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ETHICAL CHALLENGES AND INNOVATION MANAGEMENT: ARTIFICIAL INTELLIGENCE AS A DRIVER OF INDUSTRY 4.0

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Abstract: *The rapid advancement of artificial intelligenc has positioned it as a key driver of the fourth industrial revolution. AI enables businesses to digitalise processes, optimise workflows, and foster innovation by leveraging two primary forms: Generative AI, which produces creative outputs such as text and images, and Automated AI, which improves operational efficiency through process automation. These technologies address challenges such as demographic shifts and the shortage of skilled labour, contributing to economic growth and productivity. However, the adoption of AI raises significant ethical and social concerns. Fairness, transparency, accountability, and human autonomy must be considered to ensure trust and acceptance among employees and society. Ethical frameworks, like the EU Ethics Guidelines, emphasise harm prevention, non-discrimination, and data protection. Ethical leadership and effective innovation management are crucial for AI's successful integration. Leaders must promote a vision for innovation, empower employees, and create an open communication culture, fault tolerance, and continuous learning. Addressing fears of job displacement and supporting up-skilling initiatives are essential to maintaining organisational commitment. AI is a fundamental pillar of Industry 4.0, enabling economic growth and innovation while addressing societal challenges. A value-oriented and transparent implementation ensures its potential benefits businesses, employees, and society.*
Keywords: *AI, Artificial Intelligence, Industry 4.0, Ethics*

INTRODUCTION

Rapid technological advances, particularly in artificial intelligence (AI), create new business challenges. It is not only the sometimes weak economy in some industries that poses a challenge for companies, but also demographic change and the shortage of skilled workers (Jacob 2020). In this context, AI drives the fourth industrial revolution (Industry 4.0) (Barthel-meß and Furbach 2021). However, introducing AI also brings ethical and legal issues that must be considered (Heinen, Heuer and Schautschick 2017; Barthelmeß and Furbach 2021; Giering 2021). Ethical behaviour and leadership are the basic requirements for driving innovation forward. Without ethical leadership behaviour, innovation is not possible (Blok and Lemmens 2013). This plays an increasingly important role, especially at a time when China is shaping the global market in many areas following its innovation initiative (Cao and Wang 2016). According to Tidd & Bessant (2021), there has been no economic growth without innovation since the 1800s (Tidd and Bessant 2021). In innovation management, an ethical and innovation-friendly management methodology is essential, and the following points stand out here (Tidd and Bessant 2021):

- Visionary leadership: Managers must communicate a clear vision for innovation and explain the purpose and importance of innovation to employees. This creates motivation and commitment.
- Empowerment and autonomy: Employees must act independently and contribute new ideas. A culture of autonomy and trust promotes creativity.
- Open communication and feedback: An open communication culture in which feedback is welcomed and constructively implemented is essential for innovation. Even if unconventional, employees must feel safe sharing their ideas.
- Fault tolerance: Innovation is associated with risks and mistakes. Managers must create a culture where mistakes are seen as learning opportunities, not failures.
- Cooperation and teamwork: Innovation often requires collaboration between departments and teams. Managers must promote cooperation and avoid silo thinking.

- Provision of resources: Innovation requires resources, both financial and human. Managers must ensure that the necessary resources are available.
- Continuous learning and development: Innovation requires constant learning and developing new skills. Managers must promote the further training of employees and create a learning organisation.

RESEARCH METHODOLOGY

Ethical working and behaviour are, therefore, fundamental to economic growth. The introduction or use of AI can undoubtedly occur without significant problems through good change management, but there are always ethical concerns here. The EU expert group has published a guide on this topic that explains the ethical considerations of AI (Europäische Kommission 2019). The ethical concerns surrounding AI are diverse and complex. The ethics guide (Europäische Kommission 2019) addresses the following points, among others:

- Human autonomy: AI systems should not restrict or undermine human self-determination. AI systems should not make decisions that significantly impact people's lives exclusively.
- Harm prevention: AI systems should be designed and deployed so that they do not cause any harm, physically or psychologically. Safety mechanisms and control instances are essential.
- Fairness and non-discrimination: AI systems should be fair and impartial and not promote discrimination based on gender, origin, religion or other characteristics. Bias in data and algorithms must be avoided.
- Transparency and explainability: The functioning of AI systems should be transparent and comprehensible. Users should understand how decisions are made to create trust and ensure accountability.
- Data protection: AI systems must not infringe on people's privacy. The handling of personal data must comply with the applicable data protection regulations.
- Responsibility: Responsibility for the decisions and actions of AI systems must be clearly defined. Accountability mechanisms are required to ensure transparency and accountability. It is not always possible to eliminate ethical concerns, as ethical issues in the context of AI require constant discussion and adaptation. Instead, the aim is to take these concerns seriously and minimise them through appropriate measures. The guide (European Commission 2019) offers some approaches to this:
- Compliance with ethical principles: The development and use of AI systems must be based on the ethical principles set out in the guidelines (European Commission 2019) (Europäische Kommission 2019).
- Implementing control mechanisms: Technical and organisational measures, such as audits and human supervision, can help minimise AI system risks.
- Transparent design of AI systems: The functioning of AI systems should be as transparent as possible to create trust and ensure the traceability of decisions.
- Continuous review and adaptation: The ethical implications of AI systems must be continuously reviewed, and the corresponding measures must be adapted to meet the changing technological and social challenges.
- Broad social dialogue: An open dialogue between experts, political decision-makers, and the public is essential to ensure a responsible approach to AI.

These aspects must always be considered when introducing AI systems to ensure the technology's acceptance and trustworthiness among employees. Only in this way can AI's benefits and innovative potential for companies and society be fully utilised (Käde and Maltzan 2020; Barton and Pöppelbuß 2022; Rebstadt et al. 2022). AI and its use in companies can become or contribute to innovation if used correctly and ethically.

The types of AI currently used in companies are:

- **Generative AI:** This type of AI creates new content, such as text, images, music or other creative outputs, based on existing data. Well-known examples are GPT models (like me) and DALL-E for image generation (Ellis and Slade 2023).
- **Automating AI:** This AI is used to automate processes, such as manufacturing. It optimises or replaces human activities in predefined task fields (Smuha 2019).

Both types of AI can be used in different industries and functions to support innovation processes and

achieve efficiency gains. Generative AI can be used in marketing for image or text generation, product development to create new designs, and research to generate creative solutions (Pfeiffer 2020). Digitalising processes that could not previously be digitalised is also an excellent opportunity for companies. This includes the allocation and processing of documents such as order confirmations. Digitalising processes has been the best way to streamline processes for decades (Dörn 2017; Töpfer 2023). Automating AI is used to control machines or monitor and intervene in processes, among other things. Quality management activities are often performed here, e.g., tracking the welding or soldering of robots or humans manually connecting plugs. Both application forms enable companies to develop innovative products and services and efficiently organise internal processes. Chalmers et al. (2021) referred to AI as the virtual revolution and Industry 4.0 (Chalmers, MacKenzie and Carter 2020). Industry 4.0 will be characterised by networking and digitalisation. A core aspect or a central pillar here is AI, which will further digitalise processes now and in the near future and simplify workflows to such an extent that innovations will be made possible or significantly accelerated (Pfeiffer 2020; Bar-thelmeß and Furbach, 2021; Müssig 2021). AI is a powerful technology that can significantly promote company innovation and efficiency. It is, therefore, essential to consider the ethical aspects of the introduction and application of AI to guarantee acceptance and trust in the technology. A value-oriented and transparent implementation of AI is crucial to ensure that the potential for companies and society can be fully utilised (Pfeiffer 2020; Barthelmeß and Furbach 2021; Müssig 2021). AI can act as an essential driver for Industry 4.0 by enabling the digitalisation of processes and the development of innovative products and services. Automating AI in production can counter demographic change (Barthelmeß and Furbach 2021).

The ethical aspects must also be considered to avoid losing employees' acceptance from the outset. Implementing new technologies always promotes the fear of losing one's job or requiring completely new tasks (Pfeiffer 2020; Bar-thelmeß and Furbach 2021; Müssig 2021). This can lead to de-skilling or up-skilling. De-skilling refers to the "downgrading" of an employee to a lower job and, of course, the loss of prestige and lower pay. Moreover, up-skilling refers to the exact opposite. If AI is used in production to counteract demographic change or achieve efficiency gains, offering employees new perspectives and training opportunities is essential. This is the only way to manage change and ensure the successful acceptance of the workforce. As confident as AI is a pillar of Industry 4.0, it is all the more certain that an industrial revolution has never been possible without people. Organisational commitment is essential for the company's development and, therefore, at least as important as AI. In this context, we are not talking about engagement or attachment to the company but about commitment (U-tama 2023). Commitment to the company goes beyond engagement or connectedness. It is intended to represent the degree or strength of the company's connections and is an indicator of connectedness or, instead, belonging to the company. The higher the commitment to the company, the higher the motivation and work performance (Hunt et al. 2023).

RESULTS

Introducing artificial intelligence (AI) as a central technology of Industry 4.0 opens up enormous potential for innovation, productivity and economic growth. AI allows digitalising processes, increasing efficiency, and developing new products and services. Generative AI and Automating AI play a key role here by promoting creative solutions or optimising manual activities in production. However, the use of AI also brings with it ethical challenges that cannot be ignored. Questions of fairness, transparency, responsibility and respect for human autonomy are crucial to ensuring acceptance of and trust in AI systems. The ethics guidelines offer concrete approaches to minimise risks and uphold ethical principles.

The successful implementation of AI requires ethical behaviour and leadership. Managers play a crucial role by:

– Communicating visions for innovation,
– Empowering and supporting employees (empowerment and autonomy),
– Enabling fault tolerance and continuous learning,
– Providing resources and create a culture of open communication.

In addition, the social implications must not be neglected:

The fear of job loss, de-skilling and the need for up-skilling must be taken seriously. Targeted training measures and new employee perspectives can help shape change positively. A high level of organisational commitment from the workforce is essential for the long-term success of AI-supported innovations.

CONCLUSION

In conclusion, it can be said that AI is a driving pillar of Industry 4.0, making it possible to cope with demographic change, secure economic growth and enable innovation processes. For this to succeed, ethical, social and technological challenges must be addressed equally. A value-orientated and transparent implementation of AI ensures that the potential of this powerful technology is fully exploited – for the benefit of companies, employees and society as a whole.

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ЕТИЧНИ ПРЕДИЗВИКАТЕЛСТВА И УПРАВЛЕНИЕ НА ИНОВАЦИИТЕ: ИЗКУСТВЕНИЯТ ИНТЕЛЕКТ КАТО ДВИГАТЕЛ НА ИНДУСТРИЯ 4.0

Резюме: *Бързото развитие на изкуствения интелект го превърна в ключов двигател на четвъртата индустриална революция. ИИ дава възможност на предприятията да цифровизират процесите, да оптимизират работните процеси и да насърчават иновациите, като използват две основни форми: Генериращ ИИ, който създава творчески резултати като текст и изображения, и Автоматизиран ИИ, който подобрява оперативната ефективност чрез автоматизация на процесите. Тези технологии се справят с предизвикателства като демографските промени и недостига на квалифицирана работна ръка, като допринасят за икономическия растеж и производителността. Прилагането на ИИ обаче поражда значителни етични и социални проблеми. Справедливостта, прозрачността, отчетността и човешката автономия трябва да бъдат взети предвид, за да се гарантира доверието и приемането им от служителите и обществото. Етичните рамки, като например Етичните насоки на ЕС, наблягат на предотвратяването на вреди, недискриминацията и защитата на данните. Етичното лидерство и ефективното управление на иновациите са от решаващо значение за успешното интегриране на ИИ. Лидерите трябва да насърчават визия за иновации, да овластяват служителите и да създават култура на отворена комуникация, толерантност към грешки и непрекъснато обучение. Отстраняването на страховете от изместване на работните места и подкрепата на инициативи за повишаване на квалификацията са от съществено значение за поддържане на организационната ангажираност. ИИ е основен стълб на Индустрия 4.0, който дава възможност за икономически растеж и иновации, като същевременно се справя с обществените предизвикателства. Ориентирането към ценности и прозрачно прилагане гарантира, че потенциалът му е от полза за бизнеса, служителите и обществото.*

Ключови думи: *ИИ, Изкуствен интелект, Индустрия 4.0, Етика*

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