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Lucie Sara Zavodna

https://orcid.org/0000-0001-7309-6590

Department of Management
Faculty of Management
Prague University of Economics and Business
Prague, Czech Republic
Lucie.zavodna@vse.cz

Margarethe Überwimmer

https://orcid.org/0000-0001-6273-3224

FH Oberösterreich
University of Applied Sciences UA
Steyr, Austria
Margarethe.Ueberwimmer@fh-steyr.at

Elisabeth Frankus

https://orcid.org/0000-0001-9954-9287

Institute for Advanced Studies
Vienna, Austria
frankus@ihs.ac.at

Barriers to the implementation of artificial intelligence in small and medium-sized enterprises: Pilot study

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Abstract

Aim/purpose – This pilot study explores the main obstacles hindering the effective implementation of Artificial Intelligence (AI) in small and medium-sized companies (SMEs). By thoroughly understanding these barriers, organizations can develop customized strategies and interventions to overcome them, facilitating smoother and more successful AI adoption. The paper's primary goal is to help organizations understand the barriers to AI adoption to develop tailored strategies and interventions to overcome these challenges, leading to a more efficient and successful integration of AI. Through a rigorous examination of real-world experiences and perceptions, this paper seeks to elucidate the multifaceted challenges that impede the effective deployment of AI solutions.

Design/methodology/approach – The study identifies four main impediments to AI implementation based on data from 22 interviews with industry experts in the Czech Republic and Austria.

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Findings – First, a notable lack of trust emerges as a significant barrier, with stakeholders harboring apprehensions regarding AI's reliability, ethical implications, or potential consequences. Second, the knowledge gap hampers progress, indicating a need for better understanding and expertise in AI technologies and applications. Third, infrastructure limitations, including inadequate computing resources, outdated systems, or insufficient technical support, pose a challenge. Lastly, a shortage of skilled professionals proficient in AI further complicates implementation efforts, highlighting the importance of nurturing talent and expertise.
Research implications/limitations – The findings regarding AI implementation strategies are significant for small and medium-sized enterprises. Although the research focuses on Czech and Austrian companies, the findings may apply to other countries. Additionally, it is worth noting that this is qualitative research with a smaller sample size.
Originality/value/contribution – By addressing these barriers proactively, organizations can navigate the complexities of AI adoption more effectively and unlock its transformative potential.

Keywords: AI, barriers, implementation, SMEs.
JEL Classification: M10, M15, M2.

1. Introduction

In recent years, integrating Artificial Intelligence (AI) technologies into various sectors has garnered significant attention due to its transformative potential (Dwivedi et al., 2021). It should not be seen as introducing new technology (Alhosani & Alhashmi, 2024). AI emerged in the 1950s as a critical tool for enhancing efficiency, driving innovation, and gaining a competitive advantage in business (Natale & Ballatore, 2020). As companies increasingly recognize the strategic importance of AI, understanding the barriers impeding its successful implementation becomes paramount.

The contemporary business environment is characterized by rapid technological advancements and evolving consumer demands, prompting organizations to explore AI solutions to remain relevant and competitive (Pereira & Romero, 2017). From optimizing operational processes to revolutionizing customer experiences, the benefits of AI adoption are vast and multifaceted (Govori & Sejdija, 2023). However, despite the promising prospects, many companies encounter challenges that hinder the seamless integration of AI into their operations. On a European level, SMEs are still little engaged with AI (Ulrich & Frank, 2021).

To address these challenges comprehensively, it is imperative to delve into the nuanced perspectives of companies regarding the barriers to AI implementation. Qualitative research, mainly through in-depth interviews with industry stakeholders, offers invaluable insights into the intricacies of these obstacles. By

engaging directly with decision-makers and practitioners, researchers can uncover nuanced perspectives, contextual factors, and underlying issues that quantitative analyses may overlook. The main research question (RQ) was: What are SMEs' main barriers to AI? So, what prevents SMEs from adopting AI technologies?

This paper is a pilot study that contributes to the existing body of knowledge by conducting qualitative research to identify and analyze the barriers hindering the implementation of AI in SMEs across various industries. The paper's primary goal is to help organizations understand the barriers to AI adoption so they can develop tailored strategies and interventions to overcome these challenges, leading to a more efficient and successful integration of AI. Through a rigorous examination of real-world experiences and perceptions, we seek to elucidate the multifaceted challenges that impede the effective deployment of AI solutions. By understanding these barriers in-depth, organizations can develop tailored strategies and interventions to address them effectively, facilitating smoother and more successful AI adoption journeys. Furthermore, this research benefits individual companies and contributes to the broader understanding of AI implementation challenges within the business ecosystem. Insights from this study can inform policymakers, industry practitioners, and academia, facilitating collaborative efforts to overcome barriers and accelerate the realization of AI's transformative potential.

The current state-of-the-art regarding AI adoption barriers in SMEs is insufficient for several reasons. Most existing research on AI adoption tends to focus on larger enterprises with more substantial resources and infrastructure (Bammens & Hünermund, 2021). However, SMEs operate under different constraints and face unique challenges not adequately addressed in the broader AI adoption literature. Most AI adoption studies are conducted in technologically advanced regions such as North America, Western Europe, and East Asia. Research focusing on the Central European context is scarce, particularly in the Czech Republic (CZ) and Austria (AT). Existing literature often relies on quantitative data, which, while valuable, may not capture the nuanced and context-specific challenges SMEs face. As AI technology rapidly evolves, so do the barriers to its adoption. New emerging challenges may not have been previously considered or adequately addressed in earlier studies. This research captures contemporary issues and provides up-to-date insights, making it relevant and timely for SMEs' current and future AI implementation efforts.

The paper is structured as follows: The literature review is followed by a methodological section explaining the procedure for qualitative research in detail. Furthermore, the study's results – barriers to SMEs' AI adoption – are discussed and summarized in the final section.

2. Literature review

The EU defines SMEs as enterprises that employ fewer than 250 persons and have an annual turnover not exceeding 50 million euros. In 2022, about 24.3 million SMEs were active in the EU-27, accounting for 99.8% of all enterprises in the non--financial business sector (Annual Report on European SMEs 2022/2023, 2023). Literature on the usage of AI in SMEs has been growing in recent years. We can find papers in healthcare (Ahmed et al., 2023; Kim & Lee, 2021; Peña et al., 2019; Singh et al., 2020), HR/Talent management (Agarwal, 2022; Faqihi & Miah, 2023; von Richthofen, 2022), and manufacturing (von Garrel & Jahn, 2023; Ferreira et al., 2023; Dey et al., 2023). Many researchers have mentioned applications in SMEs (for example, Dey et al., 2023; Maroufkhani et al., 2023; Wei & Pardo, 2022). Literature has also addressed the role and ethics of AI (Hagendorff, 2020; Morley et al., 2023; Siau & Wang, 2020) and the adoption and relevance of AI (Bettoni et al., 2021; Ulrich & Frank, 2021).

To explore the barriers to implementing AI, numerous studies provide valuable insights. Exploring barriers reveals a multifaceted landscape influenced by various internal and external factors. Based on a comprehensive review, Ullah et al. (2021) identified 21 critical digitalization and innovation barriers. Overall, the highest barrier scores are observed for high software and hardware costs, high complexity of the selected technology dissemination system, and lack of government incentives, R&D support, policies, regulations, and standards. For the organizational group, the barrier with the highest failure chances is the lack of organizational willingness to invest in digital marketing. According to Bérubé et al. (2021), the obstacles to AI implementation can be categorized into three main areas: (1) insufficient organizational capabilities related to data, (2) a lack of individual competencies specifically in AI, and (3) generic implementation barriers commonly identified in previous research on innovation implementation. Similarly, research by Lada et al. (2023) indicated that top management commitment and organizational readiness significantly influence AI adoption. In contrast, factors such as competitive pressure, employee adaptability, and external support have an insignificant impact on AI adoption. Drmac (2022) identified four barriers across the pre-implementation, implementation, and post-implementation phases of AI: (1) undefined use cases, (2) low levels of AI knowledge, (3) inadequate data, and (4) misalignment with end-user needs. Drmac's study also outlined key activities to overcome these barriers, including defining AI transformation, anchoring AI implementation, and optimizing AI

usage. Grünbichler (2023) found that most hurdles in AI implementation exist at the management, employee, organizational, and data levels. Additionally, external factors such as a shortage of skilled workers, inadequate technical infrastructure, and limited knowledge about software offerings also significantly impact the introduction of AI. Shang et al. (2023) identified key drivers of AI adoption, including support from top management and leadership, organizational readiness, and the need for increased productivity and efficiency. However, significant barriers were noted, such as the high costs of AI implementation and maintenance the lack of top-down support and the employees skilled in AI. In a study interviewing companies in Vietnam, Nguyen et al. (2022) found ten critical factors related to AI adoption. The results indicated that technical compatibility, relative advantage, technical complexity, technical capability, managerial capability, organizational readiness, government involvement, market uncertainty, and vendor partnership are significantly related to AI application adoption. Moreover, Alsheiabni et al. (2019) showed that AI presents many of the same barriers and challenges as other innovations. Their results showed that organizations with high levels of AI adoption generally identified the same barriers as organizations with no or low levels of AI adoption. Their study distinguished barriers into three groups based on the level of AI adoption: (1) lack of in-house skills to implement and manage alongside an unclear business case for AI implementations, (2) the perceived lack of leadership support, and (3) AI talent shortages and employee resistance.

In the healthcare sector, Brennan (2022) categorized the barriers to AI implementation into several themes: technology, data, regulation, human resources, education, and culture. Similarly, Chomutare et al. (2022) found that the most cited facilitators were related to engagement with and management of the implementation process, while the most cited barriers involved the intervention's generalizability, interoperability with existing systems, and the quality and availability of data within the inner settings. Paranjape (2021) identified additional barriers to AI adoption in healthcare, such as high investment costs, lack of proven clinical benefits, numerous decision-makers, and privacy concerns. For a summary of the barriers identified (Table 1).

Table 1. Barriers identified in the literature

Barrier	Literature source	Qualitative finding
Trust	Bérubé et al. (2021); Brennan & Kirby (2022); Alsheiabni et al. (2019)	AI reliability, transparency, and legal ramifications
Management	Chomutare et al. (2022); Grünbichler (2023); Lada et al. (2023); Shang et al. (2023)	lack of understanding or support from the management of the company, their commitment
Knowledge	Ullah et al. (2021); Bérubé et al. (2021); Nguyen et al. (2022)	expertise in AI technologies, knowledge transfer, and talent retention
Infrastructure	Ghobakhloo & Ching (2019); Nguyen et al. (2022); Grünbichler (2023); Alsheiabni et al. (2019)	inadequate computing resources, insufficient support, and a lack of robust legal frameworks
Skilled experts	Drmac (2022); Alsheiabni et al. (2019); Shang et al. (2023); Brennan & Kirby (2022)	shortage of AI professionals, and technical experts, HR talents
High costs	Shang et al. (2023); Nguyen et al. (2022); Brennan & Kirby(2022); Paranjape (2021); Ullah et al. (2021)	high acquisition costs, ongoing expenses, and skepticism about the profitability
Organizational readiness	Lada et al. (2023); Shang et al. (2023); Nguyen et al. (2022)	entrenched mindsets
Data quality and management	Bérubé et al. (2021); Grünbichler (2023); Paranjape (2021); Brennan (2022)	poor data quality and inadequate data management practices
Government and institutional support	Lada et al. (2023); Alsheiabni et al. (2019); Ullah et al. (2021)	lack of clear guidance and support from public institutions
Employee resistance	Bérubé et al. (2021); Alsheiabni et al. (2019); Brennan & Kirby (2022)	traditional ways of working
Technological complexity	Alsheiabni et al. (2019); Paranjape (2021); Ullah et al. (2021)	the technical expertise to implement and manage AI systems
Ethical and social concerns	Morley et al. (2023); Hagendorff (2020); Siau & Wang (2020)	ethical implications and potential social consequences
Customization needs	Ghobakhloo & Ching (2019); Wei & Pardo (2022); Shang et al. (2023)	customization to suit specific organizational contexts

Overall, similar patterns emerge across various authors' research. Our study focused on the barriers to AI implementation in SMEs in Austria and the Czech Republic by consulting experts from these SMEs. Building on the findings of the previously mentioned authors, we guided the experts through this topic to gather insights from qualitative interviews.

3. Research methodology

A qualitative research approach was employed to explore the challenges obstructing the adoption of AI technology within the INTERREG project ATCZ271 (AI SDT LAB) framework, focusing on the South Bohemian Region, Upper Austria region, and Vienna region. The goal of this project was to create a cross-border network of cooperating entities to (1) jointly identify the possibilities of practical use of AI, (2) find an appropriate and adequate level of application of this technology to optimize organizational processes, and (3) find ways to overcome existing barriers complicating the implementation of AI into practice. This research was conducted in alignment with the approved project timeline. A total of 22 interviews were carried out, comprising ten interviews with experts from the Czech Republic, seven with experts from Upper Austria (including representatives from an AI consultancy firm, public authorities, and export companies), and five with experts from the Vienna region. The interviews were held from February 2022 to April 2022.

Table 2. Interviewee profiles

Company	Count	Area
public institution	5	regional institutions & public authorities
SMEs in the data analytics business	2	production companies, exporting companies
SMEs in the industrial automation business	2	production companies, exporting companies
SMEs in the agriculture business	3	production companies
SMEs in mechanical engineering	2	production companies, exporting companies
SMEs in logistics	2	production companies, exporting companies
SMEs in the consultancy business	3	production companies, exporting companies
other SMEs	3	SMEs

Following the COREQ criteria for qualitative research, the interviewers were two female and two male researchers with Ph.D. degrees. They were all academics employed at a university and working on the INTERREG project (AI SDT LAB). These researchers have more than ten years of research experience. No relationship had been established before the interviews. The interviewees knew only the expertise of the interviewers and their home universities. The project goals and main steps were always introduced.

In the Czech Republic, the surveyed entities comprised three regional institutions and public authorities. At the same time, seven represented various companies, including production companies, exporting enterprises (specifically in Marketing and Sales), and SMEs and Start-Ups that had already implemented AI

systems. In Austria, the surveyed entities were two regional institutions and public authorities, while ten represented various companies (Table 2). Table 3 presents the interview questions. These questions were pilot-tested in two companies (one AT and one CZ).

Table 3. Questions for interviews

No.	Question	Area
1	*2*	*3*
1.1	What obstacles in AI implementation/introduction do you face?	Obstacles to the smooth introduction of AI
1.2	Could you share the most serious obstacles you are facing now?	
1.3	How do you plan to overcome the three most serious obstacles (in specific steps)?	
1.4	Who will be responsible for this?	
1.5	How is the IT department involved now?	
1.6	Who processes big data in your organization?	
1.7	From 1 to 5 (1 = very ready; 5 = not at all ready), how prepared do you think your organization is to remove the barriers preventing the introduction of artificial intelligence applications?	
1.8	Did you enlist the help of a facilitator during the AI implementation process?	
2.1	In your opinion, what are the three most relevant issues for the organization when it comes to AI trust and AI implementation and systems?	Increasing confidence in the implementation of AI
2.2	How is trust in AI perceived in your organization?	
2.3	What specific measures have you taken to combat the lack of trust in AI (if any)?	
3.1	Are you in contact with any available institutions (think of regional institutions and public bodies – local, national, EU level, that offer support in implementing an AI system)?	Role of supporting institutions
3.2	Which tools would you need the most? (Think about examples of good practice, consultation meetings, training/education, research and development, round tables/feedback rounds)	
4.1	From your experience, what would the ideal AI implementation process look like? Who should be involved in which step? Who should be responsible?	The process of implementing AI systems
4.2	What are the critical steps during implementation?	
4.3	Where could it fail?	
4.4	What kind of support would you need?	
4.5	In general, and in your opinion, how is it necessary to properly support SMEs?	
4.6	Where do you see a lack of managerial information about AI applications?	
4.7	What tools and measures do you think could be beneficial for a manager to increase the general level of awareness of AI applications and systems?	

Table 3 cont.

1	*2*	*3*
5.1	How well are AI applications integrated into your organization at the time of this interview? Level 1-5 (1 = well integrated; 5 = not integrated at all)	The process of integrating AI systems and applications
5.2	What are the signs of good integration?	
5.3	What are the signs of poor integration?	
5.4	What do you think are the three most important values of using AI for SMEs?	
5.5	What helped you to see the expression of these values?	
5.6	What kind of support do you think SMEs and start-ups would need to achieve these values?	
5.7	How can the customer experience be positively influenced?	
5.8	Which other departments could benefit from the use of AI?	
5.9	What specific value does AI bring to the sales and marketing department and production?	
5.10	How could AI systems revolutionize sales and marketing/manufacturing?	
5.11	When will the introduction of AI become profitable?	
5.12	When does AI help achieve broader savings?	

Each interview lasted approximately 55 minutes on average, with durations ranging from 25 to 90 minutes, conducted either in person or via MS Teams (19 interviews were face-to-face). The goal was to get a minimum of 20 SMEs into the study. Data were collected at the company location or online. Consistency was ensured throughout the interview process by employing the same interview schedule and set of questions developed and discussed by the INTERREG project team. The audio recordings were transcribed verbatim to ensure that the text matched the audio, making all raw data transparent and allowing the findings to be reproduced and rigorously tracked. To ensure accuracy, we meticulously reviewed both the text and the audio, manually verifying all results to guarantee that the transcriptions were accurate. The researchers in CZ and AT reviewed both the text and the audio. Then, they translated the analysis results into English, manually verifying all results to ensure the transcriptions were accurate. All four researchers verified transcripts. This rigorous methodological approach enabled a comprehensive understanding of the challenges and facilitated the extraction of valuable insights for the project.

The coding process was as follows: We broke down the data into smaller parts and labeled them with codes. Each line or small text segment was assigned a code for more detailed analysis. We grouped the codes into categories by identifying relationships among them. We looked for patterns and similarities. Then, we grouped categories into broader themes that capture the essence of the data. We also verified the findings with participants (experts). Later, we discussed the findings with the project team (AI SDT LAB) to collect feedback and ensure credibility.

4. Research findings

Both the existing literature (for example, Chatterjee et al., 2021; Lada et al., 2023; Grünbichler, 2023) and the empirical findings from interviews conducted as part of this INTERREG project (AI SDT LAB: 2021-2022) underscore the critical importance of involving top management in AI adoption projects from their inception. As the ultimate decision-makers within a company, the involvement of top management is paramount, particularly when embarking on potentially transformative projects that entail organizational change. Top management's early engagement ensures awareness and alignment with revolutionary initiatives, facilitating smoother implementation processes. Moreover, top management plays a pivotal role in guiding internal teams of experts and providing crucial financial backing to transition AI projects from pilot phases to full-scale implementation (Mikalef & Gupta, 2021). Effective change management emerges as a significant factor in successfully integrating AI within companies. Barriers to adoption often stem from entrenched mindsets, especially prevalent in family-owned businesses or SMEs led by less forward-thinking managers. Among the crucial leadership skills mentioned are patience and ongoing personal examples. As stated by interviewee from the Czech company: *The manager should be able to convey a practical demonstration of the application*. A higher level of personal approach and the ability to use AI are expected directly from managers rather than advisors than ever before. Thus, AI implementation requires much greater effort and personal managerial involvement. In contrast, managers are expected to listen to IT experts. Essential skills for sales and marketing employees were identified as speeding up production, improving quality, and reducing downtime in production.

Indeed, AI adoption necessitates a holistic organizational shift, demanding agility, innovation, and a digital-first mindset. It is essential for companies to demonstrate adaptability while prioritizing digital initiatives. Simultaneously, a cautious, step-by-step approach to implementation is advisable, ensuring that each phase is thoroughly planned and executed.

Based on expert opinions on AI implementation, the following issues were identified through interviews: 1) lack of trust, 2) lack of knowledge, 3) lack of infrastructure, and 4) lack of resources.

4.1. Barrier 1: Lack of trust

Challenges related to trust in AI technology are prevalent in both national contexts. Trust in AI encompasses a spectrum of factors but fundamentally hinges on establishing technical and social trust within organizations, among business stakeholders, AI experts, and the broader public. Across all case companies, concerns regarding organizational and cultural biases against AI technology surfaced due to inherent distrust in its value proposition. One expert from the Austrian company stated: *AI is characterized by a certain percentage of unreliability. Companies are also worried about being unable to verify when an error emerges in the evaluation. The implementation of AI is not always suitable*.

One significant organizational bias manifests in mistrust toward data sources, data collection processes, and data management practices, hindering AI implementation efforts. Additionally, the low traceability of AI systems poses a barrier, eroding trust and potentially leading to legal ramifications for mishandling data. In Upper Austria, trust-building is closely tied to measurable outcomes and performance indicators. For instance, expert interviews highlighted barriers to value-based trust, such as suboptimal customer relationship management software solutions and diverting resources from strategic endeavors.

Experts from companies would appreciate best practices from other companies, which could serve as practical tools for fostering trust in AI (interviews): *We looked for a partner with whom we would be able to build trust. We found a partner who had contacts in the Netherlands and had experience in the AI industry. He loaned us a demo of the software, and thanks to that, we could test and work with the technology hands-on for free*. Managers benefit from observing practical AI applications and financial analyses demonstrating its efficacy in other companies. The emulation of successful AI implementations by larger enterprises can guide smaller businesses. Thus, knowledge sharing through workshops, transparent communication about potential job displacement, managerial openness to new ideas, ongoing education, training initiatives, and practical demonstrations emerge as crucial measures in enhancing trust in AI implementation. These activities stand out as commonly cited prerequisites for successfully integrating AI.

4.2. Barrier 2: Lack of knowledge

Knowledge barriers pose significant challenges to the adoption of AI technology. Expert interviews in Vienna highlighted the prevalent lack of expertise among companies, not only in executing successful AI implementations but also

in understanding the intricacies of AI technology. Many companies in Vienna struggle with identifying suitable AI solutions available on the market and discerning their capabilities and limitations.

In Upper Austria, additional knowledge gaps were observed, including a widespread lack of awareness among companies regarding the necessity to generate data and train their own models for AI technologies. Conversely, in the Czech Republic, the focus shifted toward knowledge transfer and talent retention, with technical experts often migrating to the private sector or seeking employment abroad, resulting in a loss of valuable skills and knowledge within the region. As one Czech expert mentioned: *There are no technical universities in South Bohemia. This is coupled with a shortage of technicians and the fact that users are unwilling to learn new things, be flexible, and be open to new technologies. The hardest thing for employees is to break operational blindness and eliminate old habits*. Another Czech expert noted that there is also a problem with current employees: *We have seen that the biggest obstacle to introducing artificial intelligence into a company is its employees. Employees fail to understand the benefits of introducing artificial intelligence in their company*.

Moreover, companies in these regions expressed frustration over the absence of clear guidance and support from public institutions regarding AI adoption. While AI solution providers may offer seemingly comprehensive packages, the reality is that AI implementation requires customization to suit specific organizational contexts. This lack of clarity extends to public authorities' formulation of AI strategies, leaving firms uncertain about long-term implementation strategies and where to seek support.

Furthermore, firms in the region lamented the dearth of educational resources and AI experts, coupled with resistance from the workforce to embrace new approaches and break away from entrenched habits. This dual challenge of knowledge deficiency and workforce inflexibility compounds the barriers to effective AI adoption in these regions.

AI adoption is a typical case of constantly learning organizational activities. Introducing AI itself is the initial step, but forward and follow-up operations require ongoing care for the team. Firms desire to increase educational opportunities about software, implementation, processing, and management of AI. One of the respondents stated: *The introduction of AI does not bring with it one change only, but a whole array of them*.

Finding a partner between organizations is perceived as beneficial for a better learning process, mainly on two levels. First, it is to find an organization that can be found because the principle of AI is based on learning processes from

previous experience. Second, it is to find a trusted partner to work with. Ventures identify the Ministry of Industry and Trade, the South Bohemian Science and Technology Park, and the university in the analyzed region as primary partners for AI implementation.

4.3. Barrier 3: Lack of infrastructure

Inadequate internal and external infrastructure poses significant obstacles to AI adoption within organizations and at the national and regional levels of research and development (R&D) policy. Internally, these challenges primarily revolve around a deficiency in knowledge and processes required for training employees and managing data streams.

In the Czech Republic, few educational institutions offer a comprehensive education in AI, and those that do often lack sufficient resources and equipment. Additionally, there is a noticeable absence of economic and programmatic support in the form of knowledge centers, along with inadequate infrastructure for knowledge transfer between research institutes specializing in knowledge production and small and medium-sized enterprises (SMEs).

Furthermore, infrastructure-related barriers extend to the realm of intellectual property protection, exacerbated by insufficient AI legislation. The lack of robust legal frameworks contributes to uncertainty surrounding protecting intellectual property rights, discouraging investment and innovation in AI initiatives. Addressing these infrastructure deficiencies is crucial for fostering a conducive environment for AI adoption and innovation within organizations and across regional R&D ecosystems. As one Czech expert stated: *It is also evident that the Czech market is simply not ready regarding AI products. If a certain company opts for AI, it will soon discover that AI cannot be applied in the same way as a one-size-fits-all program. In addition, companies have no idea which institution would be able to help them with the application of AI.*

4.4. Barrier 4: Lack of resources

Companies face a significant challenge in trusting the value of investments in AI technology and struggle to pinpoint areas where AI can enhance their business operations. There is prevalent skepticism regarding AI's potential benefits, leading to hesitance in adopting AI solutions due to perceived high acquisi-

tion costs and ongoing expenses. Many companies express concerns about their technical capabilities to independently implement and manage AI systems, contributing to a lack of confidence in venturing into AI initiatives.

Moreover, the perception of AI as prohibitively expensive and untested within their industry further deters companies from investing in AI solutions. The uncertainty surrounding the profitability of such investments, coupled with apprehensions about accommodating the necessary knowledge and skill requirements, creates significant barriers to adoption. Additionally, concerns about hidden costs, such as licensing fees, add to the reluctance to embrace AI technologies.

Employee apprehensions, including fear of technological unfamiliarity and a perceived generation gap in AI proficiency, also contribute to resistance to AI adoption. Recognizing the potential benefits of AI and assessing its reliability remain serious challenges for companies. One Czech expert mentioned: *AI could be of use to us, but we had no subcontractors, and when we found one, the acquisition costs were high, and the whole project would not be profitable*. Also, there are problems with customized production firms: *AI is impractical in customized orders. In mass production, we have indications of AI, but the obstacle is the high purchase price of introducing the technology*.

Successful implementation of AI requires robust strategies and adequate financial resources to support its long-term evolution within organizations. For example, Gartner & Turner (2022) outlines four essential actions for achieving financial AI success: hiring external AI talent, transitioning beyond the pilot phase of AI tool implementation, appointing data-savvy AI leaders, and investing in AI-enabled technologies. These actions are critical for companies to navigate the complexities of AI adoption and capitalize on its transformative potential effectively.

4.5. Additional findings

Two activities were identified as part of an ideal AI implementation process: (1) Openness and support. Ventures must be ready to know that ... *AI is not software that would run on anything* (AT expert). Companies should be upfront in adjusting their processes. AI must be fully integrated into financial reporting. *The ideal AI implementation process is a coherent project in which people involved in AI are nominated* (AT expert). (2) Planning. The price-performance ratio was identified as a critical factor for successful AI implementation. A reliable and detail-oriented feasibility study with demo simulations available before-

hand is crucial for assessing whether AI will benefit the firm. Ventures expect detailed process analysis and close cooperation during implementation (including addressing software bugs and fine-tuning). Close cooperation of owners and stakeholders and a high level of mutual support are mentioned at almost all stages of analysis.

Specific activities to increase the inclusion and use of AI mentioned by experts represent an extension of the following: (1) Best practices and examples. As identified in other parts of the interviews, ventures found inspiration from examples of good practice to be most important. Experts positively evaluated examples of potential overlaps of particular AI solutions. The role of positive promotion and support from the South Bohemian Science and Technology Park in intensifying AI adoption was explored. The shortage of public discussion and sharing of expert knowledge through roundtables is persistent. (2) Education programs. All ventures in the sample emphasized the crucial need for information in the press, more education programs, technical information, and expert training. *Training, training, training* (CZ expert). (3) Funding. Surprisingly, funding is not mentioned as the primary concern. Companies primarily identify a lack of subsidies and quality subcontractors in the region.

Moreover, the following drivers were identified for successful AI implementation and integration: (1) Integration. Successful AI implementation must lead to cost reduction, optimization of manufacturing processes, and increased production. (2) HR savings. Ventures expect monetary savings by eliminating errors caused by human labor. Additionally, AI is expected to replace human resources, replace repetitive work, and enhance savings in human labor. (3) Reliability. Ventures expect better functionality of the system after AI implementation. *A good technology should eliminate errors and save personnel costs so that the relevant people could be engaged in other activities* (AT expert). AI is perceived as producing superior products with hi-tech quality and a low level of A&D.

AI value drivers for companies are identified particularly in microeconomic and management consequences and circumstances: (1) Cost efficiency. … *the greatest value is financial savings. Lower costs, reduction in production time, making production more effective* (CZ expert). … *the highest values of AI for companies are saving money, increasing efficiency, simplifying processes, automation, and profitability* (AT expert). *Minimization of production losses, 24/7 control (as different from the worker), elimination of human error* (AT expert). Only one company identified the value driven by AI on the purchasing side, not the production side. (3) Process control. The most influential value

drivers identified were process simplification and increasing efficiency, including eliminating production losses by human error and 24/7 control. (4) Reliability. Firms predominantly expect higher functionality and reliability from AI implementation compared to human labor. (5) Competitiveness. … *the highest value of AI lies in the increase of our competitiveness. Our products are smaller and faster, we manage more hourly cycles, our efficiency grows, and our products need fewer workers to operate them* (AT expert). *The company's prestige in the eyes of jobseekers would grow* (AT expert). (6) Autonomy. Ventures expect an autonomous system with linear functioning, which brings them competitive advantages compared to competitors offering sequential and thus delayed delivery (supply).

As in any system, issues appeared. In the analyzed sample, two cases were identified: (1) Process control. Ventures reported a loss of control if the AI does not identify a problem when it occurs. Then, the error in production remains unspecified. (2) Integration. *Poor integration takes no account of the environment of the given company and its specific needs and processes* (CZ expert).

5. Discussion

We can find similarities between our findings and existing literature. Similarly to Bérubé et al. (2021) and Brennan & Kirby (2022), the lack of trust is identified as a significant barrier, with concerns over AI's reliability, transparency, and potential legal ramifications. Our research confirms that a knowledge gap exists, as noted by Ullah et al. (2021) and Bérubé et al. (2021), with SMEs struggling to understand AI technologies, applications, and market offerings. Moreover, infrastructure issues are echoed in the study, similar to findings by Ghobakhloo and Ching (2019) and Nguyen et al. (2022), noting inadequate computing resources and insufficient support for AI implementation. The study also highlights the shortage of skilled AI professionals, widely acknowledged as a critical barrier, as noted by Drmac (2022) and Alsheiabni et al. (2019).

The main differences with the existing literature focus on SMEs in Central Europe, particularly the Czech Republic and Austria. Much existing research centers on technologically advanced regions like North America, Western Europe, and East Asia. Moreover, the study highlights a lack of guidance and support from public institutions as a significant barrier, indicating a need for better regional public policy and support frameworks. We also noted a discrepancy with the high costs of AI implementation identified in the literature, which was mentioned by only one company in our study.

6. Conclusions

In conclusion, successful AI implementation in organizations requires a holistic approach that addresses internal and external barriers. In our research, we identified four main barriers: lack of trust, lack of knowledge, lack of infrastructure, and lack of resources. These findings address RQ1: What are SMEs' main barriers to the adoption of AI? Critical steps include strengthening organizational capabilities, enhancing individual competencies, securing top management support, and ensuring robust technical infrastructure. By addressing these challenges, organizations can better navigate the complexities of AI adoption and fully leverage its transformative potential. In addition, effective AI implementation can be hindered by poor data quality and inadequate data management practices. Some experts mentioned that SMEs may struggle to scale AI solutions effectively once they move beyond pilot projects. Also, difficulty in finding and establishing partnerships with AI solution providers and other organizations hampers progress. Lastly, resistance from employees accustomed to traditional ways of working can slow down AI adoption.

Despite the high costs associated with AI, funding was not always the top concern for SMEs. Instead, they often prioritized practical support, such as access to technical expertise and real-world examples. SMEs recognized that while financial resources are crucial, providing practical, hands-on support and real-world demonstrations can sometimes be even more effective in encouraging AI adoption. This indicates that practical support mechanisms should accompany funding programs. Finally, it was also interesting to find that there are no differences in the perception of barriers to implementing AI between CZ and AT companies (SMEs).

The uniqueness of this study lies in its focus on the challenges faced by SMEs in Central Europe, a relatively under-researched area in the context of AI adoption. It provides specific insights into regional barriers, such as the lack of local technical universities and the migration of technical talent abroad.

For practitioners, the knowledge gap in SMEs can be addressed by increasing AI literacy through training programs, workshops, and collaborations with educational institutions. Also, investing in modern infrastructure and seeking partnerships with tech firms can mitigate infrastructure challenges.

The barriers and challenges SMEs face in adopting AI technologies often differ from those encountered by large organizations due to resource variations, organizational structures, and strategic priorities. SMEs are more sensitive to

unexpected costs such as licensing fees and ongoing maintenance. Larger organizations often have dedicated innovation or R&D budgets specifically for technology adoption. SMEs lack in-house expertise and have difficulty attracting and retaining skilled AI professionals. Larger organizations are more likely to attract top talent due to their brand reputation and higher salaries. Also, they often foster a culture of innovation that is more conducive to AI adoption.

All research has limitations, and it is essential to acknowledge them. The relatively small number of experts (N = 22) involved in this study means that the results lack statistical significance and should be considered as reflecting only a portion of the broader AI landscape. This is particularly pertinent given that the interviewed experts did not represent all industries where AI is being developed. Additionally, the research was conducted exclusively in Austria and the Czech Republic, which may further constrain the findings. While the qualitative approach offers in-depth insights, it may not effectively quantify the barriers' extent or impact. Nonetheless, these limitations do not diminish the overall value of this research.

Future research can build on the findings of this study, providing a more comprehensive understanding of the barriers to AI adoption in SMEs and facilitating the development of effective strategies to overcome these challenges. For example, studies can expand the geographic scope to conduct similar research in other regions to compare barriers across different geographic and economic contexts. Moreover, it would be helpful to complement qualitative findings with quantitative research to measure the prevalence and impact of identified barriers. Longitudinal studies could track changes in barriers and the effectiveness of interventions over time. Additionally, exploring AI adoption barriers in specific sectors within SMEs to identify unique challenges and tailored solutions and investigating the role of public policy and governmental support in AI adoption could provide recommendations for policy enhancements.

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