

Help! Which AI Should I Choose? - Work in Progress

Hennie Huijgens
hennie.huijgens@hu.nl
Utrecht University of Applied
Sciences
Utrecht, Netherlands

Devrim Eskiyeerli
d.eskiyeerli@fontys.nl
Fontys University of Applied Sciences
Venlo, Netherlands

Burcu Kör
burcu.kor@hu.nl
Utrecht University of Applied
Sciences
Utrecht, Netherlands

ABSTRACT

An extensive inventory of 137 Dutch SMEs regarding the most important considerations regarding the use of emerging digital technologies shows that the selection process is difficult. Entrepreneurs wonder which AI application suits them best and what the added (innovative) value is and how they can implement it. This outcome is a clear signal from SMEs to researchers in knowledge institutions and to developers of AI services and applications: Help! Which AI should I choose? With a consortium of students, researchers, and SMEs, we are creating an approach that will help SMEs make the most suitable AI choice. The project develops a data-driven advisory tool that helps SMEs choose, develop, implement and use AI applications focusing on four highly ranked topics.

KEYWORDS

Artificial Intelligence, Small and Medium Enterprises (SME), Added Value, Return on Investment, Innovation, Digital Transformation

1 INTRODUCTION

SME entrepreneurs believe that they are lagging behind large companies. Especially when it comes to digital innovation and the application of artificial intelligence (AI) in particular [3]. SMEs are praised as the engine of the economy, yet at the same time—while large companies invest heavily in sustainable collaboration with (technical) universities to conduct top research into the application of AI [4]—SMEs lag behind in investing in such collaborations [1, 5, 6]. Where SMEs—often in collaboration with universities of applied sciences—do invest in research into the effects of digital technology, the focus of that research is often more on the responsible and social aspects of AI application and to a much lesser extent on the technological and business economics side thereof. This makes it difficult for many entrepreneurs to estimate which applications of new digital technology will lead to real innovation and maximum added value. In other words: many entrepreneurs find it difficult to determine which new forms of digital technology they should invest in [1, 7].

However, a recent study conducted by, among others, the authors of this paper among 137 practitioners from Dutch SMEs, attempt to reduce this research gap by focusing on the questions about digital innovation that exist among practitioners in SMEs [3]. The main research question in the study was “Which existing and new questions about digital transformation are identified as most important by SME professionals?”

The results of the research—which was carried out as a guided student project in which 15 students from various disciplines and universities participated—show that SMEs rank questions about the possible applications of AI in their own practice, supported by evidence-based insight into innovation potential, added value, return of investment and an appropriate implementation strategy as most important (see Table 1). The results of this exploratory study, completed in 2023, form the starting point for the research project explained in this short paper.

Table 1: Top-5 Results of the ranking of predefined questions as prioritized by 137 SMEs.

Topic	Predefined Question	Priority Score P
Best Fit Application	I want to understand what is the best fit digital technology for my SME in order to invest in the right digital solutions.	1.000
Optimize Innovation	I want to understand the opportunities of integrating Emerging Digital Technologies (AI, robotics, machine learning) into my business operations in order to optimize innovation within my firm.	0.799
Added value	I want to understand the potential added value of Emerging Digital Technology on a longer term in order to ensure a sustainable future proof use of digital solutions.	0.780
Potential ROI	I want to understand the potential return on investment for implementing emerging Digital Technologies within the firm in order to support good business decisions.	0.638
Implementation strategy	I want to understand the relevant implementation strategies for Emerging Digital Technologies in order to plan for successful adoption.	0.561

SME practitioners were asked to prioritize three—out of an overall list of 14—research questions drawn up in advance by the researchers based on a thorough literature review, based on a survey question “Range the following questions according to relevance to the business operations of your organization”. The Top-5 list is sorted on ranked priority, indicated by an indexed Priority Score P. The remaining predefined questions are to be found in the initial study [3].

Taking the top-5 questions about digital transformation prioritized by SMEs as a starting point, we focus in the follow-up research described below on the research question “How can an SME entrepreneur gain personalized insight into the application possibilities of AI in his or her company, whereby the potential innovative power, the added value, the potential ROI, and the most suitable implementation strategy play a determining role in the advice generated?”

The remainder of this paper is structured as follows. The research design is described in Section 2. Since we have not yet produced results, we briefly discuss foreseen implications of our research approach in Section 3, and finally in Section 4 we draw conclusions. Due to the limited length of this short paper, no separate literature section is included.

2 RESEARCH DESIGN

As shown in Figure 1, the research project is divided into a number of sub-projects. In an Exploratory Study, completed in 2023 [3],

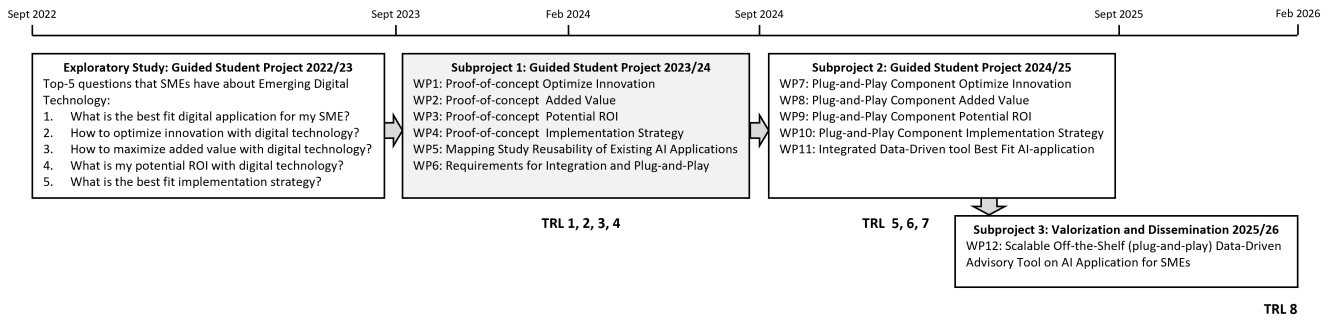


Figure 1: Overview of the research approach. A prioritized list of research questions, resulting from an exploratory study among 137 practitioners from SMEs [3] is used as input for a first sub project (depicted in light grey) that is described in this paper. The focus in this Sub Project 1 is on the development of proof of concepts based on the top-5 SME-questions. The results of Sub Project 1 will be on Technology Readiness Levels 3 (TRL 3 - experimental proof of concept) and where achievable 4 (TRL 4 - technology validated in lab) [8, 9]. In follow-up Sub-projects 2 and 3 that are scheduled for the next academic years the proof-of-concepts will be integrated and valorized into a data-driven advisory tool on AI application for SMEs.

137 SMEs were surveyed and interviewed to gain insight into the questions that SMEs have about digital innovation. The resulting top-5 of prioritized research questions, as shown in Table 1, forms the input for Sub-project 1: Four proof of concepts are developed and additional research is conducted. This sub-project is the basis for the further content of this paper. Following Sub-project 1, a second and third sub-project will be carried out in which the proof of concepts delivered in Sub-project 1 will be integrated into one (plug-and-play) data-driven advisory tool for the application of AI in SMEs. Sub-projects 2 and 3 are out of scope for this short paper. Sub-project 1 is divided into six different work packages that are described in more detail in the following paragraphs, including illuminating quotes from SMEs interviewed in the Exploratory Study.

2.1 Optimizing Innovation

Work package 1 investigates the second ranked SME-question (see Table 1) “I want to understand the opportunities of integrating AI applications into my business operations to optimize innovation within my SME company”. The result of WP1 is a proof-of-concept of a data-driven component in which, using AI technology, evidence-based and personalized insight is provided into the extent to which an AI application is expected to contribute to the innovation capacity of a specific company. WP1 therefore ties in with an important question that emerged from the inventory among professional practitioners in the exploratory study: “What growth and innovation opportunities do emerging digital technologies offer within my company?” Or as a researcher at an SME research agency put it:

“We set up new pilot stores, where research is conducted by using 3D via Virtual Reality. You can show a prototype of a new product in it, especially for innovation purposes.” [Senior consumer products researcher at a research agency for SMEs].

Practitioners from tech startups also repeatedly emphasized the importance of innovation, especially when it comes to keeping up with the pace of innovation of larger tech companies:

“The rapid pace of innovation within Google is a challenge to keep up with. It is also an opportunity because of the capabilities of the startup” [Business Development Manager at a B2B tech startup].

An important challenge in catching up is regularly stated that it is important to include all stakeholders—employees, customers, governments—in that transformation:

“How do you get all people on board with all the digital innovations?” [Marketing Manager at a software company].

The core question of WP1 will be about measuring innovation in an SME. What are existing approaches and methods? What role does data analysis play in this? What can we add to those existing methods, approaches or models? And what role can innovative AI technology play in this?

2.2 Maximizing Added Value

In work package 2 we will delve deeper into the third ranked SME-question (see Table 1) “I want to understand the potential added value of AI applications in the longer term to ensure a sustainable future-proof use of AI solutions in my SME company”. The result of WP2 is a proof-of-concept of a data-driven component in which evidence-based and personalized insight is provided using AI technology into the extent to which an AI application is expected to add value to an SME or its stakeholders.

Two additional questions mentioned by SMEs play an important role in the issue of added value: “How does the acceptance and implementation of emerging digital technologies provide my company with a comparative advantage?”, and “What are the possible beneficial effects of using new emerging digital technologies in my business?” The core question in WP2 will be how the added value of AI applications in SMEs can be made measurable, as an entrepreneur in the funeral industry also mentions:

“How to get valuable insights from all the data?” [Managing director at a funeral organization].

Because many SMEs already use websites and e-commerce, we expect that the link with data collected in online environments plays a major role. AI SEO—a form of search engine optimization that uses artificial intelligence to improve the organic performance

of a website or web page—appears to be an important research direction in this work package:

☞ *"As a search engine optimization specialist, I want to understand how to use digital technologies to remain relevant and valuable for my customers"* [SEO specialist at an online marketing agency].

The core question in WP2 will therefore focus on making the added value of AI applications measurable and on the role that AI technology can play in this.

2.3 Potential ROI

Work package 3 focuses on the fourth ranked SME-question (see Table 1) *"I want to understand the potential return-on-investment for implementing AI applications within my SME to support good business decisions."* The result of WP3 is a proof-of-concept of a data-driven component in which, using AI technology, evidence-based and personalized insight is provided into the expected return on investment (ROI) after implementation of a specific AI application in a specific enterprise.

Additional questions mentioned by SMEs that align with WP3 are *"Does the revenue generated from the implementation of emerging digital technologies currently available justify their adoption in my business?"*, *"How can I finance emerging digital technologies if it is so expensive?"*, *"How can I determine the conditions that would make me willing to invest in emerging digital technologies?"*, *"What influence does a subsidy have on my decision to adopt new technologies?"* and *"How can conducting a cost-benefit analysis help determine the adoption and implementation of emerging digital technologies?"*

Making investments is a challenge for a company that runs on investments from private equity (while private equity investments in Dutch SMEs are increasing sharply, where banks have partly withdrawn from the world of SME financing, including due to increasingly heavy regulatory pressure [2], as a marketing manager of such a company mentions as an important question regarding digital innovation:

☞ *"Investments are difficult in an equity-driven company"* [Marketing manager at a publisher of puzzle magazines and puzzle games].

☞ *"The return on investment is low and spread over a longer period for SMEs"* [CEO of a tech startup].

In addition, SMEs regularly referred to well-trained staff:

☞ *"An obstacle is a shortage of sufficiently trained staff who have data knowledge, partly due to staff shortages at the macro level. Furthermore, there is a shortage of investment money and time because [company name] is small"* [Entrepreneur of a number of retail non-food stores].

WP3 therefore focuses on making the financial aspects of AI applications measurable and investigating the extent to which AI technology can play an innovative role in this.

2.4 Best Fit Implementation Strategy

In work package 4 we investigate the fifth ranked SME-question (see Table 1) *"I want to understand the relevant implementation strategies for AI applications in my SME to plan a successful adoption"*. The result of WP4 is a proof-of-concept of a data-driven component in which, using AI technology, evidence-based and personalized insight is provided into the most suitable implementation strategy for a specific AI application.

SMEs mentioned some questions related to opportunities and challenges, such as *"What are the possible pitfalls about emerging digital technologies that I should take into account when implementing them?"* and *"Is there a solution to the challenge of implementing emerging digital technology due to a lack of IT staff in my company?"* The connection with managers in SMEs was also mentioned as a point of attention:

☞ *"How can the board be made enthusiastic about implementing new digital technologies?"* [Market at a retail non-food store chain].

☞ *"I want to clearly explain to customers what possibilities there are with emerging digital technologies to adapt them to the customer and how money can be earned with the implementation"* [Commercial director at a tech company in marketing analytics].

Other questions were about support and advice with that implementation and the connection to existing systems and business processes: *"Who can I consult for advice if I need help with the use or implementation of emerging digital technology?"*, *"How can I implement new -successfully integrate emerging digital technologies with the existing technologies I use?"*

☞ *"Important is to make the purchasing process more data-driven and less based on gut feeling."* [Entrepreneur of a retail non-food store chain].

A final topic had to do with the resources required for an implementation and *"What other resources are needed besides time and money to effectively implement emerging digital technology?"* and *"How can I shorten the time it takes to implement emerging digital technology?"*

☞ *"We want to increase the use of digital technologies such as ChatGPT for coding"* [Entrepreneur of a data analytics startup].

☞ *"We actually implement different implementations, I would say actually because we implement other technologies in our technology. We have a SaaS platform, and we use AI technology from another company implemented in our technology"* [Data Scientist in a tech startup].

WP4 therefore has a strong business profile, with a focus on implementation aspects of AI technology in both mature tech startups and digital beginners in SMEs. An important question here is to what extent AI technology can play a supporting role in implementation processes of digital technology.

2.5 Re-usability of existing AI applications

Large companies are increasingly investing—often in collaboration with academia—in large labs that conduct research into the application of artificial intelligence (AI). Partly because of this, SMEs lag behind in research and application of AI. As an underlying starting question for the highest ranked SME-question (see Table 1) *"I want to understand what the best AI application is for my SME company to invest in the right digital solutions"*, we will therefore conduct research into AI applications that have already been developed in large research labs [4] and to the extent to which those applications can be considered for reuse or further development into AI applications specifically for SMEs.

WP5 is therefore in line with a large number of more general questions that SMEs mentioned as important for digital innovation. The focus was on the application area of AI technology, such as

“What are the potential applications of emerging digital technologies?”, “What strategies can be used to identify the emerging digital technology that best suits my needs or those of my company?”, and “How does the excessive amount of information about emerging digital technologies affect our ability to choose a specific technology?” Or, as the commercial director of a tech company put it:

☞ “I want to be able to choose and understand the right emerging digital technologies together with my colleagues in order to be a specialist in the market for my customers” [Commercial director at a tech scale-up in marketing analytics and customer data].

WP5 is about the more general aspects of applying AI technology in an SME company and the way in which the developed components from WP1, 2, 3 and 4 are to be integrated into one application. WP5 will not produce a proof of concept but is expected to consist much more of desk research, literature study and case study research in existing external research labs.

2.6 Integration and plug-and-play requirements

Work package 6 is in fact a preparation for Sub-project 2, which maps out the requirements that the working prototypes developed in Sub-project 1 must meet with regard to integration into one SME-oriented advisory tool that is characterized by the possibility of simple and scalable implementation in the operational processes of an SME company, such as ‘plug-and-play’ technology and ready-made ‘off-the-shelf’ applications. WP6 has similarities with WP4, in which research is being conducted into appropriate implementation strategies. A number of research questions mentioned by SMEs in interviews in the exploratory study relate to the plug-and-play aspects of an AI application, such as “What options are there for my company to implement emerging digital technology if we know and therefore have to hire external staff?”, “What are the potential negative consequences of over-dependence on emerging digital technologies?”, and “Is the latest technology easier to implement and is it considered more user-friendly?”.

☞ “There is limited knowledge within the company and it will certainly help to have a plug and play application” [Consultant at a healthcare company].

☞ “We set up the company to easily integrate new digital technologies, that was always in scope” [Entrepreneur of a tech startup in AI applications for SMEs].

The character of WP6 is more technologically oriented than WP5 and focuses mainly on a congruent set of requirements for the technical solutions to be developed in follow-up sub-projects 2 and 3. However, due to the iterative nature of artifact development in our project, we have chosen to place these follow-up projects outside the scope of this paper.

3 DISCUSSION

As the observant reader may have already noticed, this paper contains many question marks. By asking questions and including quotes from SMEs about the questions they themselves struggle with when it comes to digital innovation, we want to emphasize that the human side cannot be forgotten in the business and technological aspects of AI application. By simply dividing the discussion into human aspects on the one hand and technological aspects on the other, we shortchange decision-making.

3.1 Implications for Academia

As substantiated in our literature section, there is a research gap when it comes to AI-related research in SMEs. In our research we aim to contribute to practice-oriented research into AI applications specifically within SMEs. We emphatically pursue a portfolio-oriented, iterative (agile) approach that gives researchers and practitioners insight into a backlog prioritized by SMEs in which there is sufficient room for interim adjustment of research goals.

3.2 Implications for Practice

In implementing the work packages, the researchers work closely with experts from a number of leading SME companies that specialize in AI development and financing thereof. In this way we ensure that a strong link with practice is guaranteed under the project.

A striking point of discussion between (tech)practitioners of these participating companies and researchers in the project is the different expectations regarding lead time: while researchers assume a lead time of two years to achieve TRL 8 (Product/service is complete and operational), the expectation among the SMEs that this should happen much faster. By using an agile way of working that is in line with the practice of SMEs, we aim to achieve a positive effect on the lead time.

3.3 Implications for Education

Inspired by positive experiences in the preceding exploratory study, we make intensive use of guided deployment of bachelor- and master students from various disciplines and knowledge institutions in our research project where possible. In doing so, we aim to actually give shape to the wish of those institutions to more closely connect education and research. However, a challenge that plays a role here is the (sometimes limited) availability of students with a technology background.

4 CONCLUSIONS

In an ongoing work-in-progress study, which is a follow-up to an exploratory study among 137 SMEs completed in 2023, we discuss in detail six work packages that are essential in the development of a data-driven advisory tool for AI development within SMEs.

REFERENCES

- [1] AINED, 2023. Application of ai-systems URL: <https://ained.nl/aanpak/toepassen-van-ai-systemen/#Valorisatie>.
- [2] FD, 2023. Private equity is making rapid progress in the netherlands .
- [3] Huijgens, H., van Beijnum, B., Alekseichuk, A., Reissenweber, S., Detmar, I., Boers, T., Majumdar, T., van Diepen, B., de Bree, M., Mueller, M., Dybvadskog, O., Opreae, V., Oancea-Negoitae, C., Yudhistirae, A., van den Enk, I., van Oosten, W., Lettinga, G., Oosterhoff, M., Steevensz, J.L., Eskiyerli, D., van Teeffelen, L., Meents, S., de Regt, A., Rastogi, A., 2023. Emerging digital technologies in smes: Building a prioritized backlog for future research. in Press .
- [4] ICAI, 2023. Innovation center for artificial intelligence URL: <https://icai.ai/>.
- [5] NLAIC, 2023. Ained mit ai call van start voor ai-projecten mkb URL: <https://nlaic.com/nieuws/ained-mit-ai-call-van-start-voor-ai-projecten-mkb/>.
- [6] Ramdani, B., Raja, S., Kayumova, M., 2022. Digital innovation in smes: a systematic review, synthesis and research agenda. Information Technology for Development 28, 56–80.
- [7] ROBUST, 2023. Long term program robust URL: <https://icai.ai/ntp-robust/>.
- [8] RVO, 2022. Technology readiness levels (trl) URL: <https://www.rvo.nl/onderwerpen/trl>.
- [9] Uren, V., Edwards, J.S., 2023. Technology readiness and the organizational journey towards ai adoption: An empirical study. International Journal of Information Management 68, 102588.