enhances decision-making, frees up human creativity for higher-level tasks, and fosters a leaner, more agile venture structure. This has guided Brown (2024) to compare AI to a virtual co-founder. Yet, most of the described research is conceptual and does not investigate the actual use of AI tools in practice, especially early-stage startups.

Study 1: Qualitative study

The aim of the first study is to gain a deep understanding of how AI tools are currently used in early-stage startups and how they affect the process of venture creation, thereby providing answers to the first two research questions.

Approach and Methods

We collected data through 14 interviews with IT startup founders, following a semi-structured approach (Berg and Lune, 2017). This approach allows us to gain a deep understanding of the specific cases, extensively exploring which and how founders use AI tools and in what way they impact the founding process of their startup (Adams, 2015; Rashid *et al.*, 2019). Given the recent introduction of advanced AI tools to the market, this study focuses on founders of early-

stage startups to ensure that use cases can be explored from the very beginning of the venture creation process.

We selected IT startups which we deem at the forefront of applying AI-tools. While the focus on IT-related ventures might limit generalizability, the primary aim of the qualitative study was to investigate startups who have gained experience in applying AI tools. The startups were identified using a snowball sampling method where initial interview partners came from the university network and a related incubator program. The startups in our final sample are from Austria, Germany, Spain, Switzerland, and the U.S., and are building IT-solutions across different areas of application ranging from healthcare to waste management (see Table 1). Interviews were held online in late 2023. The interview guideline covered the following areas: company specifics, implementation of AI-tools, outcomes, and impact (see Appendix A in the supplementary material). In the interviews, the respondents were asked to name the AI tools they use on a regular basis in their venturing, followed by questions on what tasks the tools were used for, what role they play, and in which way they contributed to task-fulfillment (i.e. mechanisms) for every identified use case.

----- Include Table 1 about here -----

After the transcription, the collected data was coded and labelled based on predefined categories to facilitate an efficient and transparent data analysis (Berg and Lune, 2017). Specifically, the coding framework was constructed in a deductive way, building on the EEF. The high-level categories used to code and assess AI UCs are *process stage*, *mechanisms*, and *role* (Davidsson *et al.*, 2020). For each deductive category, we developed precise definitions, examples, and coding rules (Mayring, 2000) which are described in Appendix D. When the collected data did not match the predefined categories, we developed additional inductive categories to codify all passages to clearly define unique UCs (see Appendices B and C). While the third

author, who has conducted all the interviews, kept the insider perspective and coded all data, the co-authors' roles were primarily to take the outsiders' perspective by giving feedback to the coding scheme and checking the coding of the UCs (Gioia *et al.*, 2013).

In line with the analysis approach described by Mayring and Fenzl (2014, p. 550), the transcribed interviews were individually broken down into smaller pieces to assess different UCs of AI tools mentioned by founders. After coding half of the interviews, the predefined categories were reassessed and adapted to account for emerging patterns from inductive reasoning. In doing so, the process stages as defined by foundational research were further broken down into *founding phase* (1), *task category* (2) and *use case* (3) to account for the practice-focused logic of startup founders. Next, content analytical units were coded based on *mechanisms* and *role* (Appendix D in the supplementary material contains all the coding rules and exemplary quotes). Finally, the identified UCs were aggregated and compared across all interviews to create a comprehensive data set, including the frequency of mentions, and clustered to build insights based on identified patterns, using the qualitative content analysis method as described by Mayring (2000). Because of space constraints, we focus on the key results of the quantitative study concerning mechanisms and roles of AI use in the following.

Findings

Based on the data, we identified a total of 109 cases of AI use which we categorized into 29 unique UCs of AI tools for venture creation in nine different task categories, namely *idea generation*, *industry research*, *business model*, *pre-validation*, *product building*, *sales*, *marketing*, *education and data*, and *administration* (See Table 2). While some use cases were prevalent in more than half of all ventures (UC#1 Brainstorming; UC#12 Coding support; UC#19 Text generation marketing), others could only be found in individual firms (e.g. UC#28 Financial model). A

description of all UCs, including exemplary quotes, can be found in Appendix C. In our sample, early-stage startups used 19 different AI tools during the venture creation process. Among the identified tools, *ChatGPT* was by far the most applied one, being mentioned in 21 out of 29 application cases. *Google Bard* is used in four cases, *Bing AI* and *DALLE 3* in two, and the remaining 15 tools find application in one respective UC only. While not originally anticipated, respondents almost exclusively mentioned GenAI tools when being asked to name the AI tools they use.

----- Include Table 2 about here -----

Considering the *role* of AI tools as external enablers in venture creation, as defined by Davidsson *et al.* (2020, p. 320), the majority of UCs are defined by a *process-shaping* role, meaning that AI influences the venture creation process without directly impacting the product or venture itself (Davidsson *et al.*, 2020, p. 321). In seven UCs, AI tools are directly *shaping* the *product* and *venture* itself. Yet, as most of the interviewed founders try to incorporate AI-solutions into their product offering, there might be a more significant impact to be explored in future research.

Finally, regarding the *mechanisms* that AI tools have on venture creation, nine UCs are described by compression, meaning that time-savings are the most relevant impact (see Figure 1). This is followed by conservation with seven mentions, referring to a resource-saving influence, and expansion with six mentions, which is defined as increasing “the availability of a resource” (von Briel *et al.*, 2018, p. 52). Substitution, combination, and generation mechanisms are found in two UCs each, while AI tools influence venture creation through uncertainty reduction in one UC.

To better understand the quantitative importance of the individual UCs, we considered in how many startups the respective UCs were present, as indicated by the frequency column in Table 2. In Figure 1, we indicate the number of identified UCs by role and mechanism, as most important attributes of AI implementation: AI tools are by far the most frequently used in a *process-shaping* role, thus affecting the process of new venture creation. Two mechanisms stand out: Compression is the most prevalent mechanism, indicating cases where AI tools are used to perform internal processes in shorter time. For example, IP#3 explained: “*«It helps with the iteration, it helps with the time we have to invest, but it doesn’t take all the work off our hands. (...) we use it as a great support tool to help us work more efficiently.»*». As a similar mechanism, conservation refers to performing an activity with less resources (e.g. less employees), rendering internal processes more efficient. For example, IP#1 stressed: “*«But the effect is also very significant in terms of resources we require. We can basically outsource tasks to AI for the most part. For example, for all visuals we don’t need any graphic designer or other guy.»*». Secondly, AI tools are often used in a *product-shaping* role. Typically, AI-tools are combined with other resources to create new functionalities or offerings. Thirdly, AI tools perform a *triggering* role where such tools have prompted entrepreneurs to start the new business or introduce a new product or service. Typically, the availability of new functionalities of AI tools has triggered them to pursue this perceived business opportunity. Interestingly, AI technologies are seldomly used for directly shaping the venture itself.

----- Include Figure 1 about here -----

Interviewed founders continuously emphasize that, overall, AI is an efficiency tool. AI has a significant impact on the speed and efficiency of the venture creation processes. Many founders highlight that cost- and time-savings are the main influences of AI (i.e. Compression and Conservation). This is nicely summarized by IP#6 “*«So at the end of the day, it’s an efficiency-*

boosting tool. (...) I think you can definitely get further and are faster with the same amount of staff using the AI tools that we now have.». While AI is in some cases more than an efficiency tool and e.g. also changes the way how ideas are validated, the involvement of AI in task fulfillment mostly remains on a supportive level. AI provides access to more resources, shares perspectives on ideas, and helps in research, while it only creates tangible outcomes autonomously in a few cases (e.g., UC#12, UC#13, UC#15, UC#16). AI mainly serves as a source of creative inspiration, supports decision-making, and is subject to adjustment by founders. The validity of outcomes of AI tools without any human inspection and possible adjustment is viewed critical (e.g. IP#8; IP#14). Outputs of AI are shaped in an interaction with founders and so far, lack significant transformative impact on the role and tasks of entrepreneurs. They also do not lead to substantial changes in founder team set up (IP#7).

Discussion of study 1

The first finding of our study is that ChatGPT is by far the most applied tool in venture creation, applying to 21 UCs out of 29 identified, which underlines its widespread adoption among early-stage startup at the time of data collection. The reason for the dominant position of this tool seems to be its broad and easy applicability. Applying the EEF of Davidsson *et al.* (2020), ChatGPT can be said to have a broad scope of application and a low agency-intensity when used on an individual level. Founders refer to a time-value trade-off that needs to be considered when assessing UCs for AI: the more specific a tool is, the more complicated its setup becomes. More narrow-scoped tools might become more relevant for standardized tasks that appear more regularly at later stages in the entrepreneurial process, similar to the proposition of von Briel *et al.* (2018).

This study assesses roles and mechanisms of AI use on a UC basis. While conceptual research has outlined possible positive effects of using AI for all stages of the entrepreneurial

process, our qualitative study suggests that AI-tools are most frequently applied in a process-shaping role, allowing entrepreneurs to perform venture creation activities in shorter time and with fewer resources. Compression and conservation are the most frequent mechanisms of AI application, next to expansion. In this way, our results make it possible to sharpen the propositions of previous conceptual research by providing indications of the quantitative significance of the individual mechanisms (Davidsson and Sufyan, 2023; Giuggioli and Pellegrini, 2023). At least so far, these efficiency-related mechanisms are much more widespread than mechanisms that directly affect the product offering or the venture itself.

We do not find a significant influence of AI on the process structure itself, in the sense that it would completely transform the role of entrepreneurs and change the “locus of entrepreneurial agency” (Nambisan, 2017, p. 1029). While one might argue that the use of AI tools indeed leads to a more diffused entrepreneurial agency (Nambisan, 2017), as additional perspectives are taken into account before making a decision, entrepreneurs consider it relevant to always inspect and possibly adjust the output of AI tools. Thus, AI cannot be considered as a new agent or an additional co-founder, as anticipated by Brown (2024). However, the impact of AI tools on agency might change with increasing maturity, when tasks become more standardized and data-driven. A limitation of our qualitative study is the relatively small sample size and the focus on IT startups, which might limit its generalizability to other industries. Still, based on the 14 interviews we identified more than 100 cases of AI use, and a largely coherent picture emerged.

Overall, the findings of study 1 indicate that GenAI-tools can be fruitfully applied in the process of venture creation. The identified AI UCs relate to activities conducted in the early stage of venture development and suggest important efficiency effects for startups with access to GenAI tools compared to those without. We assume that the availability of ChatGPT and

other GenAI tools has made early-stage startups more efficient in the process of setting up a business, reducing the number of required employees as well as the time for achieving the next milestones in the entrepreneurial process. Using the terminology of the EEF, we assume that startups with access to GenAI tools, i.e. started after the launch of ChatGPT-3, will benefit from two most frequently observed mechanisms of AI application, the compression and conservation enabling mechanisms, as outlined below:

Hypothesis 1 (H1): Startups founded post-ChatGPT-3 will have a lower employee count at the time of their first funding round compared to startups founded pre ChatGPT-3. (Conversation effect)

Hypothesis 2 (H2): Startups founded post-ChatGPT-3 will achieve their first funding round in a shorter time compared to startups founded pre ChatGPT-3. (Compression effect)

Study 2: Quantitative study

Building on the literature review and the results of study 1, the second study aims to measure and test the quantitative impact of the introduction of GenAI tools, approximated by the introduction of the currently most widely used tool, ChatGPT, on entrepreneurial efficiency, thereby answering our third research question.

Methodology: Funding stage as benchmark

To measure the efficiency of startups, it is necessary to compare them at a similar point in time. Ideally, we would follow a productivity approach and measure input against an output. However, quantifying output among early-stage startups presents a unique challenge due to the diversity of products, services, and operational models (Rompho, 2018, p. 33). This diversity impedes a direct comparison of productivity across companies. While some studies have looked at output on single tasks (Cambon *et al.*, 2023; Peng *et al.*, 2023), our objective extends

to comparing startups that undertake a variety of tasks. Therefore, it is imperative to identify a commonality among startups to compare them in a relevant manner.

We focus on startups that have achieved the milestone of their first funding round, i.e. their seed funding, which allows for a uniform comparison, aligning ventures that, despite any inherent differences in their mission or tasks, are at a similar stage in their development trajectory (Santisteban and Mauricio, 2017). We follow Alemany and Andreoli (2018, p. 12) and define the first funding round, i.e. the seed funding, as the end of the seed stage. The period that precedes the seed funding, the seed stage, is pivotal in a startup's lifecycle, serving as a foundational period where core ideas are tested, initial products are developed, and market validation begins (Santisteban and Mauricio, 2017). Obtaining seed funding offers a fixed point in time where comparison is most meaningful and offers a structured approach to analyze the impact of GenAI on startups.

We test our hypotheses using two key indicators: the time required for startups to reach their initial seed funding round and the number of employees they have at the time of seed funding.

To do so, we will do a comparative analysis of startups before and after the launch of ChatGPT-3. To proceed with this comparative analysis and operationalize these concepts, we identify specific, measurable variables that serve as proxies for the enabling mechanisms conservation and compression.

Data

To analyze the impact of GenAI tools on early-stage startups, we compare data from two distinct samples: one from the period immediately preceding the introduction of ChatGPT-3 and one from the period following its launch. This approach is grounded in the assumption that

the release of ChatGPT-3 represents a paradigm shift (Haleem *et al.*, 2022) that has democratized the use of GenAI for companies (Ray, 2023, p. 122).

The data collection strategy draws inspiration from Te *et al.* (2023), leveraging the extensive databases of Crunchbase and LinkedIn to gather key startup metrics. On Crunchbase, the dataset for funding rounds in the first group was constructed using several filters. For the first group, we selected startups founded within a 12 months period *after* the launch of ChatGPT-3 (December 2022 to November 2023) that had achieved their seed funding rounds between June 2023 and November 2023. This allows a 6-months gap between the launch of ChatGPT-3 and the first funding round. This time lapse should be sufficient to notice the effects, given the rapid adoption of GenAI technology. For the second group, the same approach was taken, except for the year *prior* to the launch. This approach minimizes the temporal distance between the two groups and ensures a direct comparison (See Table 3).

Additionally, we narrow down the sample by geographic location, exclusively including startups based in the U.S., the main reason being that startups in the U.S. can be assumed to be at the forefront of applying AI tools. We also use the industry filter to only select startups active in the "Information Technology" and "Finance" industry to have a homogeneous sample and avoid variations by industry. Moreover, we collect company descriptions from Crunchbase to refine the sample to include only startups developing a product, excluding those primarily offering services. This refinement prevents artificial inflation of employee counts, particularly in cases such as consulting firms.

Table 3 provides a summary of the creation and funding dates, including the period gap between each. To simplify, the group post-ChatGPT-3 launch is called "2023" and the group before the launch "2022". For the 2022 group, the sample comprises 97 startups, while the 2023 group contains 140 startups.

----- Include Table 3 about here -----

We have chosen to minimize the time lapse between the two groups to the shortest feasible duration to mitigate the influence of macro-economic changes that could otherwise skew the analysis.

Variables

Compression Mechanism - Time to Funding: We use ‘time to funding’ as a measure for the compression enabling mechanism of GenAI. This variable measures the time from the startup's formation to the acquisition of seed funding. The rationale behind selecting "time to funding" lies in its relevance to assessing how GenAI can shorten the critical pre-funding period.

The primary source for the founding and funding dates is Crunchbase. Crunchbase uses different sources for their data on founding and funding dates, including their extensive investor network, active community contributors, AI and machine learning, and their own data team (Crunchbase, 2022). Several academic studies have used Crunchbase as their primary data source and we refer to previous studies for a discussion of its advantages and limitations (Kanze *et al.*, 2018; Te *et al.*, 2023; Żbikowski and Antosiuk, 2021). To ensure reliability, we compare the founding date for each startup using the data from LinkedIn, which includes the date at which a company account has been created. If the dates on LinkedIn and Crunchbase differ by a maximum of 31 days, we consider the earliest and the latest potential founding date. If the difference is larger than 31 days, or if one of the two dates falls outside the selected timeline, the case is removed from the dataset. Furthermore, while the exact seed funding dates are systematically available on Crunchbase, the creation dates for some startups lack precision, with only the month specified. In that case, a maximum and minimum creation date within the specified month is also included.

Conservation Mechanism – Number of Employees: We use ‘number of employees’ as a measure for the conservation mechanisms of GenAI. We measure the number of employees at a fixed point in time, shortly before the first funding round, allowing a coherent comparison between early-stage startups. The employee counts at the time of seed funding for both samples is collected on LinkedIn. To mitigate potential biases caused by imminent funding rounds boosting hiring, we gather employee counts one month *before* the seed funding round.

Findings

Time to funding. For the 2022 group, startups meeting the minimum criteria¹ had a mean estimated time to funding of 166.4 days (SE = 9.23), with a 95% confidence interval (CI) ranging from 148.1 to 184.8 days. For those meeting the maximum criteria, the mean estimated time to funding was 186.4 days (SE = 9.71; 95% CI: 167.1 to 205.7 days). The time to funding distribution for both criteria exhibited slight negative skewness and negative kurtosis, indicating relatively symmetrical distributions with lighter tails compared to a normal distribution. In contrast, for the 2023 group, the estimated minimum mean time to funding was significantly lower at 120.1 days (SE = 6.78; 95% CI: 106.7 to 133.5 days). The average maximum time to funding was slightly longer at 142.9 days (SE = 6.90; 95% CI: 129.3 to 156.6 days). Similar to the 2022 group, the distributions for both criteria in 2023 displayed marginally positive skewness and negative kurtosis, suggesting relatively symmetrical distributions with thinner tails compared to a normal distribution.

Inferential statistics: Time to funding. To test whether it is justified to generalize the results of our sample to the overall population, we conducted a Mann-Whitney-U-test and compared the

¹ As described above, we had to consider different founding dates in cases where the dates differed in the two databases, leading to a minimum and a maximum time to funding.

time it took startups in 2022 and 2023 to reach their first seed-funding round. The Mann-Whitney-U-test is a non-parametric statistical test used to determine whether there is a significant difference between the distributions of two independent samples. Unlike parametric tests, it does not assume a normal distribution of the data, making it suitable for non-normally distributed interval data (Nachar, 2008, p. 14).

The Mann-Whitney-U-tests show a significant difference between the two independent samples (before and after the introduction of ChatGPT-3) in how quickly startups reached their seed-funding for all scenarios. For the minimum time to funding (Min-Min Criteria), the test yielded a Mann-Whitney-U-statistic of 4895 with a p-value of less than 0.001. This indicates that startups established in 2023, post-ChatGPT-3, were able to secure funding an average of 50 days faster than those in 2022, with a moderate effect size (rank biserial correlation of 0.279). In the maximum time to funding scenario (Max-Max Criteria), a Mann-Whitney-U-statistic of 5101 with a p-value of 0.001 further confirmed that startups in 2023 also experienced a significant reduction in time to funding, with a mean difference of 45 days, with moderate effect size of 0.249.

Employee count. For testing the second hypotheses, we compare the employee count of startups before and after the introduction of ChatGPT-3. For the 2022 group, the mean number of employees at the time of funding was 8.0 (SE = 0.91; 95% CI: 6.2 to 9.8). The distribution of employee counts for 2022 exhibited positive skewness (2.69, SE = 0.25) and leptokurtosis (7.73, SE = 0.49), indicating that the distribution was skewed to the right and had heavier tails compared to a normal distribution. This suggests that while most startups had relatively small employee counts, there were a few outliers with significantly larger employee numbers. Further examination of the data reveals a substantial range of employee counts, spanning from 1 to 50 employees, with a variance of 80.87 and a standard deviation of 8.99. The interquartile range,

representing the middle 50% of the data, was 6, indicating moderate variability in startup employee counts. These findings suggest that while the average employee count at funding for 2022 startups was relatively low, there was considerable variability in the size of startup teams, with notable outliers having larger employee numbers.

For the 2023 *group*, the mean number of employees at the time of funding was only 3.5 (SE = 0.25; 95% CI: 3.1 to 4.0). The distribution of employee counts exhibited positive skewness (1.13, SE = 0.21) and platykurtosis (0.16, SE = 0.41), indicating that the distribution was skewed to the right but had lighter tails compared to a normal distribution. This suggests that while most startups had relatively small employee counts, there were also fewer outliers compared to the 2022 cohort. The range of employee counts for 2023 was narrower, from 1 to 12 employees, with a variance of 8.41 and a standard deviation of 2.90. The interquartile range was 4, indicating moderate variability in startup employee counts.

Overall, these findings suggest that, on average, startups in 2023 had fewer employees at the time of funding compared to 2022. Also, the distribution of employee counts in 2023 was less skewed and had lighter tails, indicating a more concentrated distribution of team sizes.

Boxplots (see Figure 2) demonstrate the trend towards leaner startup teams in 2023, presumably due to the operational efficiencies introduced by GenAI technologies like ChatGPT-3. The reduced variability and lower median employee count in 2023 indicate that startups are reducing their reliance on larger teams, likely achieving the same outcome with fewer resources. To ensure the robustness of our findings, we will conduct further statistical analyses to confirm the validity and reliability of the observed trends.

----- Include Figure 2 about here -----

Inferential Statistics: Employee Count. To test whether it is justified to generalize the results of our sample to the overall population of similar startups, we again conducted a Mann-Whitney-U-test (Nachar, 2008) comparing the employee count at the time of funding between startups in 2022 and startups in 2023. Here, the null hypothesis (H_0) assumes no difference in the median employee count between the two groups. The analysis revealed a Mann-Whitney-U-statistic of 3867 with a p-value of less than .001, indicating a statistically significant difference in the employee count at funding between the two groups. This suggests strong evidence to reject the null hypothesis, implying a significant disparity in employee count between startups in 2022 and 2023. Additionally, the rank biserial correlation coefficient, measuring the magnitude of association, was calculated to be 0.431, indicating a moderate-to-large effect size.

Discussion of study 2

The results indicate that startups established in 2023 reached their seed-funding round significantly faster than those established in 2022. More specifically, the time to funding was between 45 to 50 days shorter in 2023 compared to 2002, with a statistically significant effect². These findings suggest that the introduction of ChatGPT-3 has had a substantial impact on reducing the time to funding for startups, highlighting its role as an external enabler through the compression mechanism. This supports the hypothesis that GenAI, exemplified by ChatGPT-3, significantly enhances efficiency of venture creation by reducing the time it takes to reach the first funding round.

² Specifically, the minimum time to funding (Min-Min Criteria) was significantly shorter in 2023, with a mean difference of 50 days and a moderate effect size. Similarly, the maximum time to funding (Max-Max Criteria) showed a significant reduction, with a mean difference of 45 days.

The analysis also revealed a statistically significant difference in the employee count at the time of funding between startups from 2022 and 2023. Startups in 2023 had significantly fewer employees at the time of funding compared to those in 2022, with a mean difference of 2.0 employees and a moderate-to-large effect size. This suggests that the introduction of ChatGPT and other AI tools has influenced workforce dynamics, allowing startups to operate with leaner teams while maintaining efficiency. Although the 2022 group had more outliers, which could have skewed the results, the significant presence of these outliers suggests that startups in 2022 often required larger teams. In contrast, the fewer outliers in the 2023 group underscore their ability to operate effectively with smaller teams. These results support the conservation enabling mechanism hypothesis, indicating that GenAI enables startups to conserve human resources by increasing individual-level productivity.

Limitations of the quantitative study

While our quantitative evidence supporting the conservation and compression enabling mechanisms is striking, alternative explanations and external factors could potentially explain these results. One notable factor is the widespread excitement about AI technologies in 2023, which could have accelerated the funding process for startups utilizing AI. Indeed, examining the company descriptions from our samples, around 55% of the startups in 2023 included "AI" or "Artificial Intelligence" in their descriptions, compared to only 20% in 2022. This indicates that a greater number of startups in 2023 were not only using AI as a tool but aiming at integrating it as part of their business model. Thus, it might be that these startups were able to raise seed-funding because of their perceived future potential rather than their current status of development, only. This indicates the challenge of analyzing the efficiency of the entrepreneurial process among early-stage startups. While the EEF focuses on the effects of changing external conditions on the initiation and development of new ventures (Davidsson *et al.*, 2020), their

development also depends on how such changes affect the perceptions of other actors in the respective entrepreneurial ecosystem. This resource access effect might depend less on the individual venture but to a larger degree on the ecosystem the venture is embedded in. As an additional limitation, our quantitative study only includes early-stage startups that have been able to secure seed-funding within a certain time-period, leading to a potential survivor bias.

General discussion and conclusion

Our mixed-method approach provides detailed insights into the usage and the effects of AI-tools among early-stage startups. Because of its broad applicability, flexibility, and low agency-intensity, ChatGPT has been the dominantly used tool among the entrepreneurs in our qualitative study. The launch of ChatGPT-3 in November 2022 seems indeed to have led to a democratization of the use of GenAI (Ray, 2023, p. 122). With the speed of technological development and the frequent launch of new tools since, the dominance of ChatGPT can probably be considered as temporary only. Still, our results also have important general implications for the effect of new technologies, such as GenAI, on the entrepreneurial process.

While previous research has argued that highly specific digital technologies are more likely to enable compression and conservation mechanisms (van Briel et al 2018), our results point in another direction. A high specificity of an external enabler might be beneficial when it comes to automating processes in an operating venture, i.e. in the role of shaping the venture itself. In contrast, the venture gestation process seems to profit most from an external enabler with a low specificity, such as GenAI, that helps in conducting the many and diverse tasks in the process of starting a new business. Combined with the ease of use of GenAI tools in this role, i.e. their low agency-intensity (Ramoglou and Tsang, 2016), this seems to explain their widespread use in the venturing process. Thus, when considering the potential benefits of an

external enabler, it is important to distinguish between the different roles they can play for entrepreneurial ventures (Davidsson *et al.*, 2020, p. 320).

Also, it is important to acknowledge that GenAI tools mainly improve individual level productivity rather than company processes. Recent findings from more established companies also suggest that integrating GenAI tools into processes at the company level is more challenging as they do not integrate well into existing workflows and do not learn (MIT Nanda, 2025). While previous research has argued that entrepreneurial opportunities have different degrees of agency-intensity, referring to the level of effort that is required in actualizing an opportunity (Ramoglou and Tsang, 2016), our analysis on the basis of the EEF allows a more fine-grained understanding. Specifically, our results stress that the agency-intensity of a new technology varies depending on the role in which it is used, as already presumed by Davidsson and Sufyan (2023). In our case, applying GenAI tools on an individual level to increase the efficiency of the process of venture creation (speed and resource use) has a low agency-intensity and has been adopted rapidly. Yet, using AI to improve company workflows or to develop new functionalities, products or services seems to be more demanding, i.e. have a higher agency-intensity, and might only affect the entrepreneurial process with a greater time lag from the emergence of such a new technology. Thus, our study contributes to a better understanding of how the effects of GenAI unfold as entrepreneurs aim at profiting from this new technology.

While extant research on the effects of IT on venture performance stresses the efficiency gains resulting from the competent implementation of IT solutions into company operations and data processing (Jin and McElheran, 2025), our results point towards strong efficiency gains concerning the venture creation process itself, making the creation of new ventures faster and less resource intensive, with implications for competition and the ease of bringing new

product offerings into the market. In other words, the ability to competently apply AI tools in the process of venture creation might become a source of competitive advantage (Nason and Wiklund, 2018). While GenAI tools are broadly available at low cost, the degree to which they are competently and consistently used in venture creation process might still differ, possibly leading to persistent performance differences. Yet, the question of whether using AI can provide sustainable competitive advantage is subject of some debate (Wingate *et al.*, 2025).

Although the agency-intensity of applying GenAI tools is low for some applications, some degree of human agency is still required. When applying AI tools, at least so far, entrepreneurs always “keep humans in the loop” (Shepherd and Majchrzak, 2022, p. 9) as AI is used as an assistant, augmenting and accelerating decision making, rather than completely substituting human agency. In this sense, AI cannot be considered as an additional co-founder, as suggested by Brown (2024), which might, however, change in the future with more advanced AI-tools, such as agentic AI systems that can remember, learn and act autonomously within defined parameters (MIT Nanda, 2025, p. 23).

While the structure of founding teams seems not to have been affected by the emergence of AI tools, our quantitative study indicates that their use has a significant effect on the personnel requirements in early-stage startups. Our results suggest that startups today are able to raise seed funding with less employees and in shorter time compared to the pre-ChatGPT era. Thus, AI tools seem to be valuable for entrepreneurial efficiency and have the potential to help start-ups become operational with fewer employees and thus counter the shortage of skilled workers. Future research will have to show whether this is a lasting effect, that will also increase entrepreneurs’ chances of success and potentially boost the number of entrepreneurs (Shepherd and Majchrzak, 2022) or whether competitive forces will simply increase the demands of investors and customers, thereby leveling out these positive effects.

Finally, our research illustrates how the External Enabler Framework can be applied to study the effect of AI tools on the entrepreneurial process, contributing to this growing research field (Kimjeon and Davidsson, 2022). In a qualitative study we identified two prevalent mechanisms of AI usage in the venture creation process which we then tested in a quantitative study, suggesting that the introduction of ChatGPT-3 has substantially reduced the required time (compression) as well as the necessary personnel resources (conservation) to obtain seed funding and thereby to move forward in the venture creation process. Yet, as described above, our results should also be treated with some caution as this strong effect might also result from enhanced resource access resulting from investors' positive expectations about the impact of AI among IT-related startups. This illustrates that the effects of an external enabler need to be investigated in a broad context, including other stakeholders in an entrepreneurial ecosystem, and we encourage future research to do so.

Our results have also implications for practice and public policy. The findings of our study should encourage entrepreneurs from industries beyond IT with a presumably lower affinity to use AI tools, to profit from possible efficiency gains. The UCs documented in this study indicate that using AI can lead to time and resource savings for several tasks. In addition, AI tools allow an efficient way to get feedback on one's business idea and might also lead to new product offerings. Our results suggest that AI tools substantially influence the way people start new ventures. Rapid and lean venture creation processes might become the "new normal" with implications for competition among startups, new venture survival, and employment creation. Policy makers should be aware of this development and consider its implications when supporting entrepreneurial ecosystems and designing policy measures in general. Also, entrepreneurship educators should include the use of GenAI in respective entrepreneurship courses, to educate students in the opportunities and challenges of using such tools.

Bibliography

- Abaddi, S. (2024). "GPT revolution and digital entrepreneurial intentions". *Journal of Entrepreneurship in Emerging Economies*. Vol. 16 No. 6, pp. 1903-1930. <https://doi.org/10.1108/JEEE-07-2023-0260>
- Adams, W. C. (2015). "Conducting Semi-Structured Interviews". In *Handbook of Practical Program Evaluation* (pp. 492-505). Wiley. <https://doi.org/10.1002/9781119171386.ch19>
- Alemany, L., and Andreoli, J. J. (2018). "Introduction to entrepreneurial finance". In L. Alemany and J. J. Andreoli (Eds.), *Entrepreneurial Finance: The Art and Science of Growing Ventures*. (pp. 2-22). Cambridge University Press.
- Almansour, M. (2023). "Artificial intelligence and resource optimization: A study of Fintech start-ups". *Resources Policy*, 80, 103250. <https://doi.org/10.1016/j.resourpol.2022.103250>
- Alvarez, S. A., and Barney, J. B. (2007). "Discovery and Creation: Alternative Theories of Entrepreneurial Action". *Strategic Entrepreneurship Journal*, Vol. 1 No. 1-2, pp. 11-26. <https://doi.org/10.1002/sej.4>
- Berg, B. L., and Lune, H. (2017). *Qualitative research methods for the social sciences*, 9th edition. Pearson.
- Blanco-González-Tejero, C., Ribeiro-Navarrete, B., Cano-Marin, E., and McDowell, W. C. (2023). "A Systematic Literature Review on the Role of Artificial Intelligence in Entrepreneurial Activity". *International Journal on Semantic Web and Information Systems*, Vol. 19 No. 1, pp. 1-16. <https://doi.org/10.4018/IJSWIS.318448>
- Brown, S. (2024, January 17). *How generative AI is changing entrepreneurship*. MIT Sloan. <https://mitsloan.mit.edu/ideas-made-to-matter/how-generative-ai-changing-entrepreneurship>
- Cambon, A., Hecht, B., Edelman, B., Ngwe, D., Jaffe, S., Heger, A., Vorvoreanu, M., Peng, S., Hofman, J., Farach, A., Bermejo-Cano, M., Knudsen, E., Bono, J., Sanghavi, H., Spatharioti, S., Rothschild, D., Goldstein, D. G., Kalliamvakou, E., Cihon, P., ... Teevan, J. (2023). "Early LLM-based Tools for Enterprise Information Workers Likely Provide Meaningful Boosts to Productivity" (Issue MSR-TR-2023-43). <https://www.microsoft.com/en-us/research/publication/early-llm-based-tools-for-enterprise-information-workers-likely-provide-meaningful-boosts-to-productivity/>
- Chalmers, D., MacKenzie, N. G., and Carter, S. (2021). "Artificial Intelligence and Entrepreneurship: Implications for Venture Creation in the Fourth Industrial Revolution". *Entrepreneurship: Theory and Practice*, Vol. 45 No. 5, pp. 1028-1053. <https://doi.org/10.1177/1042258720934581>
- Creswell, J. W., and Plano Clark, V. L. (2018). *Designing and Conducting Mixed Methods Research* (3rd. edition). SAGE Publications, Inc.

- Crunchbase. (2022). "Where does Crunchbase get their data?" <https://support.crunchbase.com/hc/en-us/articles/360009616013-Where-Does-Crunchbase-Get-Their-Data>.
- Davidsson, P., Recker, J., and von Briel, F. (2020). "External Enablement of New Venture Creation: A Framework". *Academy of Management Perspectives*, Vol. 34 No. 3, pp. 311–332. <https://doi.org/10.5465/amp.2017.0163>
- Davidsson, P., and Sufyan, M. (2023). "What does AI think of AI as an external enabler (EE) of entrepreneurship? An assessment through and of the EE framework". *Journal of Business Venturing Insights*, Vol. 20, e00413. <https://doi.org/10.1016/j.jbvi.2023.e00413>
- Davis, F. D. (1989). "Perceived usefulness, perceived ease of use and user acceptance of information technology". *MIS Quarterly*, Vol. 13 No. 3, pp. 319–339.
- Eisenmann, T. R. (2020). "Determinants of Early-Stage Startup Performance: Survey Results". *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3725023>
- Fossen, F. M., McLemore, T., and Sorgner, A. (2024). "Artificial Intelligence and Entrepreneurship". *Foundations and Trends® in Entrepreneurship*, Vol. 20 No. 8, pp. 781–904. <https://doi.org/10.1561/03000000130>
- Gioia, D. A., Corley, K. G., and Hamilton, A. L. (2013). "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology". *Organizational Research Methods*, Vol. 16 No. 1, pp. 15–31. <https://doi.org/10.1177/1094428112452151>
- Giuggioli, G., and Pellegrini, M. M. (2023). "Artificial intelligence as an enabler for entrepreneurs: a systematic literature review and an agenda for future research". *International Journal of Entrepreneurial Behaviour and Research*, Vol. 29 No. 4, pp. 816–837. <https://doi.org/10.1108/IJEBR-05-2021-0426>
- Glasner, J. (2023). "AI's Share of US Startup Funding Doubled In 2023". *Crunchbase News*, August 29. Retrieved from: <https://news.crunchbase.com/ai-robotics/us-startup-funding-doubled-openai-anthropic-2023/>
- Haefner, N., Parida, V., Gassmann, O., and Wincent, J. (2023). "Implementing and scaling artificial intelligence: A review, framework, and research agenda". *Technological Forecasting and Social Change*, Vol. 197 (September), 122878. <https://doi.org/10.1016/j.techfore.2023.122878>
- Haenlein, M., and Kaplan, A. (2019). "A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence". *California Management Review*, Vol. 61 No. 4, pp. 5–14. <https://doi.org/10.1177/0008125619864925>
- Haji, S., and Sheehy, W. (2023). *Exploring the Impact of AI-Tools on Swedish Startups—A qualitative Analysis of Operations Optimization and Alignment with the Lean Startup Development*. Uppsala University.

- Haleem, A., Javaid, M., and Singh, R. P. (2022). "An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges". *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, Vol. 2 No. 4, 100089. <https://doi.org/10.1016/j.tbench.2023.100089>
- Hsu, F.-H. (1999). "IBM's Deep Blue Chess grandmaster chips". *IEEE Micro*, Vol. 19 No. 2, pp. 70–81. <https://doi.org/10.1109/40.755469>
- Jin, W., and McElheran, K. (2025). "Economies Before Scale: I.T. Strategy and Performance Dynamics of Young U.S. Businesses". *Management Science*. Vol. 71 No. 9, pp. 7449-7473. <https://doi.org/10.1287/mnsc.2019.03116>
- Kanze, D., Huang, L., Conley, M. A., and Higgins, E. T. (2018). "We Ask Men to Win and Women Not to Lose: Closing the Gender Gap in Startup Funding". *Academy of Management Journal*, Vol. 61 No. 2, pp. 586–614. <https://doi.org/10.5465/amj.2016.1215>
- Kimjeon, J., and Davidsson, P. (2022). "External Enablers of Entrepreneurship: A Review and Agenda for Accumulation of Strategically Actionable Knowledge". *Entrepreneurship Theory and Practice*, Vol. 46 No. 3, pp. 643–687. <https://doi.org/10.1177/10422587211010673>
- Kusetogullari, A., Kusetogullari, H., Andersson, M., and Gorschek, T. (2025). "GenAI in Entrepreneurship: a systematic review of generative artificial intelligence in entrepreneurship research: current issues and future directions". *arXiv*. <https://doi.org/10.48550/arXiv.2505.05523>
- Mayring, P. (2000). «Qualitative Inhaltsanalyse». *Forum Qualitative Sozialforschung*, Vol. 1 No. 2.
- Mayring, P., and Fenzl, T. (2014). "Qualitative Inhaltsanalyse". In *Handbuch Methoden der empirischen Sozialforschung* (pp. 543–556). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-531-18939-0_38
- McGee, J. E., and Terry, R. P. (2024). "COVID-19 as an external enabler: The role of entrepreneurial self-efficacy and entrepreneurial orientation". *Journal of Small Business Management*, Vol. 62 No. 2, pp. 1058–1083. <https://doi.org/10.1080/00472778.2022.2127746>
- McKinsey & Company. (2023). "Generative AI: The next productivity frontier". <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier#introduction>
- Meurer, M. M., and Davidsson, P. (2023). "External Enablement of Social and Commercial Entrepreneurship". *Academy of Management Proceedings*, 2023(1). <https://doi.org/10.5465/AMPROC.2023.17803abstract>
- MIT Nanda. (2025). "The GenAI Divide. State of AI in Business 2025". https://mlq.ai/media/quarterly_decks/v0.1_State_of_AI_in_Business_2025_Report.pdf

- Nachar, N. (2008). "The Mann-Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution". *Tutorials in Quantitative Methods for Psychology*, Vol. 4 No. 1, pp. 13–20. <https://doi.org/10.20982/tqmp.04.1.p013>
- Nambisan, S. (2017). "Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship". *Entrepreneurship: Theory and Practice*, Vol. 41 No. 6, pp. 1029–1055. <https://doi.org/10.1111/etap.12254>
- Nason, R. S., and Wiklund, J. (2018). "An Assessment of Resource-Based Theorizing on Firm Growth and Suggestions for the Future". *Journal of Management*, Vol. 44 No. 1, pp. 32–60. <https://doi.org/10.1177/0149206315610635>
- Obschonka, M., and Audretsch, D. B. (2020). "Artificial intelligence and big data in entrepreneurship: a new era has begun". *Small Business Economics*, Vol. 55 No. 3, pp. 529–539. <https://doi.org/10.1007/s11187-019-00202-4>
- Peng, S., Kalliamvakou, E., Cihon, P., and Demirer, M. (2023). "The Impact of AI on Developer Productivity. Evidence from GitHub Copilot". *arXiv*. <https://doi.org/10.48550/arXiv.2302.06590>
- Ramoglou, S., and Gartner, W. B. (2023). "A Historical Intervention in the "Opportunity Wars": Forgotten Scholarship, the Discovery/Creation Disruption, and Moving Forward by Looking Backward". *Entrepreneurship Theory and Practice*, Vol. 47 No. 4, pp. 1521–1538. <https://doi.org/10.1177/10422587211069310>
- Ramoglou, S., and Tsang, E. W. K. (2016). "A realist perspective of entrepreneurship: Opportunities as propensities". *Academy of Management Review*, Vol. 41 No. 3, pp. 410–434. <https://doi.org/10.5465/amr.2014.0281>
- Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., and Waseem, A. (2019). "Case Study Method: A Step-by-Step Guide for Business Researchers". *International Journal of Qualitative Methods*, Vol. 18, 160940691986242. <https://doi.org/10.1177/1609406919862424>
- Ray, P. P. (2023). "ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope". *Internet of Things and Cyber-Physical Systems*, Vol. 3, pp. 121–154. <https://doi.org/10.1016/j.iotcps.2023.04.003>
- Rezazadeh, A., Kohns, M., Bohnsack, R., António, N., and Rita, P. (2025). "Generative AI for growth hacking: How startups use generative AI in their growth strategies". *Journal of Business Research*, Vol. 192. <https://doi.org/10.1016/j.jbusres.2025.115320>
- Rompho, N. (2018). "Operational performance measures for startups". *Measuring Business Excellence*, Vol. 22 No.1, pp. 31–41. <https://doi.org/10.1108/MBE-06-2017-0028>
- Santisteban, J., and Mauricio, D. (2017). "Systematic literature review of critical success factors of Information Technology startups". *Academy of Entrepreneurship Journal*, Vol. 23 No. 2, pp. 1–23.

- Shane, S. (2000). "Prior Knowledge and the Discovery of Entrepreneurial Opportunities". *Organization Science*, Vol. 11 No. 4, pp. 448–469.
- Shepherd, D. A., and Majchrzak, A. (2022). "Machines augmenting entrepreneurs: Opportunities (and threats) at the Nexus of artificial intelligence and entrepreneurship". *Journal of Business Venturing*, Vol. 37 No. 4. <https://doi.org/10.1016/j.jbusvent.2022.106227>
- Te, Y. F., Wieland, M., Frey, M., Pyatigorskaya, A., Schiffer, P., and Grabner, H. (2023). "Making it into a successful series a funding: An analysis of Crunchbase and LinkedIn data". *Journal of Finance and Data Science*, Vol. 9. <https://doi.org/10.1016/j.jfds.2023.100099>
- Teece, D. J. (2007). "Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance". *Strategic Management Journal*, Vol. 28 No. 13, pp. 1319–1350. <https://doi.org/10.1002/smj.640>
- Truong, Y., Schneckenberg, D., Battisti, M., and Jabbouri, R. (2023). "Guest editorial: Artificial intelligence as an enabler for entrepreneurs: an integrative perspective and future research directions." *International Journal of Entrepreneurial Behavior and Research*, Vol. 29 No. 4, pp. 801–815. <https://doi.org/10.1108/IJEBr-04-2023-033>
- Uriarte, S., Baier-Fuentes, H., Espinoza-Benavides, J., and Inzunza-Mendoza, W. (2026). "Artificial intelligence technologies and entrepreneurship: a hybrid literature review". *Review of Managerial Science*. Vol. 20, pp. 251-299. <https://doi.org/10.1007/s11846-025-00839-4>
- von Briel, F., Davidsson, P., and Recker, J. (2018). "Digital technologies as external enablers of new venture creation in the IT hardware sector". *Entrepreneurship: Theory and Practice*, Vol. 42 No. 1, pp. 47–69. <https://doi.org/10.1177/1042258717732779>
- Weber, M., Beutter, M., Weking, J., Böhm, M., and Krcmar, H. (2022). "AI Startup Business Models". *Business and Information Systems Engineering*, Vol. 64 No. 1, pp. 91–109. <https://doi.org/10.1007/s12599-021-00732-w>
- Wingate, D., Burns, B. L., and Barney, J. B. (2025). "Why AI Will Not Provide Sustainable Competitive Advantage". *MIT Sloan Management Review*, May 2025, pp. 2–4. <https://sloanreview.mit.edu/article/why-ai-will-not-provide-sustainable-competitive-advantage/>
- Żbikowski, K., and Antosiuk, P. (2021). "A machine learning, bias-free approach for predicting business success using Crunchbase data". *Information Processing and Management*, Vol. 58 No. 4, 102555. <https://doi.org/10.1016/j.ipm.2021.102555>

TABLES

Table 1: List of interview partners

Interview partner	Area of IT application	Location	Duration of interview	Interview date
IP#1	Healthcare	Spain / U.S.	27 min.	23.10.2023
IP#2	Human Resources	Germany	40 min.	31.10.2023
IP#3	Digital Art	Austria	43 min.	01.11.2023
IP#4	Healthcare	Germany	52 min.	06.11.2023
IP#5	Fashion	Germany	42 min.	11.11.2023
IP#6	Data Management	Germany	40 min.	14.11.2023
IP#7	Government	Germany	50 min.	14.11.2023
IP#8	Finance/Banking	Germany	31 min.	15.11.2023
IP#9	Waste Management	Germany	30 min.	20.11.2023
IP#10	Legal and Governance	Germany	27 min.	20.11.2023
IP#11	Data Analytics	Germany	31 min.	21.11.2023
IP#12	Real Estate	U.S.	20 min.	21.11.2023
IP#13	Bioinformatics	Germany	42 min.	21.11.2023
IP#14	Sales and Marketing	Switzerland	38 min.	25.11.2023

Source: Own work of the authors.

Table 2: List of use cases

UC#	Task	Task Category	Tool	Mechanism	Role	Frequ.
UC#1	Brainstorming	Idea generation	ChatGPT	Expansion	Triggering	9
UC#2	Business idea	Idea generation	ChatGPT, Google Bard	Expansion	Triggering	1
UC#3	Stakeholder research	Industry research	ChatGPT	Substitution	Shaping - process	2
UC#4	Market research	Industry research	ChatGPT, Google Bard	Expansion	Triggering	7
UC#5	Industry understanding	Industry research	ChatGPT	Conservation	Shaping - process	2
UC#6	Best practices	Business model	ChatGPT, Google Bard	Conservation	Shaping - venture	4
UC#7	Customer profiling	Business model	Chat GPT	Compression	Shaping - process	1
UC#8	Competitor analysis	Business model	Bing AI	Compression	Shaping - process	2
UC#9	Idea pre-validation	Pre-validation	ChatGPT	Conservation	Shaping - process	6
UC#10	Interviewee selection	Pre-validation	ChatGPT	Conservation	Shaping - process	1
UC#11	Stakeholder interviews	Pre-validation	ChatGPT	Conservation	Shaping - process	4
UC#12	Coding support	Product building	Github Copilot, ChatGPT	Combination	Shaping - product	10
UC#13	Website development	Product building	ChatGPT, Framer	Compression	Shaping - product	2
UC#14	Product infrastructure	Product building	Stable Diffusion, DALL-E 3, Replit	Combination	Shaping - product	5
UC#15	3D product comp.	Product building	Spline AI	Generation	Shaping - product	1
UC#16	Text-to-voice comp.	Product building	SoundStorm	Generation	Shaping - product	1
UC#17	Outreach messaging	Sales	ChatGPT	Compression	Shaping - process	3
UC#18	Sales process	Sales	Hubspot, Intercom	Compression	Shaping - process	1
UC#19	Text generation	Marketing	ChatGPT	Compression	Shaping - process	11
UC#20	Text improvement	Marketing	ChatGPT	Compression	Shaping - process	6
UC#21	Pitch decks	Marketing	Gamma.app, V0, DALL-E 3, Stable Diff.	Substitution	Shaping - process	3
UC#22	Marketing material	Marketing	Midjourney, DALL-E 3	Conservation	Shaping - process	9
UC#23	Data sources	Education & data	Perplexity AI, Bing AI, Google Bard, Cons.	Expansion	Shaping - process	3
UC#24	Content learning	Education & data	ChatGPT	Expansion	Outcome-enhanc.	5
UC#25	Coding learning	Education & data	ChatGPT	Expansion	Outcome-enhanc.	4
UC#26	Interview analysis	Administration	ChatGPT, Whisper, Aircall	Compression	Shaping - process	3
UC#27	Recruiting	Administration	ChatGPT	Conservation	Shaping - venture	1
UC#28	Financial model	Administration	ChatGPT	Uncertainty red.	Shaping - process	1
UC#29	Legal contracts	Administration	ChatGPT	Compression	Shaping - process	1

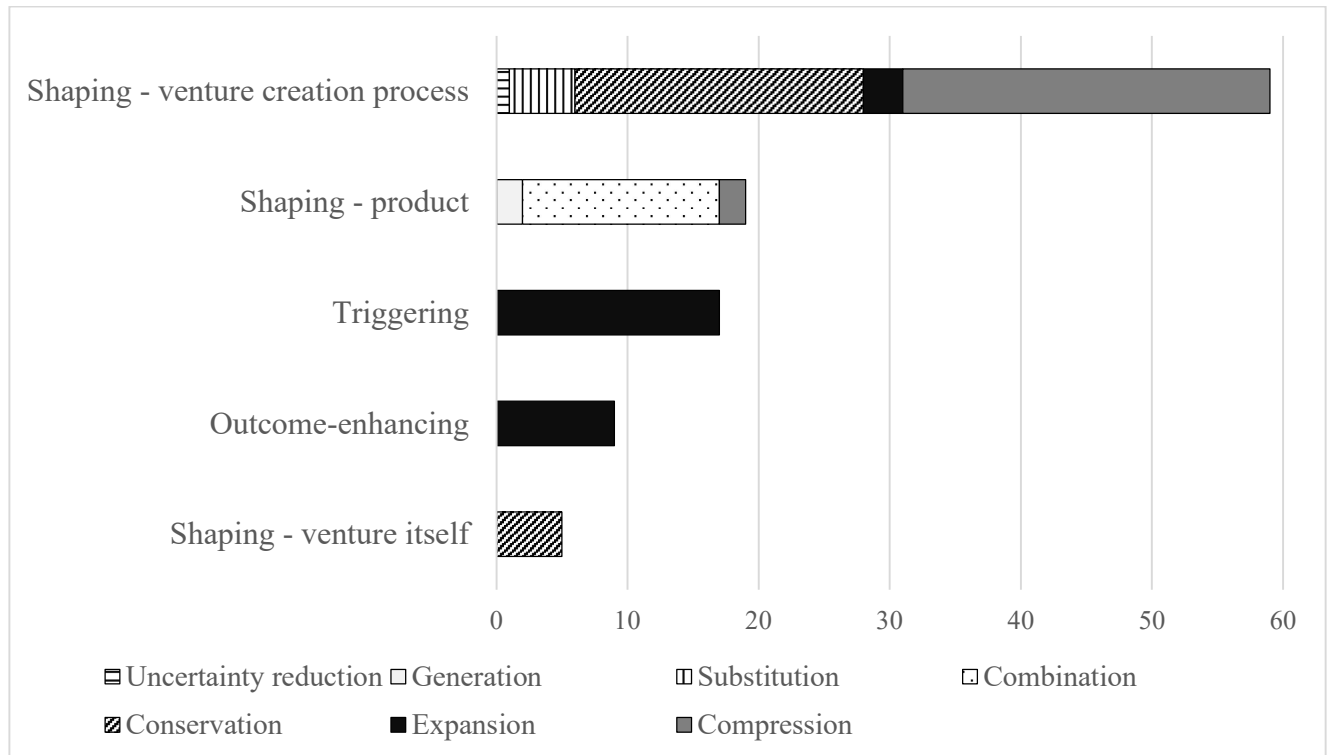
Notes: Frequ.: Frequency, i.e. number of companies where respective UC identified. Source: Own work of the authors.

Table 3: Timeline table for creation date and funding date

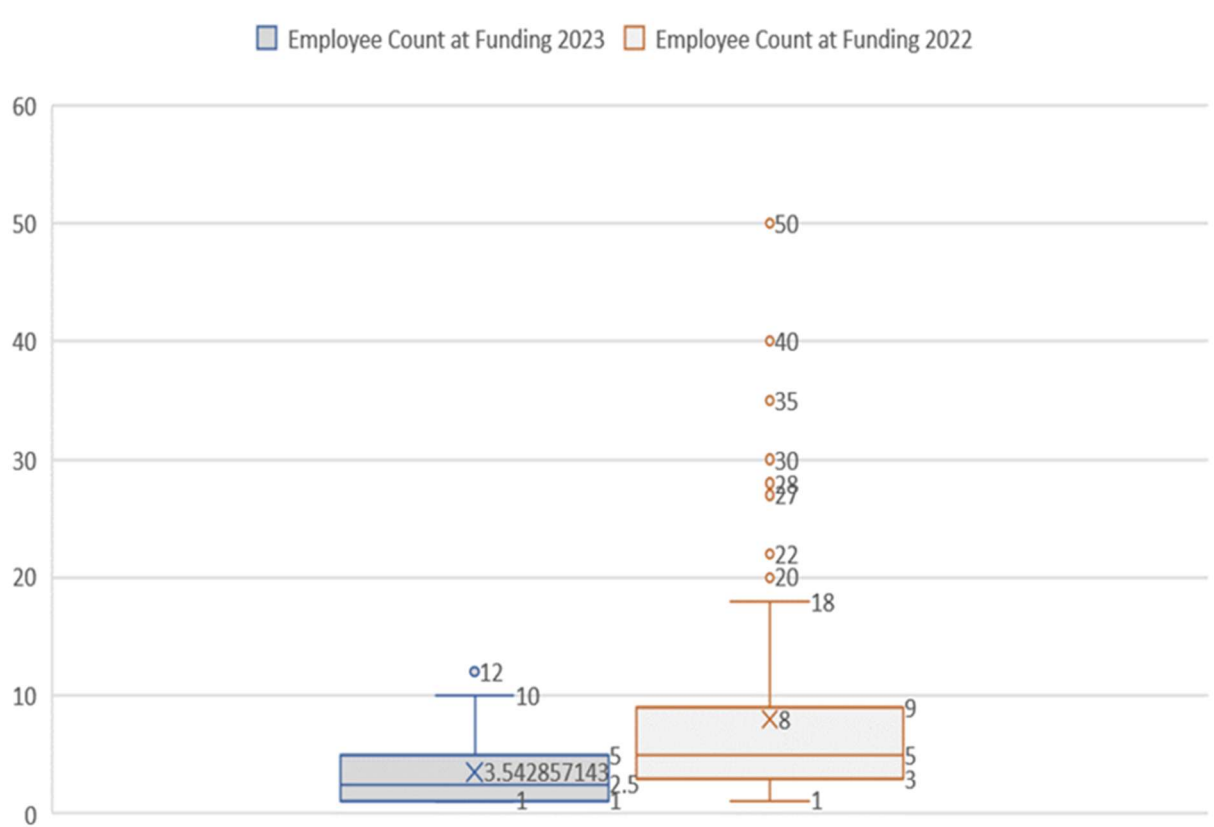
Group	Creation Min	Creation Max	Period Gap (days)	Seed Funding Min	Seed Funding Max	Period Gap (days)
2023	Dec. 1, 2022	Nov. 30, 2023	364	June 1, 2023	Nov. 30, 2023	182
2022	Dec. 1, 2021	Nov. 30, 2022	364	June 1, 2022	Nov. 30, 2022	182

Source: Own work of the authors.

FIGURES

Figure 1: Frequency of identified use cases by role and mechanism

Source: Own work of the authors.

Figure 2: BoxPlot of employee count at funding before (2022) and after (2023) launch of ChatGPT-3

Source: Own work of the authors.

Supplementary Material

Appendix A: Interview Guide

Analysis of the Influence of Artificial Intelligence on the Entrepreneurial Process of Venture Creation

Interview Structure & Questions

While the following questions should guide the interview and give an idea of its content, the interview will leave room for open discussion to facilitate an explorative approach.

- Company-specifics
 - What *industry* does your company operate in?
 - What *value proposition* and offering/product does your company provide?
 - When did you start your company?
 - What *stage* is your company in? (e.g., formation, validation, build, growth)
 - Where is your company located?
- Implementation of AI
 - Which AI *tools* do you use and implement in your venture creation process?
 - At what *stage* did you use this tool? (e.g., formation, validation, build, growth)
 - What was the *task* you used the AI tool for? Which *role* did it play in the process (triggering, outcome-enhancing)?
 - What was the *goal* of the implementation?
 - How did you and your team *interact* with and control the AI system? (e.g., full automation vs. decision support)
- Outcomes and Impact
 - Was the implementation *successful/useful*? Did it satisfy/outperform the goal?
 - What is the specific *outcome* that was achieved? What was the *result* of the implementation? (e.g., idea creation, market sizing)
 - How does it *impact* the tasks of you and your team? (e.g., automate, support, streamline)
 - How does the implementation *influence the process* of venture creation? (e.g., faster iterations in formation of business model)

Source: Own work of the authors.

Appendix B: Definition of Inductive Coding Categories

Process Stage		Founding Phase		Task category	
Prospecting	Stage involving tasks concerned with exploring potential ideas (Bakker and Shepherd, 2017, p. 133)	Ideation	Beginning phase where the idea and concept of the venture is shaped	Idea generation	Use of AI to identify problem space, brainstorm, and filter business ideas as a foundation to venture creation
				Industry research	Use of AI tools to gain understanding of the market, identify key stakeholders, and validate facts and data
Developing	Stage involving tasks concerned with deep diving into the identified idea and assessing its “feasibility and desirability” (Bakker and Shepherd, 2017, p. 133)	Formation	Phase where organization is formed, and business model is shaped	Business model	AI tools to support the organization of the venture and its model by sharing best-practices and frameworks
		Validation	Phase where the initial idea is tested with stakeholders to achieve product-market-fit	Pre-validation	AI tools to pre-validate the idea by assessing the status-quo, building hypothesis, and probe and mimic interviews
Exploiting	Stage involving tasks concerned with building and scaling operations (Bakker and Shepherd, 2017, p. 134)	Building	Phase where offering is actualized and built to launch in the market	Product building	Tool implementation within the product, use as support in coding, and generate functionalities and infrastructure
		Growth	Phase where venture is concerned with scaling its offering	Sales	Use of AI tools to facilitate customer acquisition and grow customer base
Non-specific	N/A - applies across different or all process stages	General	Not stage specific, but applies to different or all stages from prospecting to exploiting	Education & data	Use of AI to learn about venture related topics, gain skills and research facts required for the venture creation process
				Marketing	AI implementation in marketing tasks to enhance quality of outcomes, speed up process, and save costs

				Administra- tion	Use of AI tools to automate or sup- port standardized and simple tasks, and reduce over- head to save time per employee
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Source: Own work of the authors.

Appendix C: Coding Scheme Use Cases

Dimension	Founding phase	Task category	Name of use case (UC)	Example	Coding Rule	References
Prospecting	Ideation	Idea generation	Brainstorming	"... we basically took every idea, and then we asked ChatGPT and Bard to describe UCs in this problem space, describe the future of companies working in this space, how relevant is this problem space?" (IP#5, 11.11.23)	Use of tool to support the thinking and exploration process in the context of idea creation through creativity and diversity of thought	(IP#2, 31.10.23, L 321-325) (IP#3, 01.11.23, L 48-55 & 84-86) (IP#4, 06.11.23, L 73-77) (IP#5, 11.11.23, L 115-120) (IP#6, 14.11.23, L 5-7 & 50-52) (IP#7, 14.11.23, L 69-72 & 85-87) (IP#9, 20.11.23, L 20 & 75-76) (IP#12, 21.11.23, L 2-3 & 37-42) (IP#14, 25.11.23, L 182-186)
			Business idea	"It was through the interaction of AI that we even realized that such an industry existed." (IP#5, 11.11.23)	AI application related to defining the perception of an opportunity by describing an idea	(IP#5, 11.11.23, L 121-124 & 135-140)
		Industry research	Stakeholder research	"Wie zum Beispiel: Stell dir vor, du bist ein Head Hunter und ich bin ein Talent, das einen Job sucht. Was würdest du mich denn Fragen? Und dadurch bekomme ich einen besseren Eindruck, ohne mit den tatsächlichen Stakeholdern sprechen zu können." (IP#2, 31.10.23)	Application of AI to mimic stakeholder perspectives to gain information on markets, processes, demand, or products	(IP#2, 31.10.23, L 148-151) (IP#7, 14.11.23, L 166-169)

			Market re- search	"Also ich würde mal sagen natürlich sind gewisse Recherche Aspekte, wenn ich irgendwas über ein Thema wissen will, sei das eine simple Beschreibung von gewissen marktspezifischen Fachbegriffen, etc. ..." (IP#7, 14.11.23)	Use of AI to retrieve information on market environment within problem space subject to analysis	(IP#1, 23.10.23, L 99-105) (IP#3, 01.11.23, L 107-111) (IP#6, 14.11.23, L 42-47) (IP#7, 14.11.23, L 76-79 & 173-174) (IP#8, 15.11.23, L 22-25) (IP#10, 20.11.23, L 84) (IP#11, 21.11.23, L 137-141)
			Industry understanding	"Da hat uns es auch geholfen einfach schnell tiefer reinzukommen, weil du deinen Chatbot hast, der dir hilft, den Kunden besser zu verstehen, den Markt besser zu verstehen." (IP#11, 21.11.23)	AI application to gain knowledge and learn about the market and industry, concerning relevant players, processes and trends	(IP#11, 21.11.23, L 42-49) (IP#14, 25.11.23, L 129-131)
Developing	Formation	Business model	Best practices	"So, we just described what we need, the kind and how to do this kind of research. And then the large language models will kind of just give us an idea of what to do and how to do the research." (IP#5, 11.11.23)	Use of AI to collect information on theories, models, and processes in the market that support for setting up the venture and defining the business strategy	(IP#1, 23.10.23, L 118-123) (IP#2, 31.10.23, L 152-167) (IP#5, 11.11.23, L 183-186) (IP#7, 14.11.23, L 82-85)

			Customer profiling	"Wofür ich es momentan verwendet habe, ist für Ideen für ideale Customer Profiles, dafür kann man gut verwenden. Man kann es gut verwenden, wenn man beispielsweise mit dem Development-Team arbeitet, dann musst du immer User-Stories erstellen für spezifische Dinge und dafür verwendet man GPT..." (IP#14, 25.11.23)	Use of AI tools with regards to support in identifying and creating ideal customer profiles	(IP#14, 25.11.23, L 142-146)
			Competitor analysis	"What we really needed were insights into the technology of these companies, these competitors, and insights into their strategy, insights into who they are, who their clients are. All of this came from 'Bing AI'..." (IP#5, 11.11.23)	Use of AI tools for collecting data on positioning, organization and products of competitive firms	(IP#5, 11.11.23, L 183-189) (IP#8, 15.11.23, L 98-99)

	Validation	Pre-validation	Idea pre-validation	"Aber ich meine es ist ja schon ein Teil der Experten-Interviews, weil du einfach auf paar Sachen kommst und dann sagst okay ja, habe ich jetzt besser verstanden. Du gehst mit Hypothesen auch in Gespräche hinein, und auch wenn keine der Informationen so richtig neu war, kannst du viel genauer auf die achten und schauen, ob er dir eine bestimmte Hypothese bestätigt, weil du sie schon davor mal erarbeitet hast." (IP#4, 06.11.23)	Application of AI to assess an idea and business model in a first iteration and gain a first external perspective	(IP#2, 31.10.23, L 207-211) (IP#3, 01.11.23, L 52-55) (IP#4, 06.11.23, L 125-130 & 244-245) (IP#5, 11.11.23, L 189-194) (IP#8, 15.11.23, L 59 & 66-69) (IP#13, 21.11.23, L 65-71)
			Interviewee selection	"Wofür ich ChatGPT verwendet habe, ist, um zu checken, um Interviews zu bekommen, mit irgendwelchen Leuten in der z.B. Medical Industrie man reden soll." (IP#14, 25.11.23)	Application of AI in identifying ideal partners for interviews and customer trails for validation	(IP#14, 25.11.23, L 128-138)
			Stakeholder interviews	"Die Leitfäden für die Interviews erstellen wir mit AI, und ich führe die Gespräche für mich wie mit einem Menschen durch." (IP#4, 06.11.23)	AI use related to the preparation of interviews	(IP#4, 06.11.23, L 107-112) (IP#5, 11.11.23, L 234-243) (IP#6, 14.11.23, L 93-99 & 101-106) (IP#8, 15.11.23, L 31-34)

Exploiting	Building	Product building	Coding support	"Genau, also dieses Programmieren auf Auftrag ist für mich ein großer Bestandteil der AI-Use-Cases. ... Und natürlich in Analyse von Code, also wenn ich selbst etwas geschrieben habe, füge ich das ein und bekomme sofort Feedback, was ich verbessern kann, oder was nicht Best-Practice ist." (IP#7, 14.11.23)	AI usage related to coding tasks, including writing of passages, improving code, and working on coding structure	(IP#1, 23.10.23, L 135-136 & 141-144) (IP#2, 31.10.23, L 168-170) (IP#4, 06.11.23, L 42-47 & 230-234) (IP#6, 14.11.23, L 12) (IP#7, 14.11.23, L 31-41) (IP#9, 20.11.23, L 37-40) (IP#10, 20.11.23, L 52-53 & 161-164) (IP#11, 21.11.23, L 24-28 & 33-37) (IP#13, 21.11.23, L 67-69 & 165-176) (IP#14, 25.11.23, L 118-120 & 188-189)
			Website development	"Da kann man dann sagen, „ok, ich möchte eine Website haben, die soll eine Page sein, das Design soll bitte diesem Unternehmen ähnlich sein“, und dann generieren sie dir schon die komplette Webseite mit allen Features." (IP#4, 06.11.23)	AI UCs concerning the creation of web-interfaces and sites	(IP#4, 06.11.23, L 36-40 & 57-64) (IP#6, 14.11.23, L 20-23)
			Product infrastructure	"We actually used it for our product interface, because for our conversational chatbot we also want some visualizations, and we built an avatar with it." (IP#1, 23.10.23)	AI use related to the creation of product design and functionality	(IP#1, 23.10.23, L 80-81) (IP#5, 11.11.23, L 255-260) (IP#8, 15.11.23, L 157-161) (IP#11, 21.11.23, L 148-158) (IP#14, 25.11.23, L 211-212)

			3D product components	"Ich würde spezifischere Tools nutzen, unsere Programmierer verwendet auch ein Tool, wo man digital 3D-Räume erstellen kann, ich kann dir das raussuchen. " (IP#3, 01.11.23)	Use of AI to create virtual 3D functionality to product offering	(IP#3, 01.11.23, L 148-149)
			Text-to-voice component	"One key aspect of our business-model is text-to-speech transformation. For that we use the APIs from SoundStorm. So we are taking their AI to build our own language-model around it." (IP#1, 23.10.23)	Use of AI to transform text and data to speech	(IP#1, 23.10.23, L 160-162)
	Growth	Sales	Outreach messaging	"Wofür wir das überhaupt benutzen, sind wirklich Mails an Investoren oder sonstige Mails, um da schneller zu arbeiten." (IP#9, 20.11.23)	AI tool use related to the support and automation of email responses and outreaches to externals	(IP#9, 20.11.23, L 33-34 & 107) (IP#10, 20.11.23, L 54 & 129) (IP#13, 21.11.23, L 52)
			Sales process	"Natürlich, was die Prozessautomatisierung angeht, was sehr wichtig ist, und da sparen wir uns schon pro Woche mehrere Stunden, beispielsweise Task-Einstellungen oder Sales-Sequences auf Basis von gewissen Triggern." (IP#9, 20.11.23)	AI applications to support the automation of CRM and sales activities	(IP#9, 20.11.23, L 22 & 114-119)

Non-specific	General	Marketing	Text generation	"Wo mir GPT auch sehr viel hilft ist für Texte, wenn wir zum Beispiel irgendwelche Aussendungen oder irgendwelche Texte für einen Clip brauchen, der nicht unbedingt wichtig ist, lagere ich das auch sehr viel an GPT aus." (IP#3, 01.11.23)	Application to generate text passages in the context of communication and marketing across different channels	(IP#1, 23.10.23, L 96 & 112-114) (IP#2, 31.10.23, L 145-147) (IP#3, 01.11.23, L 56-58 & 118-120) (IP#4, 06.11.23, L 119-121) (IP#6, 14.11.23, L 12) (IP#7, 14.11.23, L 68-69) (IP#9, 20.11.23, L 111) (IP#10, 20.11.23, L 53-54 & 67-68) (IP#12, 21.11.23, L 3 & 52) (IP#13, 21.11.23, L 50-52) (IP#14, 25.11.23, L 178-182)
			Text improvement	"Unser Marketing-Manager englischsprachig und natürlich muss unser Marketing auf Deutsch gemacht werden. Der entwickelt die Texte mit einem gewissen Input von ChatGPT, schickt die rüber, ich validiere die und dann passt das." (IP#9, 20.11.23)	Application to optimize and re-frame text passages written by humans	(IP#1, 23.10.23, L 96-97) (IP#3, 01.11.23, L 112-113) (IP#6, 14.11.23, L 12-14) (IP#9, 20.11.23, L 111-112) (IP#10, 20.11.23, L 69-70 & 141-146) (IP#13, 21.11.23, L 51)
			Pitch decks	"Zum Beispiel 'Gamma.app' für Website und Pitch-Creation - das ist eigentlich ganz cool, weil du da am Anfang einen kurzen Satz eingibst, was du machst, danach auf Generieren klicken kannst, und die App generiert eine komplette Outline und am Ende auch Designs einer Webseite." (IP#2, 31.10.23)	Tool usage related to automated generation and structuring of presentation and pitch decks	(IP#2, 31.10.23, L 131-137) (IP#5, 11.11.23, L 100-101) (IP#8, 15.11.23, L 45-47)

			Marketing material	"Gerade eben Bildgenerierung ist sehr relevant. Ich bin kein Künstler, und es wäre mir sehr schwergefallen, Logo komplett aus dem nicht selbst zu designen. Dafür ist es nicht nur Effizienzsteigerung, sondern auch Augmentieren und erweitert meine Fähigkeiten und verbessert sie nicht nur." (IP#13, 21.11.23)	AI application to generate any kind of material for marketing and branding, incl. documents, pictures and logos	(IP#1, 23.10.23, L 59-60 & 68-70) (IP#3, 01.11.23, L 62-64) (IP#4, 06.11.23, L 49-55 & 138-148) (IP#6, 14.11.23, L 118-120) (IP#7, 14.11.23, L 48-52) (IP#9, 20.11.23, L 22 & 130-132) (IP#12, 21.11.23, L 4 & 52) (IP#13, 21.11.23, L 54-55, 123-126) (IP#14, 25.11.23, L 211-216)
		Education & data	Data sources	"Was man auch noch verwenden kann, ist Bing Chat, das ist besser mit der Suchmaschine verknüpft. Google Bard ist da noch besser, da man da spezifisch nach Quellen fragen kann und man dementsprechend auch zitieren kann." (IP#4, 06.11.23)	Use of AI for research tasks requiring reliable sources and facts	(IP#2, 31.10.23, L 341-344) (IP#4, 06.11.23, L 164-170) (IP#14, 25.11.23, L 242-246)
			Content learning	“Du kannst dir relativ schnell ein Curriculum zusammenstellen und zusammenfassen, was jemand, der in der Branche Experte ist, in der Ausbildung gemacht hat.“ (IP#11, 21.11.23)	AI UC related to learning components for the entrepreneurial individual regarding business and industry-specific knowledge	(IP#4, 06.11.23, L 85-89) (IP#5, 11.11.23, L 89-95) (IP#7, 14.11.23, L 187-190) (IP#8, 15.11.23, L 36-39) (IP#11, 21.11.23, L 54-61)

			Coding learning	"Ja, ich habe angefangen den Backend-Server aufzusetzen, in einer Programmier-Sprache, die ich nicht konnte. Das geht ziemlich gut KI unterstützt, Programmier-Sprachen zu lernen." (IP#8, 15.11.23)	AI application in the context of learning programming languages	(IP#8, 15.11.23, L 125-130) (IP#10, 20.11.23, L 151-159 & 168-172) (IP#11, 21.11.23, L 98-106) (IP#13, 21.11.23, L 67-69)
		Administration	Interview analysis	"Interviews transkribieren, wenn man mit potentiellen Kunden Benutzern spricht, das haben wir auch gemacht, die dann auch ausgewertet natürlich also irgendwie, dass man Sachen zusammenfasst." (IP#6, 14.11.23)	Implementation of AI for interview transcription, summary and postprocessing	(IP#4, 06.11.23, L 108-110) (IP#6, 14.11.23, L 19-21) (IP#9, 20.11.23, L 135-138)
			Recruiting	"We had to interview them and also used AI for this. What questions do you ask a Co-founder who has to assist you in the online fashion tech space?" (IP#5, 11.11.23)	Use of AI to support the hiring and assessment process of human capital	(IP#5, 11.11.23, L 244-246)
			Financial model	"Das einzige wäre Richtung Financial-Model, dass ich da nochmal die Zahlen validieren lassen von ChatGPT." (IP#9, 20.11.23)	Use of AI in financial modelling to check calculations and structure	(IP#9, 20.11.23, L 159-163)

			Legal contracts	"Das ich weiß, wie eine Vollmacht auszuschauen hat oder ein Vertrag, den ich aufsetze. Anstatt dass ich mir 5 Templates, die ich irgendwann mal gemacht habe, anschau, lass ich es einfach mal draftern, dann weiß ich was fehlt und was weg kann, und ändere es nur mehr, anstatt dass ich mich eine halbe Stunde hinsetzen muss, um das zu machen." (IP#11, 21.11.23)	AI application regarding the set up and structuring of legal documents	(IP#11, 21.11.23, L 66-70 & 82-86)
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Source: Own work of the authors.

Appendix D: Coding Scheme Mechanisms and Roles

Dimension	Category	Definition	Example	Coding Rule	References
Mechanism	Compression	"Reduces the amount of time that is required to perform an action" (von Briel <i>et al.</i> , 2018, p. 52)	"So overall, I think the main impact is time. And in this regard, the gain and benefit are enormous. We can really save a lot of time in many aspects." (IP#1, 23.10.23)	Statement on a time saving impact of the AI UC on a task or process	UC#7 (IP#14, 25.11.23, L 142-146) UC#8 (IP#5, 11.11.23, L 181-186; IP#8, 15.11.23, L 180-181) UC#13 (IP#4, 06.11.13, L 59-61, IP#6, 14.11.23, L 17) UC#17 (IP#9, 20.11.23, L 33-34; IP#10, 20.11.23, 75-77) UC#18 (IP#9, 20.11.23, L 116) UC#19 (e.g., IP#7, 14.11.23, L 68-69; IP#9, 20.11.23, L 112-113; IP#13, 21.11.23, L 183) UC#20 (e.g., IP#9, 20.11.23, L 112-113) UC#26 (e.g., IP#9, 20.11.23, L 135-138) UC #29 (IP#11, 21.11.23, L 66-70 & 82-86)

	Conservation	"Reduces the resources that are required to perform an action" (von Briel <i>et al.</i> , 2018, p. 52)	"But the effect is also very significant in terms of resources we require. We can basically outsource tasks to AI to the most part." (IP#1, 23.10.23)	Statement on a resource saving impact of the AI UC on a task or process	UC#5 (IP#11, 21.11.23, L 56-57) UC#6 (e.g., IP#2, 31.10.23, L 152-167; IP#5, 11.11.23, L 183-186) UC#9 (e.g., IP#4, 06.11.23, L 125-130 & 244-245; IP#5, 11.11.23, L 189-194) UC#10 (IP#14, 25.11.23, L 128-138) UC#11 (e.g., IP#5, 11.11.23, L 234-243; IP#6, 14.11.23, L 103-104) UC#22 (e.g., IP#4, 06.11.23, L 139-141; IP#6, 14.11.23, L 118-120; IP#9, 20.11.23, L 22 & 130-132; IP#13, 21.11.23, L 123-126) UC#27 (IP#5, 11.11.23, 235 & 244-246)
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	Expansion	"Increases the availability of a resource" (von Briel <i>et al.</i> , 2018, p. 52)	Wo ChatGPT in der Implementierung auch genial ist, ist bei allem, was schon da gewesen ist. Also in allem, was irgendjemand anders schon mal gemacht hat, sich jemand anders schon gedacht hat, das schon vorhanden ist. (IP#4, 06.11.23)	Statement that describes increased access to a resource through an AI tool, for which otherwise multiple sources would have been required	UC#1 (e.g., IP#4, 06.11.23, L 73-75 & 83-85; IP#5, 11.11.23, L 117-120 & 186; IP#7, 14.11.23, L 71-72; IP#12, 21.11.23, L 39-42; IP#14, 25.11.23, L 182-186) UC#2 (IP#5, 11.11.23, L 121-124 & 135-140) UC#4 (e.g., IP#3, 01.11.23, L 107-111; IP#7, 14.11.23, L 76-79 & 173-174; IP#11, 21.11.23, L 137-141) UC#23 (IP#2, 31.10.23, L 341-344; IP#4, 06.11.23, L 164-168; IP#14, 25.11.23, L 242-246) UC#24 (e.g., IP#4, 06.11.23, L 85-89; IP#5, 11.11.23, L 89-94; IP#8, 15.11.23, L 36-39; IP#11, 21.11.23, L 54-61) UC#25 (IP#8, 15.11.23, L 125-126; IP#10, 20.11.23, L 151-159 & 169-170; IP#11, 21.11.23, L 100-102; IP#13, 21.11.23, L 67-69)
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	Substitution	"Replaces one resource with another" (von Briel <i>et al.</i> , 2018, p. 52)	"Gerade in meinem Design-Bereich spiele ich gerne mit ChatGPT ganz simple Sachen durch. Wie zum Beispiel: Stell dir vor, du bist ein Head Hunter und ich bin ein Talent, das einen Job sucht. Was würdest du mich denn Fragen? Und dadurch bekomme ich einen besseren Eindruck, ohne mit den tatsächlichen Stakeholdern sprechen zu können." (IP#2, 31.10.23)	Statement on a UC where AI tool specifically replaces another resource for task-fulfillment	UC#3 (IP#2, 31.10.23, L 148-151; IP#6, 14.11.23, L 97-99) UC#21 (e.g., IP#2, 31.10.23, L 131-137)
	Combination	"Bundles different resources to create new artifacts, such as devices, functionalities, and business models" (von Briel <i>et al.</i> , 2018, p. 52)	"Für den Prototyp, also für das Front-End des Prototyps. Da kann man wie bei DALL-E beschreiben, was man haben will. Ich möchte ein Menü mit 5 Buttons und sonst irgendwelche Sachen. Da dann Bilder dazugeben und dann generiert dir das Tool eine Version." (IP#8, 15.11.2023)	Statement that refers to AI combining different inputs to create a new form of output	UC#12 (e.g., IP#4, 06.11.23, L 230-234; IP#7, 14.11.23, L 31-41; IP#10, 20.11.23, L 161-164; IP#13, 21.11.23, L 165-176) UC#14 (e.g., IP#5, 11.11.23, L 255-260; IP#8, 15.11.23, L 157-161; IP#11, 21.11.23, L 152-158; IP#14, 25.11.23, L 211-216)

	Generation	"Creates new artifacts, such as devices, functionalities, and business models, by changing existing ones" (von Briel <i>et al.</i> , 2018, p. 52)	"One key aspect of our business-model is text-to-speech transformation. For that we use the APIs from SoundStorm. So we are taking their AI to build our own language-model around it. Only like this we can run our current business model." (IP#1, 23.10.23)	Statements on AI tools generating new aspects to the business, e.g. functionality or business model	UC#15 (IP#3, 01.11.23, L 148-149) UC#16 (IP#1, 23.10.23, L 160-163)
	Uncertainty reduction	"Reduction in the perceived uncertainty of any business decisions of buyers or sellers" (Davidsson <i>et al.</i> , 2020, p. 319)	Habe ich irgendeinen Rechen-Fehler hineingemacht in das Excel? Passiert. Einfach um zu schauen, dass die Zahlen stimmen, und da nutze ich das wieder als Überprüfung, als Validierung. Es gibt wirklich viel um Sicherheit, dass man korrekt und sicher arbeitet. (IP#9, 20.11.23)	Statement that describes AI tool as increasing confidence in a task-fulfillment or decision	UC#28 (IP#9, 20.11.23, L 159-163)

Role	Triggering	"Entice prospective entrepreneurs to initiate the creation of a new venture because they more or less correctly anticipate some (but not necessarily all) of the mechanisms those enablers can provide" (Davidsson <i>et al.</i> , 2020, p. 320)	It was through the interaction with the large-language models that we even got to know such an industry existed. (IP#5, 11.11.23)	Statement on tool contributing towards the venture creation by influencing the perception of the entrepreneur towards an initiating idea; this can happen in any form	UC#1 (e.g., IP#3, 01.11.23, L 48-55; IP#4, 06.11.23, L 76-77; IP#6, 14.11.23, L 50-54) UC#2 (IP#5, 11.11.23, L 135-140) UC#4 (e.g., IP#7, 14.11.23, L 173-174)
	Outcome-enhancing	"Contribute to better outcomes than the emerging venture would experience had it not benefitted from the mechanisms in question" (Davidsson <i>et al.</i> , 2020, p. 320)	“Man kann mit ChatGPT auch sehr gut seine Wissenslücken schließen in Richtung Business Aspekte in der Gründung. Man bekommt Wissen sehr gut serviert, also auch der Educational Aspect ist irgendwo da, ist aber auch mehr eine unterschwellige Sache.” (IP#7, 14.11.23)	Statement directly relates UC to a beneficial outcome of venture creation for the individuals involved	UC#24 (e.g., IP#5, 11.11.23, L 93-98; IP#7, 14.11.23, L 187-190; IP#11, 21.11.23, L 56-57) UC#25 (IP#8, 15.11.23, L 126)

	Shaping - product	"Help shape the emerging venture's product or main market offering" (Davidsson <i>et al.</i> , 2020, p. 321)	"For that we use the APIs from SoundStorm. So we are taking their AI to build our own language-model around it. Only like this we can run the current business model." (IP#1, 23.10.23)	Statement on a tool's ability to contribute to a venture's offering; e.g. by providing functionality or purpose	UC#12 (e.g., IP#4, 06.11.23, L 230-234; IP#10, 20.11.23, L 161-164) UC#13 (IP#4, 06.11.23, L 37-40) UC#14 (e.g., IP#8, 15.11.23, L 157-161; IP#11, 21.11.23, L 152-158; IP#14, 25.11.23, L 211-212) UC#15 (IP#3, 01.11.23, L 148-149) UC#16 (IP#1, 23.10.23, L 161-163)
	Shaping – venture itself	"Help shape the venture itself" (Davidsson <i>et al.</i> , 2020, p. 321)	" Where we also use Chat-GPT (...) is in research. (...)That's exactly how my co-founder uses it, who mainly handles the legal and finance side of things. For example, what do investors want to hear? What should we pay attention to in the General Terms and Conditions and Privacy Policy? Basically, everything! (IP#2, 31.10.23, L 152-167)	Statement on the impact of AI on the organization and resourcing of a venture, meaning how it engages with its environment	UC#6 (e.g., IP#1, 23.10.23, L 113-123; IP#4, 06.11.23, 126-129) UC#27 (IP#5, 11.11.23, 244-246)

	Shaping – venture creation process	"Shape the venture creation process without leaving visible traces on the venture or the market offering that eventuates" (Davidsson <i>et al.</i> , 2020, p. 321)	"Das heißt es generiert nicht das Endprodukt, das ich am Ende benutze, sondern es wird mein Prozess dahin unterstützt. Also es unterstützt unsere täglichen Operations eben über Support, Prüfen, Validieren, liefert aber nicht das Endprodukt an sich." (IP#7, 14.11.23)	Statement relating AI tool to supportive tasks that facilitate venture creation, but only form assisting step to achieve outcomes	UC#3 (IP#2, 31.10.23, L 148-151; IP#6, 14.11.23, L 93-97; IP#7, 14.11.23, L 166-169) UC#5 (IP#11, 21.11.23, L 42-49; IP#14, 25.11.23, L 129-131) UC#7 (IP#14, 25.11.23, L 142-146) UC#8 (IP#5, 11.11.23, L 184-186; IP#8, 15.11.23, L 98-99) UC#9 (e.g., IP#2, 31.10.23, L 207-211; IP#4, 06.11.23, L 125-130; IP#5, 11.11.23, L 189-194; IP#13, 21.11.23, L 65-71) UC#10 (IP#14, 25.11.23, L 128-138) UC#11 (IP#4, 06.11.23, L 107-112; IP#5, 11.11.23, L 234-243; IP#6, 14.11.23, L 101-106) UC#17 (IP#9, 20.11.23, L 108-109; IP#10, 20.11.23, L 69-70) UC #18 (IP#9, 20.11.23, L 117-119) UC#19 (e.g., IP#7, 14.11.23, L 71-72; IP#10, 20.11.23, L 72-73; IP#14, 25.11.23, L 181-182) UC#20 (e.g. IP#6, 14.11.23, L 12-14; IP#9, 20.11.23, L 111-112; IP#10, 20.11.23, L 72-73) UC#21 (IP#2, 31.10.23, L 131-137; IP#8, 15.11.23, L 45-47) UC#22 (e.g., IP#4, 06.11.23, L 49-55 & 138-148; IP#6, 14.11.23, L 118-120; IP#13, 21.11.23, L 123-126) UC#23 (IP#4, 06.11.23, L 167-170; IP#14, 25.11.23, L 242-246) UC#26 (e.g., IP#4, 06.11.23, L 108-109; IP#6, 14.11.23, L 19-21) UC#28 (IP#9, 20.11.23, L 159-163) UC #29 (IP#11, 21.11.23, L 67-70 & 84-86)
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Source: Own work of the authors.