Risks and Benefits of Artificial Intelligence in Small-and-Medium Sized Enterprises

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Abstract

Artificial Intelligence (AI) is developing fast. The set of AI, Machine Learning and large-scale data analysis, often referred to as Big Data, are having an ever-increasing impact on our future lives and businesses. Rapid enhancement produces the technologies more accessible and applicable to SMEs, the backbone of German industry. However, AI is rarely used by SMEs in the northern Rhineland-Palatinate. This paper reviews perceived risks and benefits of AI by decision-makers of SME and compares them with the result of an assessment among leading researchers in this field. Results show that an information gap exisits. The opinion of researchers on risks is largely in line with those of the companies that intensively deal with AI. For the majority of SMEs, however, a clear difference shows in the results.

Keywords
Artificial Intelligence, Application in SME, Future Research

1. Introduction

1.1 Background of the Study

Digitalization has become a necessity for small and medium-sized enterprises (SMEs). Its transformation must be actively shaped and represents another source of vast opportunities for future growth and competiveness (Pelletier & Cloutier, 2019; Fersht, et al., 2018). The digital transformation of society and economy now is in full swing providing disruptive potential for value creation (Skog, et al., 2012) and jeopardizing those not participating in the transformation (Evans, 2017; Pelletier & Cloutier, 2019). However, SMEs are still making less use of the transformation's numerous chances to develop at different levels, than average (Zimmermann, 2016). This gap is also evident for one of the main technology drivers of the transformation. Several statistics and national studies stress an SMEs gap in implementing AI.
Innovative technologies such as artificial intelligence (AI) create new opportunities and solutions where humans and systems have reached their limits (Wangler & Botthof, 2019). Comprehensive data streams, which arise through an intelligent merging of IT-system and the use of cyber-physical systems (CPS), can only be systematically evaluated with the use of AI. Measures and decisions are not only proposed based on data, but are also used to directly control devices and processes, taking Industry 4.0 to the next level (Veit, et al., 2017; Duan, et al., 2019). The methods of learning in deep layers from artificial neurons give a wide range of use cases, fundamentally transforming society and economy (Makridakis, 2017).

1.2 Rationale and Scope of the Study

SMEs are the engines of economic growth and employment in Germany. Thus, SMEs are in the limelight of the government's and European economic policy. The northern Rhineland-Palatinate with approximately 1.4 million inhabitants is particularly characterized by its broad SME landscape, primarily specializing in production, trade and the service sector. With 51,462 SMEs and a density of 41 SMEs per 1,000 inhabitants, it not just occupies a top position in Rhineland-Palatinate (see Figure 1), but is the SMEs employment growth champion of the entire nation (Schwartz & Gerstenberger, 2018). In addition to the urban agglomerations of Koblenz and Neuwied, the region is particularly characterized by rural areas, in which SMEs take on essential tasks in terms of employment, innovation, value creation and social responsibility (Reinemann, 2020).
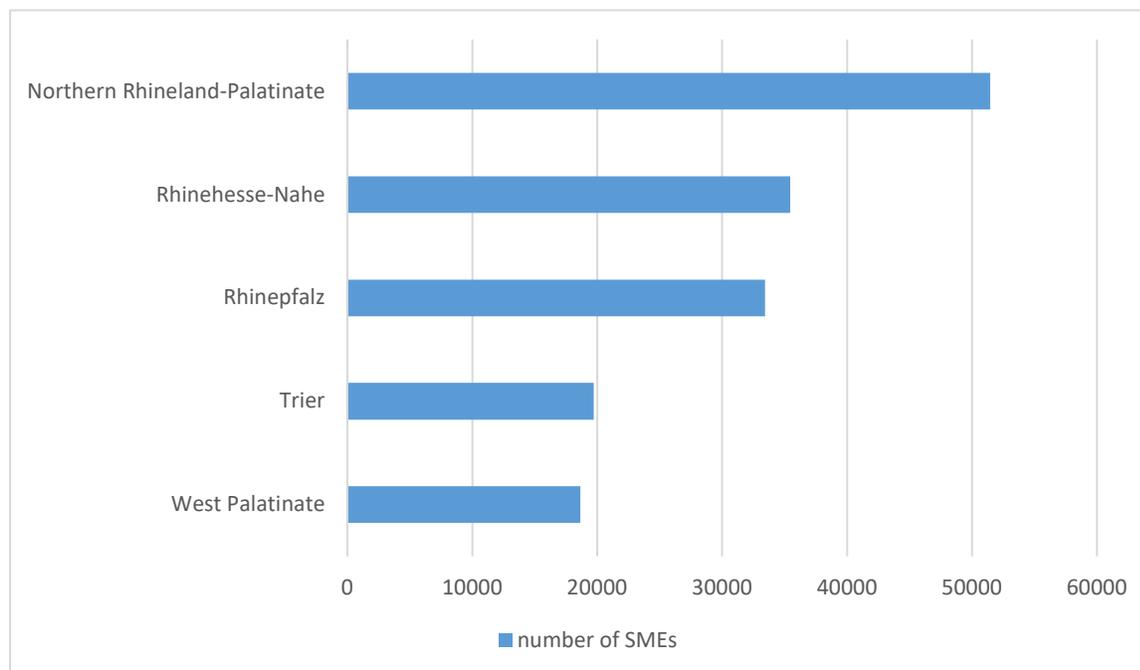

Figure 1 SME by planning region in Rhineland-Palatinate (Source: Statistisches Landesamt (2019))

A previous study showed that AI is rarely used by SMEs in this region. Less than 10 per cent already implemented an AI use case. However, about one third deal intensively with the topic of implementing AI, which signals a high perceived potential for this technology. On the other hand, the majority still hesitates, weighing pros and contras of AI implementation (Szedlak, et al., 2020). Therefore, the region is particular suitable to reveal SMEs decision-makers perceived chances, risks and challenges of AI. This allows comparing results against hypotheses derived from experts and scientist to identify dissenting views that must be addressed by additional measures to further increase the degree of dispersion of AI in SMEs. Figure 2 summaries the dispersion of AI implementation in SMEs in this region.
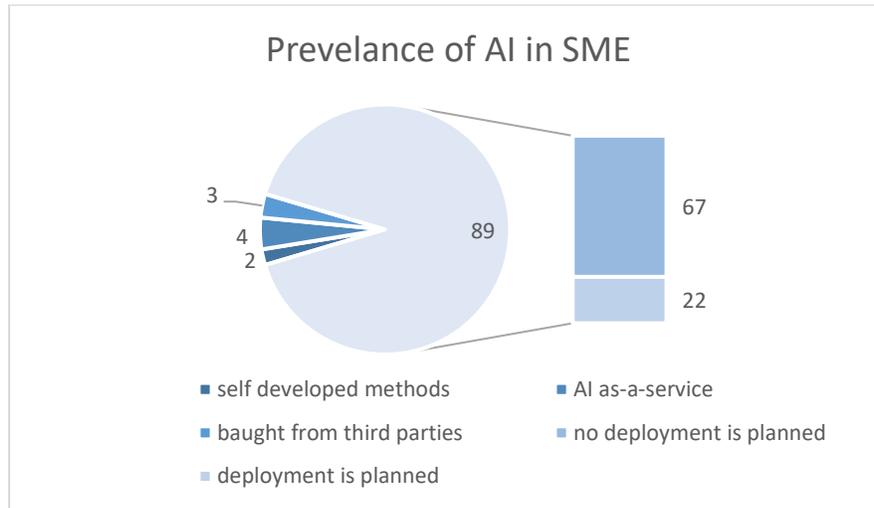

Figure 2 Type and prevalence of AI implementation in SMEs in northern Rhineland-Palatinate (Source: Szedlak, et. al. (2020))

1.3 Aim, Objectives and Value of the Study

Existing studies on AI either deal with experts statements or usually depict the statements of large corporations or companies specializing in AI. By interviewing decision-makers in SMEs about their perceived opportunities, risks and challenges of AI, a realistic image can be obtained, to reduce prejudices or barriers and to specifically spray knowledge in SMEs. The comparison with leading researchers' assessment of the current and future situation in SMEs reveals field of action in future research.

2. Methods

In order to address the research question, a web-based (online) survey was conducted between September and October 2019. Several benefits make web-based surveys popular among researchers. First, it allows for an easy and quick participation of a large target group (Israel, 2011). In addition, built-in features for data cleaning and a wide range of design tools improve respondents' survey-experience (Monroe & Admans, 2012). Low response rates are a downside of this research method (Rice, et al., 2017). Therefore four measures, with additive effects (Ballantyne, 2003), were taken to boost response rates (Monroe & Admans, 2012; Nulty, 2008):

1) Personalized serial emails were used to contact the sampled population.
2) Questionnaires are kept brief and potential participants were informed about the approximately time of completion, beforehand.
3) Anonymity of responses was assured to avoid any concerns of respondents.
4) A brief introduction into the research topic was given via mail and at the beginning of the survey to underline professionalism and to persuade respondents that their participation is of high value.

Individual delivery IDs were added to ensure that only invited people fill in the survey. The built in features of the platform SoSci survey handled access restriction and serial mails. Results of the online survey among SME decision makers are compared with results of an expert survey by the Scientific Institute for Infrastructure and Communication Services (WIK) from February 2019. 40 AI-experts from renowned research and transfer institutions took part in this survey. This is a well-founded assessment by subject matter experts who reflect the entrepreneurial challenges by selecting the appropriate experts at the interface between science and implementation.

The survey included questions looking for answers of a categorical nature, related to the status quo of AI usage. Corresponding questions split the sample and limited participation to SME decision-makers who are already dealing intensively with the topic or who have previously considered AI to be irrelevant for their company. In order to achieve comparability with existing expert assessments, the web-based questionnaire is based on the findings from previous expert studies. Ordinal data relating to perceived opportunities, risk, challenges and likelihood of future applications were collected. Likert scales are used for direct estimation, allowing respondents to express an opinion on a series of statements related to the hypotheses derived from the expert study. To answer these question a profound knowledge of the status quo and a qualified assessment of the company's future was required. Thus, the distribution lists of various regional associations and institutions were filtered to only contact people who held a corresponding position that allows for access to relevant information. A total of 357 representatives of SMEs in the northern Rhineland-Palatinate were contacted.

3. Results

98 participants met the conditions of participation and fully completed the survey. This results in an overall response rate of 27.4 per cent. The number of enrolled responses breaks down by industry as depicted in Figure 3. The majority of the participants assign themselves to the following sectors: Manufacturing, IT and Service Industry.
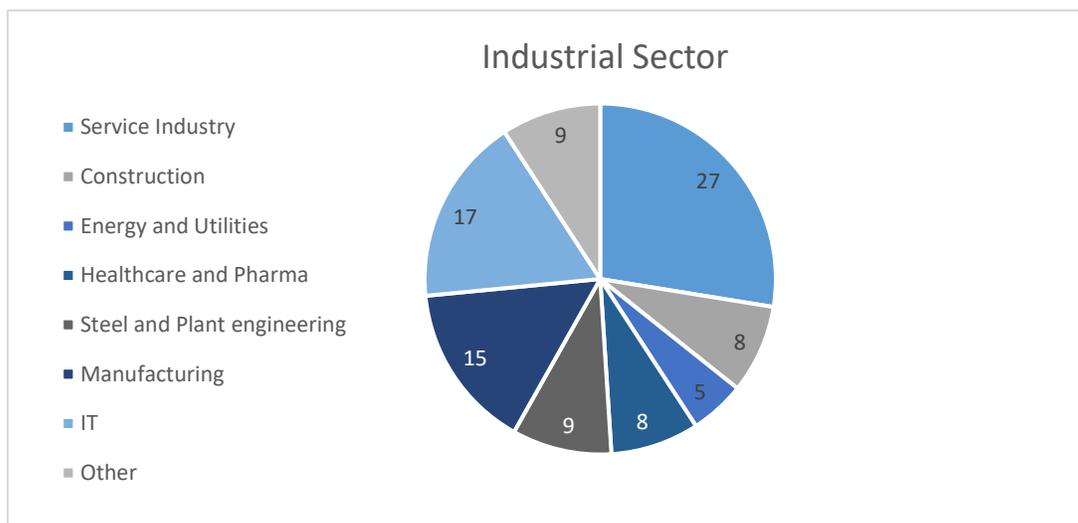

Figure 3 Absolut numbers of respondents by industry

77% of the experts from research organization consider AI not only to be hype but also important for the future of German SMEs. 70% of the experts go a step further and say that AI is crucial for the international competitiveness of German SMEs. A similar picture emerges among company representatives. However, Figure 4 also shows that, despite its great importance for the entire SME sector, very few see their own company affected to the same extent. Only one out of four SME representatives believe that AI is important for the future of their company. Just 11 per cent see a risk to their own competitiveness, if they don't jump on the AI bandwagon.
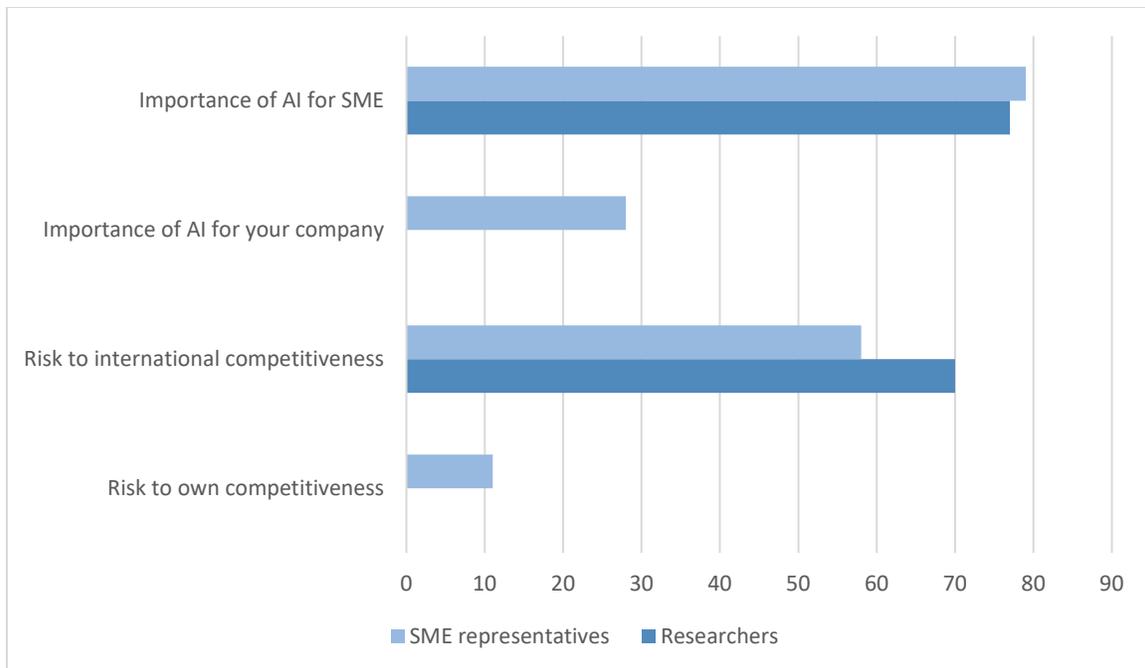
Figure 4 Relevance of AI for German SME

A clear difference between experts from industry and research organisations already emerges, looking at the results in relation to the most suitable areas of the company for the use of AI. While researchers consider almost all areas to be suitable or very suitable, more than half of the industry representatives only consider production, customer service and logistics to be highly relevant. A large difference in logistics and R&D is observed. Logistics, in particular, is seen as the most promising area by the researchers (97%). However, the reality in SMEs is different. Only half consider logistics to be a relevant area of application. A similar strong deviation shows for R&D. While 2 out of 3 researchers see a particular suitability for the use of AI, only one in five SME representatives share this opinion. On the other hand, there is consensus that AI is particularly relevant for production. Over 85 per cent of respondents, in both studies, consider production to benefit from AI applications. Further it can be stated, that the majority of respondents belief that Customer Service (69 per cent of SME representatives, Difference to researchers: -8%) gain from AI applications. On the other hand, most SME representatives reject the use of AI in accounting and human resource. Here many processes can be digitalized, though. However, for SMEs deterministic algorithms are often sufficient. Researchers share this view.

It must be stated, that IT shows highly diverging results. One third of respondents strongly disagreed when asked if AI should be deployed in their IT department. In contrast almost the same amount of participant strongly agreed to the application of AI in IT. Experts from research organization can be predominantly assigned to the latter group. 67 per cent think that the implementation of AI is highly relevant in IT departments. There is a difference of 40 percentage points, though. Figure 5 highlights the differences between experts from SMEs and research institutes in relation to the relevance of AI application for different business areas.
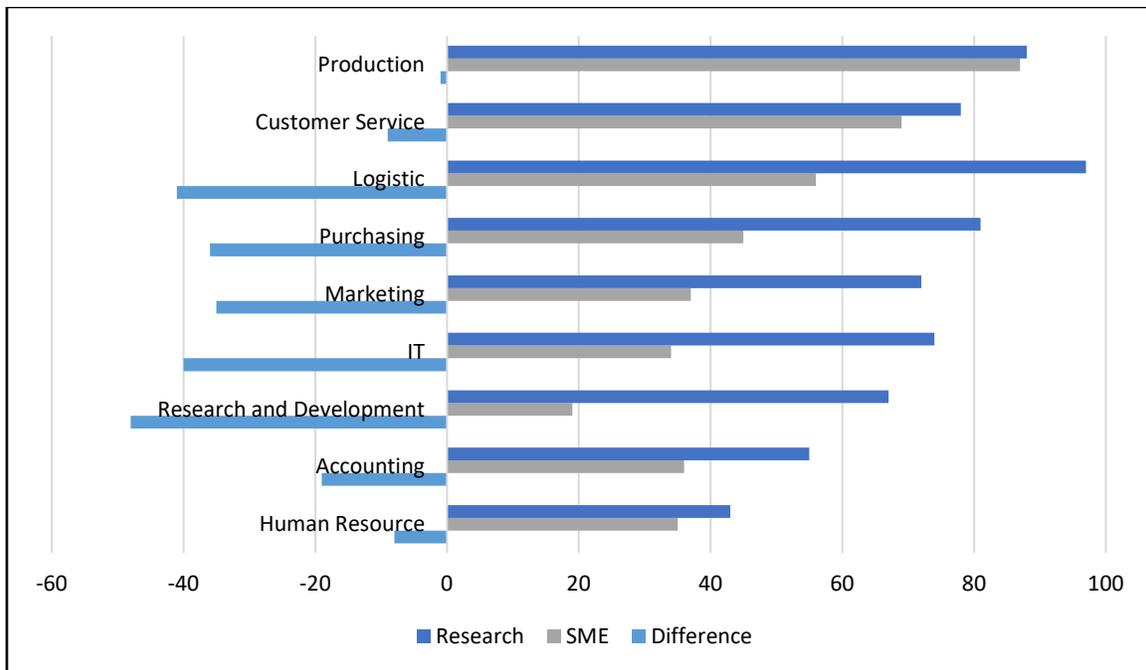
Figure 5 Relevance of AI application for different business areas

The survey results show that company representatives see the greatest opportunities through AI in the development of new products and in increased process efficiency. In particular, the chances to improve customer relationships are put in the foreground. In both case, 77 per cent assume that AI has high potential to improve customer service and for more targeted and target-oriented advertising. This coincides with the researchers assessment. However, the scientist put the focus on optimizing the entire value chain. It is noticeable that these aspects include areas from production as well as from sales and logistics. Thus, AI's potential is across the entire value chain. SME representatives have a clear focus on production, though (Figure 5).

Comparing the results emphasize that the AI experts from research see little chance of reducing staff costs. On the other hand, company representatives see this as a very high incentive. Nearly two-third believe that staff costs can be reduced through AI. Further higher quality of work fades from the spot light. Overall Figure 6 stresses that SME representatives see the chances of AI mainly in optimized processes and product innovation. Only half see the chances to develop new business models. In addition, there are considerable differences in terms of optimized pricing (16 per cent difference) and the chances to acquire new markets (21 per cent).
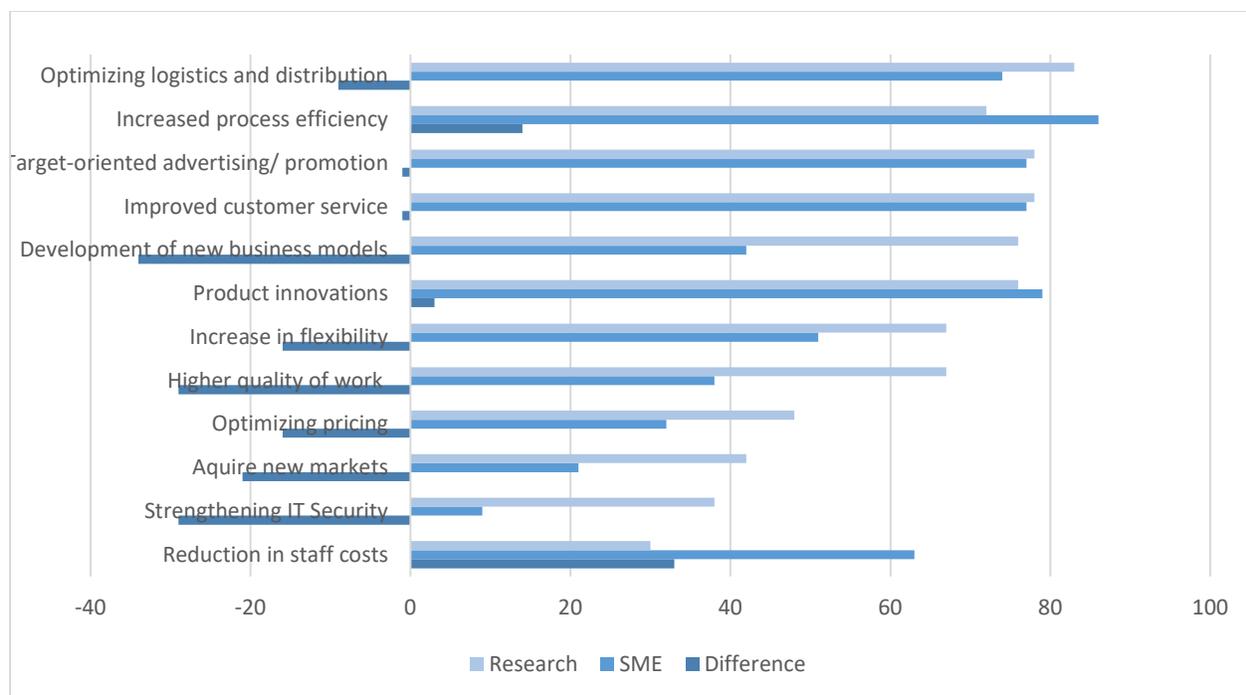
Figure 6 The chances of using AI in Small and Medium-Sized Enterprises

Respondents from both studies agree that the lack of know-how is the main barrier. 76 per cent of SME representatives evaluate this barrier as very strong. The percentage of scientist who share this view is slightly lower. Overall researchers tend to put technical issues, like insufficient data basis (37 per cent), data security concerns (30), the trustworthiness of the output (22) or a lack of market maturity (19) in the foreground. SME representatives, on the other hand, see the problem at an earlier stage. 42 per cent argue that the current level of digital maturity requires other field of actions than AI. One out of three believe that an insufficient digital infrastructure is a very strong barrier. For the interviewed SME representatives, however, the most important barrier beside the lack of knowledge is the financial resources. This is where the greatest deviation from the researchers can be observed (36 per cent). Figure 7 illustrates the deviation of the scientist and SME representative on the barriers of AI usage in SME.
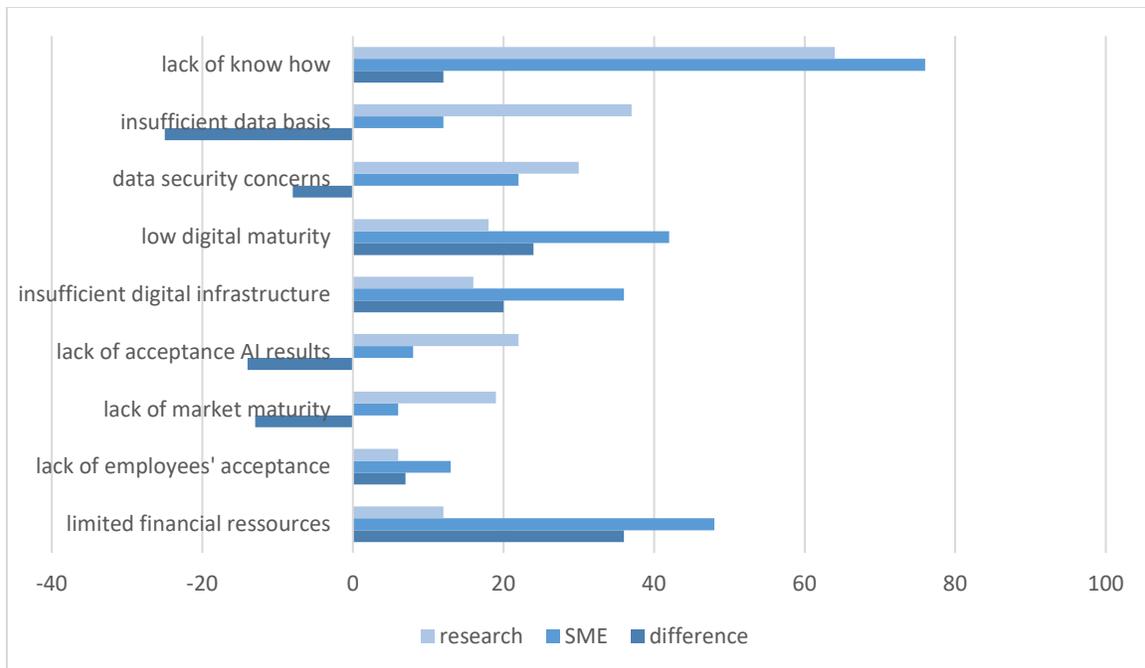
Figure 7 Assessment of barriers of AI usage in Small and Medium-Sized Enterprises

Results differ with regard to the current implementation status. While the lack of data is a main reason for further implementations for pioneers, procrastinators and deniers tend to a lack of know-how. Almost all deniers shy away from an introduction due to a lack of know-how or because of deterrent costs. The more companies deal with AI and the more concrete their implementation plans become, the less they see a lack of market maturity of existing technologies and the costs a barrier. Instead, awareness of a missing or insufficient database continues to grow. Figure 8 illustrates the top 5 most frequently mentioned barriers in relation to the current implementation status. SMEs are divided into three groups: Pioneers, Procrastinators, and Deniers. Pioneers are among the first SMEs in this region to deploy AI, while procrastinators are not there yet, but actively plan to deploy there first AI application within the next two years. A total of 31 companies deal intensively with the use of AI.
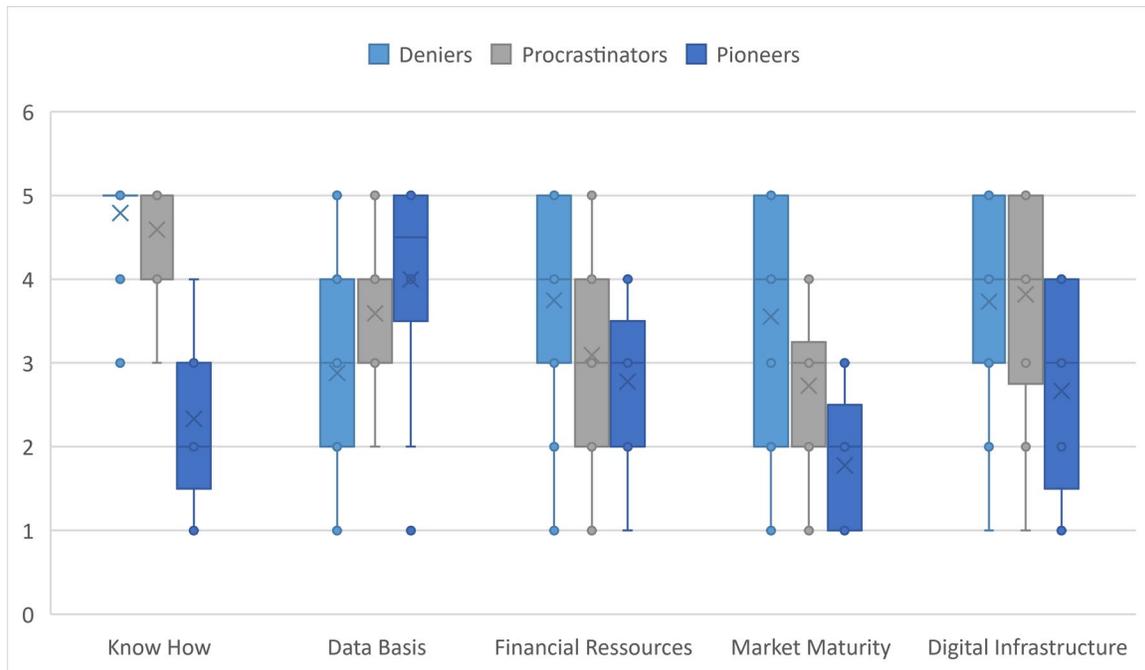
Figure 8 Barriers to progress of AI in SMEs

5. Recommendations and Conclusion

SME often do not have sufficient financial and human resources to competently evaluate and apply the possibilities of AI applications for their purposes. A large variety of consulting services address technical issues of AI implementation. Nevertheless, there remains a gap: On the one hand, companies and their employees usually find it difficult to identify meaningful AI applications for added value, to evaluate them strategically and to use them productively. On the other hand, there is often a lack of clarity about how work with AI can be designed in a humane manner and what options exist to involve employees in the introduction and use of the technology.

It is also noticeable that SME tend to view the chances and potential areas of application as less strong or relevant than the experts from research. In the case of barriers, the difference tends to be in the other direction. SME representatives tend to see barriers as more problematic. Even if the results differ according to the current implementation status in the companies, a comprehensive improvement can only be achieved when covering the needs of all SMEs by the research and transfer efforts of the technical experts. Due to the low prevalence of AI in Northern Rhineland-Palatinate to date, the needs of deniers and procrastinators in particular have to be taken into. These do often not know about the application possibilities, chances and technical requirements of AI. Consequently the existing information gap must be addressed. However, results from the researchers assessment highlight that researchers are more likely to think about the implementation gap when assessing the opportunities and risks of AI for SMEs. To date, this results in the limitation of successful transfer efforts in the northern Rhineland- Palatinate.

So far, AI has hardly been associated with strategic aspects by the SMEs. The possibility to develop new business and price models or to acquire new markets play a subordinate role for SME. Among other things, a parallel to other digitization efforts shows. Accordingly, information and transfer efforts, specially designed for beginners, are required that create an understanding of the potential and applications of AI. Technology-heavy information offers related to individual use cases ensure that a false image of AI is created among the wide majority. This also shows in the expectation of SMEs to massively reduce human resource costs by implementing AI. Following the daily tabloid reports about scenarios of the imminent substitution of humans by machines, this may not come as a surprise. However, the results of the survey do not reflect that AI solutions rarely replace entire workplaces, but only certain tasks at the workplace, so that people can focus on the tasks in which they are strong and have a comparative advantage over machines. The possibility of increasing workplace quality and of preparing and supporting decision-making remains almost unaddressed. The imparting of competencies for holistic work and organizational design in SME must

be at the centre of a systematic additional AI qualification program. The concept must address qualified actors with the aim of achieving a qualification for preventive and productive action in the AI-related operational change process. This additional AI qualification must be based on the existing domain knowledge of the target groups and supplement it with AI-related competencies. Domain knowledge, in this context, refers to the existing competencies and knowledge that the target groups bring from their professional activities. In addition to specialists, the target group must include managers, employees and works councils of SMEs, as well as consultants in order to enable them to realistically assess AI applications and to enable AI use that is equally profitable for companies and employees. Only if the topic of AI is demystified for the majority of regional SME, the prevalence can be drastically increased, supported by the already existing consulting and funding.

Against the background of a highly heterogeneous SME structure in northern Rhineland-Palatinate, the results of the study should be viewed critically. However, it is evident that the experts' assessment only corresponds to the answers given by those SME representatives who are already intensively involved with the topic of AI. In order to achieve the goal of comprehensive AI implementation in medium-sized companies, however, research and transfer efforts have to shift significantly towards the needs of SME that know little about AI, its use cases, risks and chances.

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