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PROJECT REPORTS

The SME AI Experience Center: Overcoming AI Adoption Barriers for SMEs in Industrial Production

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Abstract
The development of tools based on Artificial Intelligence (AI) provides significant potential to enhance industrial production, but many small and medium-sized enterprises (SMEs) in more rural areas, such as the study area Upper Franconia in Germany, encounter difficulties in implementing them due to limited resources and expertise. The SME AI Experience Center at the Cleantech Innovation Park offers practical support for AI integration through interactive workshops and a production plant simulating manufacturing processes. It showcases possibilities for the digital transformation by using different types of sensors and the potential of applying machine learning for tasks such as intelligent supply chains, predictive maintenance and quality control. The particular focus is on AI for sustainability. Furthermore, SME managers and workers will be aware that most AI technologies do not result in fully autonomous systems that replace the human workforce but that AI tools often rely on human-AI collaboration.

Keywords SME · Experience of AI · AI in manufacturing · AI training · AI adoption

1 Introduction

Artificial Intelligence (AI), in particular, data-driven machine learning (ML)| approaches offer numerous opportunities for industrial production to make processes more effective, efficient and sustainable [1]. For example, predictive maintenance can schedule maintenance before a potential breakdown; linking production data with quality control can help to identify systematic causes of quality fluctuations; optimising logistics chains can improve efficiency and support the idea of a circular economy [2]. Digital transformation and AI methods present SMEs with significant challenges [3]. One of the most frequently cited obstacles for implementing AI are a lack of resources of expertise (72%), incompatibility with existing devices, software and systems (54%) and challenges with the availability or quality of data (53%) [4, 5]. At the same time, companies need to comply with the requirements of the EU AI Act - the first legal regulation for AI worldwide. For many traditional SMEs, there is a corresponding need to learn innovative concepts of data-driven manufacturing and examine comprehensible, interactive, transparent and robust intelligent technologies in compliance with legal requirements.

Many AI training courses are on the market, but they mainly focus on generative AI and are geared towards

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marketing and administration. Larger and numerous smaller automotive suppliers characterise the region of the study area Upper Franconia in Germany, which can be found in the domains of mechanical engineering (20.9% of employees in the region), plastics/rubber (12.2%), metal products (8.2%), electronics/optics (11.3%), glass/ceramics (7.9%) and automotive parts (6.6%) [6]. More offers need to be specifically tailored to the manufacturing industry.

2 Purpose of the SME AI Experience Center

In response to this challenge, a university transfer project establishes the SME AI Experience Center to support regional companies in their digital transformation and in the application of AI approaches. The project aims to foster trust in AI-supported manufacturing processes and to alleviate concerns that AI might replace employees.

This goal requires interdisciplinary cooperation in Computer Science, Psychology and Education. The SME AI Experience Center provides an interactive and educational environment for industrial production employees to gain AI experience and offers a variety of hands-on workshops. There is the opportunity to test specific applications and to explore human-robot collaboration during assembly in a prototypical production line. The preparation of the teaching and learning material about AI knowledge and the interactive learning environment support the attractiveness of the subject matter.

3 Interdisciplinary Approach to Raise Awareness of AI-Enabled Manufacturing Among SMEs

For successful sensitisation about current AI solutions for manufacturing, it is worth looking beyond a purely technological perspective. Collaboration between the Chairs[1] of Cognitive Systems (expert-guided identification and description of AI concepts and methods), Human Factors (psychology-guided design of interactive teaching material) and Adult Education (educational-guided development of learner-oriented awareness trainings) lead to the development of targeted offers. The SME AI Experience Center demonstrates the potential of AI applications in a prototypical production plant. The following section introduces the demonstrator facility and outlines the interdisciplinary approach. (see also Fig. 1).

3.1 Demonstrator

The production plant designed by Albert & Hummel GmbH[2] demonstrates the assembly process of a Lego car, see Fig. 2. The aim is to familiarise SMEs with industrial

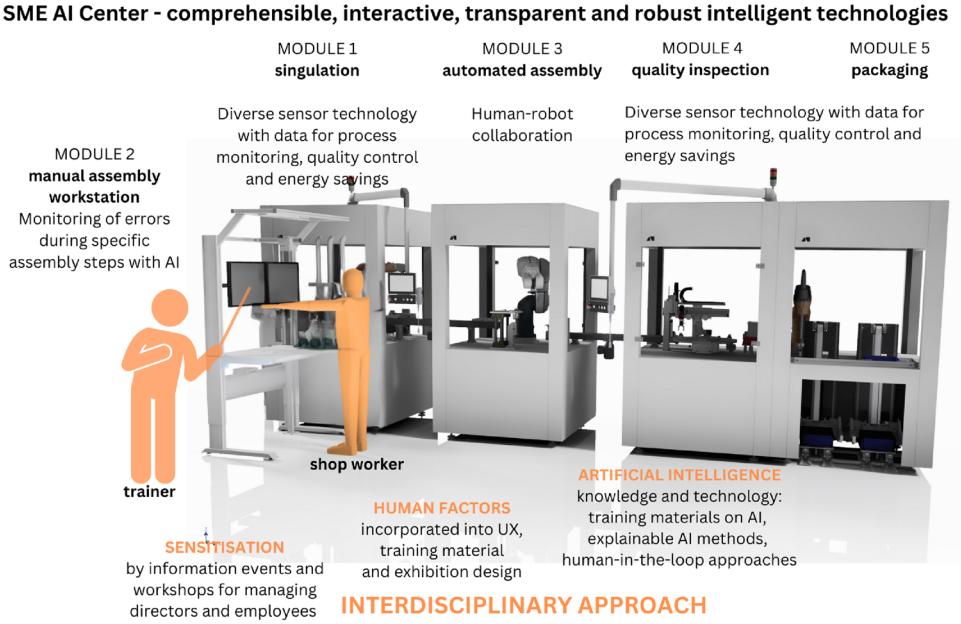

Fig. 1 SME AI Experience Center Concept

[1] Chairs are academic departments within a university. In this study, the Chairs are from the University of Bamberg, which is located in the study area.

[2] Albert & Hummel GmbH is a medium-sized company, specialising in the construction of custom machines, automation solutions, and control technology.

Fig. 2 Fully assembled Lego car

automation and AI methods. The choice of Lego bricks as a playful application example is based on the fact that simple, unspecified assembly processes seem particularly suitable for offering transfer possibilities to various industrial processes in the automotive sector. The production plant consists of five modules:

1. **Singulation:** The components are separated and prepared for assembly. The module showcases two types of singulation. The Lego bricks are first separated as bulk material using an automated 2D feed system and are further divided by a 3D vision-based system.
2. **Manual assembly:** A human worker manually assembles the lower part of the vehicle. A camera-based AI inspection distinguishes between correctly and incorrectly assembled parts.
3. **(Semi-) Automated assembly:** This module supports both automatic and semi-automatic assembly for the upper part of the car with a collaborative robot (cobot).
4. **Quality inspection:** This station demonstrates the end-of-line quality assurance of the Lego car by a camera-based and a weight-based inspection.
5. **Packaging:** Finally, the finished product is packed.

To demonstrate affordable sensor technologies and to obtain data about the production process, various sensors are installed in the modules. Different machine learning applications can use the data of the sensors, e.g., measuring air and power consumption for predictive maintenance, using digital meters at every station to help build an intelligent supply chain, or measuring the force per assembly step to provide potential explanations for root cause analysis.

3.2 Expert-Guided Identification and Description of AI Concepts and Methods

Gaining initial experience with AI applications by interacting with the relevant technologies in manufacturing is essential. The production plant uses sensors for data recording. The data can be inspected and analysed for specific use cases, such as root cause analysis, see for example, [7]. To ensure that SMEs understand AI-driven processes, the authors provide basic knowledge of the underlying concepts and methods.

Furthermore, the SME AI Experience Center showcases a human-centred AI approach. The Cognitive Systems Group demonstrates an explainable machine learning approach, the near misses and hits algorithm [8], for understanding the decision boundary of image-based classification of anomalies in welds and auditory classification of defects in industrial machines. The method can be used for an explain to revise approach [9].

3.3 Psychology-Guided Design of Interactive Teaching Material

By embedding cognitive and affective psychological aspects into its design, the SME AI Experience Center aims to enhance the trust of SME employees in AI technologies

The development of AI-focused educational materials, combined with an interactive learning environment, enhances the subject's appeal to learners. Visualisations and engaging teaching materials communicate the topic clearly and vividly. As we know from previous research, visualisations lead to greater confidence and understanding [10, 11]. We pursue an emphatically museum-educational approach to increase immersion in the subject area, intensify the learning experience and thus make the content memorable and applicable in the long term [12].

3.4 Educational-Guided Developement of Learner Oriented Awareness Trainings

While the current discourse on AI in SMEs focuses primarily on the potential of AI and the factors that determine competitiveness [13, 14], there is a lack of empirical studies on the actual use of AI in SMEs [15, 16]. According to the primarily quantitative studies, SMEs need to be more open about AI applications [17, 18]. In order to meet the different requirements for using AI methods in SMEs, the project empirically identifies needs and develops special offers. A qualitative needs analysis collects through interviews experiences, reservations, and preferences related to dealing with AI. Based on the results, favourable conditions for the didactic design are derived and learner-oriented awareness trainings are developed. Furthermore, information events sensitise SMEs to the role of AI in companies.

The project objectives address different disciplinary perspectives, conveying a holistic educational concept through close interdisciplinary cooperation. The Cognitive Systems group contributes AI expertise that integrates design methods from Psychology with learning concepts from Adult Education. The following section describes the implemented measures in detail.

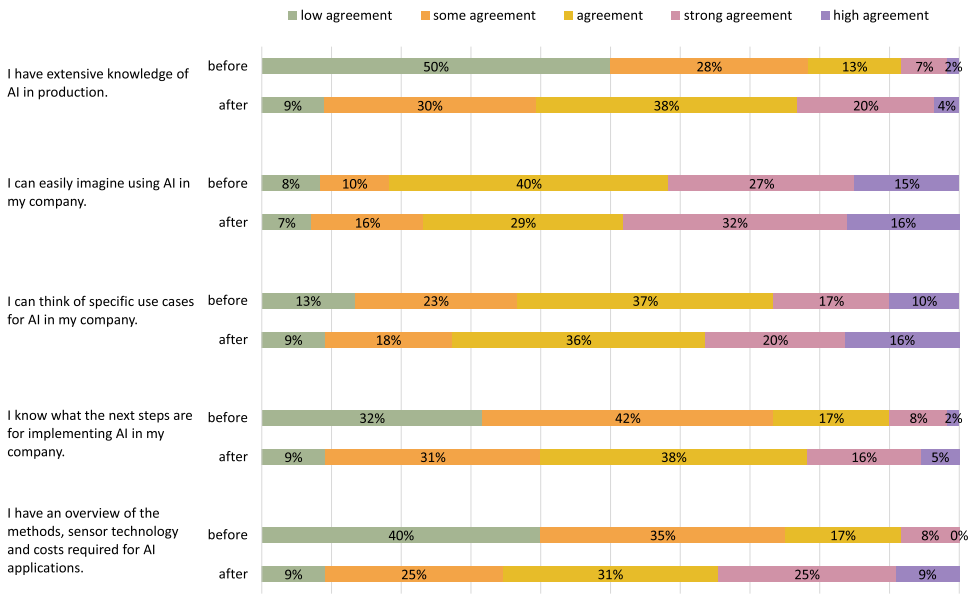

Fig. 3 Evaluation results from the SME AI workshops with n=60

4 Measures and Achievements

A regular roundtable with company representatives and entrepreneurs provides a platform for participants to share their perspectives on the SME AI Experience Center project and to discuss needs with industry stakeholders. In addition, telephone interviews with stakeholders from regional companies were conducted to gain insights into the actual use of AI methods. The needs analysis shows that AI is rarely used in manufacturing. A lack of resources (time, personnel, money) and hurdles in data management and data analysis were identified as the main barriers.

Therefore, the focus is on low-threshold, experience-based workshops where employees learn about digitisation and AI-supported production. The installed plant allows SMEs to experience AI-supported manufacturing first-hand. Various sensors enable data collection and analysis during the production. Module 2 demonstrates how AI-guided instructions and correction can assist shop floor workers during assembly. Module 3 presents human-robot collaboration. Human-in-the-loop methods, such as the near-miss and near-hit approach, ensure that AI does not diminish employees' skills, instead human expertise enhances and nurtures AI models, and, in addition, makes them more robust. Providing factsheets on AI concepts and possible manufacturing use cases, along with an interactive learning environment within an educational museum exhibition, enables SME employees to pursue in-depth training courses. The workshops convey a basic understanding of machine learning methods' functions and limitations. These workshops are evaluated qualitatively using questions based on the criteria of knowledge growth and content relevance. Figure 3 presents the results of this qualitative evaluation. The before-and-after questionnaire indicates the successful knowledge gain of the workshop participants.

The SME AI Experience Center engages its target group through various events, ranging from informative conferences, like the Upper Franconian AI Symposium (Oberfränkische Fachtagung KI) and the 'AI in Production' workshop held at the 47th and 48th German Conference on Artificial Intelligence, to more informal, low-threshold exchanges about AI, such as panel discussions at a local business network or casual discussions over a beer at the pub. Organising and participating in networking events, such as the Cleantech Innovation Summit - an annual event firmly established in the study area - helps to increase the visibility of the SME AI Experience Centre. Statements from industry partners demonstrate the practical relevance of the approach. *"This project has succeeded in creating 'hands-on AI', raising awareness among SMEs of its potential, and providing space for mutual exchange of practical experience."* (Thomas Keller, RIEGG & PARTNER intercorp. GmbH). The idea that the SME AI Experience Center initiates AI innovation in SMEs through collaboration is reflected in the following statement: *"I firmly believe in the power of the crowd - especially in manufacturing, where innovation cannot emerge in isolation. [...] This is precisely where the SME AI Experience Center comes in. By connecting SMEs, technology providers, researchers, and industry stakeholders across the entire region,*

it serves as a perfect example that the whole is greater than the sum of its parts." (Klaus Beetz, Teaching Factory Competence Center). Over the past two years, network and awareness-raising events engaged approximately 900 participants, while SME-specific and stakeholder-oriented sessions involved 20 to over 70 participants per event, depending on the format. The substantial number of participants reflects the project's growing visibility and impact.

5 Conclusion and Future Prospect

AI, and more especially data-driven machine learning methods offer significant opportunities for enhancing industrial production by making processes more efficient and sustainable. Despite its potential, SMEs face challenges in adopting these technologies due to limited resources and skills. To address these challenges, the SME AI Experience Center supports regional companies in their digital transformation. This initiative aims to build trust in AI-supported manufacturing and emphasises human-AI collaboration. The project involves practical workshops, familiarising employees with AI methods and provides learning material, with a focus on human-centred design to boost acceptance among SME employees. It also includes a production line to showcase AI applications in manufacturing. The interdisciplinary approach, combining Cognitive Systems, Human Factors, and Adult Education, aims to create a supportive environment for SMEs to explore AI applications in a museum-like format. The trainings are an important contribution towards making SMEs ready for the future. The project sets a foundation for long-term AI-driven innovation in manufacturing. The SME AI Experience Center aims to pave the way for a transition to AI-based sustainable manufacturing. The approach makes a valuable contribution to the study area. Furthermore, the concept can be applied to other industrial locations in Germany that are characterised by a high concentration of SMEs in the manufacturing sector.

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References

1. Schmid U, Bruckert S (2021) Künstliche Intelligenz in Unternehmen – Zielgruppenspezifische KI-Kompetenzen identifizieren und vermitteln. In: Ramin P (ed) Handbuch Digitale Kompetenz. Hanser Verlag, Munich, Germany
2. Wirth C, Schmid U, Voget S (2022) Humanzentrierte Künstliche Intelligenz: Erklärendes interaktives maschinelles Lernen für Effizienzsteigerung von Parametrieraufgaben. Digitalisierung Souverän Gestalten II: Handlungsspielräume in Digitalen Wertschöpfungsnetzwerken. Springer, Berlin Heidelberg, pp 80–92
3. Stowasser S, Suchy O, Huchler N, Müller N, Peissner M, Stich A, Vögel H, Werne J, Henkelmann T, Schindler T et al (2020) Einführung von KI-Systemen in Unternehmen. Gestaltungsansätze für das Change-Management, Whitepaper aus der Plattform Lernende Systeme, München
4. Martin Lundborg M-CP Künstliche Intelligenz im Mittelstand: Mit welchen Anwendungen sind kleine und mittlere Unternehmen heute schon erfolgreich? https://www.mittelstand-digital.de/MD/Redaktion/DE/Publikationen/ki-Studie-2023.pdf?__blob=publicationFile&v=4
5. Statistisches-Bundesamt: Nutzung von KI in Unternehmen. https://www-genesis.destatis.de/datenbank/online/statistic/52911/table/52911-0001. Accessed: 2025-02-27
6. IHK: Oberfranken in Zahlen. https://www.ihk.de/bayreuth/hauptnavigation/service/standort-oberfranken/statistische-daten-4299010. Accessed: 2024-10-21
7. Wehner C, Kertel M, Wewerka J (2023) Interactive and intelligent root cause analysis in manufacturing with causal Bayesian networks and knowledge graphs. In: 2023 IEEE 97th Vehicular Technology Conference (VTC2023-Spring), pp. 1–7. IEEE
8. Herchenbach M, Müller D, Scheele S, Schmid U (2022) Explaining image classifications with near misses, near hits and prototypes: Supporting domain experts in understanding decision boundaries. In: International Conference on Pattern Recognition and Artificial Intelligence, pp. 419–430. Springer
9. Finzel B, Knoblach J, Thaler A, Schmid U (2024) Near hit and near miss example explanations for model revision in binary image classification. In: International Conference on Intelligent Data Engineering and Automated Learning, pp. 260–271. Springer
10. Carusi A (2008) Scientific visualisations and aesthetic grounds for trust. Ethics Inf Technol 10:243–254
11. Moere AV, Purchase H (2011) On the role of design in information visualization. Inf Vis 10(4):356–371
12. Mayer RE (2005) Cognitive theory of multimedia learning. Cambridge Handbook Multimedia Learning 41(1):31–48

13. Mittelstand-Digital B (2019) Künstliche Intelligenz im Mittelstand: Relevanz, Anwendungen, Transfer. White paper, WIK GmbH
14. Fürst RA, Grottke M, Sibilio A, Steckelberg AV (2020) Internationale Standortbestimmung–vom Exportweltmeister zum digitalen Entwicklungsland? Digitale Bildung und Künstliche Intelligenz in Deutschland: Nachhaltige Wettbewerbsfähigkeit und Zukunftsagenda, 27–79
15. Merkel-Kiss M, Von Garrel J (2023) Systematische Literaturanalyse zum KI-Einsatz und KI-basierten Geschäftsmodellen in produzierenden kleinen und mittleren Unternehmen. Zeitschrift für Arbeitswissenschaft 77(3):453–468
16. Giering O (2021) Künstliche Intelligenz und Arbeit: Betrachtungen zwischen Prognose und betrieblicher Realität. Zeitschrift für Arbeitswissenschaft 76(1):50–64
17. IONOS: Umfrage zu KI: KMU erkennen Vorteile, zögern aber noch beim Einsatz. https://www.ionos.de/newsroom/news/umfrage-zu-ki-kmu-erkennen-vorteile-zoegern-aber-noch-beim-einsatz/. Accessed: 2024-10-21
18. Mittelstand-Digital B (2023) Mit welchen Anwendungen sind kleine und mittlere Unternehmen heute schon erfolgreich? White paper, WIK GmbH