Entrepreneurship Empowered by Artificial Intelligence

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Artificial Intelligence (AI) is changing entrepreneurship by transforming how companies innovate, operate and stay competitive in the digital era. This paper examines how AI is becoming part of entrepreneurial practices and its impact on improving operations. This research combines theoretical frameworks with practical examples to outline best practices for AI adoption among entrepreneurs. The purpose of this study is to examine how AI contributes to driving innovation, improving operational efficiency and increasing customer engagement. The aim of this paper is to provide actionable insights into leveraging AI for competitive advantage. The intention of this paper is to inspire entrepreneurs to adopt responsible and strategic approaches to AI integration. By synthesizing theoretical insights and practical findings, this paper underscores the transformative potential of AI, guiding entrepreneurs toward growth and progress in the digital economy.

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1 Introduction

In recent years, rapid progression of Artificial Intelligence (AI) technology has transformed the landscape of entrepreneurship and business economics. By using advanced analytics, machine learning and automated decision-making, entrepreneurs can drive innovation and fundamentally rethink how they create and deliver value in today's market conditions (Wajahat, 2024). Integrating AI into daily operations brings many challenges, such as (Kaplan & Haenlein, 2019): privacy issues, liability, job displacement, adapting to rapid technological changes and others. This shift towards digital technologies is becoming a key force in shaping entrepreneurial ecosystems, prompting new developments and creating new opportunities (Jovanović et al., 2024). Entrepreneurship consists of utilizing resources based on opportunities, requiring social skills alongside market and technical expertise, aligning with key benefits AI delivers (Giuggioli & Pellegrini, 2022; Johannisson, 1998): identifying opportunities, improving decision-making, enhancing performance and advancing research and education. The path to effectively incorporating AI into business is accompanied by various barriers (Cubric, 2020): economic (cost, support infrastructure), technical (availability of large training datasets, creating models) and social (lack of knowledge, safety, trust). Despite existing barriers, Small and Medium Enterprises (SMEs) show a strong awareness of market needs, driving higher innovation intentions (Rojas-Córdova et al., 2020). The structure of the paper is as follows. After the introductory section, the second section presents the impact of AI on product development, marketing, risk management and talent acquisition, pointing to the improvements in business growth by improved decision-making and seizing opportunities. The third section includes examples from two companies that leveraged AI to achieve rapid growth and gain a strong market presence, as well as two major corporations that utilize AI to maintain their competitive edge at the top of their industries, showing that AI adoption is not limited by the size of the company. The fourth section presents the conclusion of the paper.

2 AI-driven transformation

AI is revolutionizing product innovation by enabling companies to create »smarter«, more personalized and efficient solutions. By utilizing AI technologies (machine learning, computer vision, generative AI and others) companies can analyze large

data sets to identify consumer preferences and needs. With AI-driven insights, companies can adjust products and services to individual customers. As a result, AI has a critical role in fostering personalization (Choppadandi, 2023). The integration of AI into system development has revolutionized the way solutions are conceived and implemented. Design, in the context of AI-driven systems, refers to the process of creating the foundational framework and problem-solving loops that enable AI to autonomously make decisions (Verganti et al., 2020). AI-driven systems rely on autonomous problem-solving loops, reducing human involvement in designing these loops (Figure 1) that replace humans, scale easily and generate different solutions with minimal additional effort.

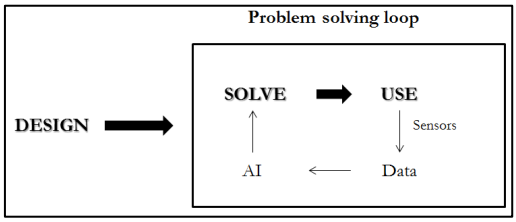

Figure 1: Design in the context of AI
Source: (Verganti et al., 2020)

Transition to AI-driven systems boosts efficiency and speeds up the processes of prototyping and testing (Goel et al., 2024). By automating repetitive and intensive tasks, AI allows companies to allocate resources towards more strategic initiatives. AI-driven design frameworks foster iterative development where systems continuously learn and improve from data inputs, leading to optimized solutions over time (Kumar, 2021). This dynamic adaptability enables companies fast respond to market changes establishing market leadership in dynamic industries. Generative design algorithms further enhance innovation by enabling rapid exploration of optimized design solutions. Generative design algorithms, for instance, enable engineers and designers to faster explore thousands of design variations. This capability reduces the time to market while ensuring that the final product meets or exceeds customer expectations (Voola, 2021). This capability also reduces the costs of experimentation, helping companies improve product attractiveness and diversify their portfolio (Babina et al., 2023). For this reason, companies can maintain a competitive advantage by bringing faster superior products to consumers. AI is transforming the company's marketing strategies by enabling the delivery of

personalized campaigns. Enabling data-driven decision-making and efficient campaign strategies that consist of chatbots, automated content creation, image recognition and e-mail, marketing has become a vital tool in modern marketing (Murgai, 2018). AI has revolutionized corporate marketing by enhancing effectiveness, modernizing strategies and optimizing performance through its integration into pricing, promotion, digital engagement and customer relationship management (Shaik, 2023). This combination of precision and adaptability establishes AI as a key driver of long-term success in modern marketing (Yang et al., 2021).

AI goes beyond marketing and helps entrepreneurs to manage risks more effectively by identifying and reducing potential threats. According to (Aziz & Dowling, 2018), when combined with machine learning, AI can be applied in different areas of risk management, including credit risk (modeled with statistical methods that offer greater accuracy and practical applications in areas, such as SMEs or consumer lending), market risk (linked to the financial market, market risk is managed with both AI and machine learning to improve model testing, reduce costs, adapt trading strategies and identify hidden risks) and operational risk (identifying and reducing financial losses from internal issues or external events, system failures or frauds, by automating tasks, analyzing data, ensuring compliance). In addition to risk management, AI is transforming human resource functions. AI is revolutionizing recruitment by automating processes, improving decision-making accuracy, enhancing candidate engagement and enabling data-driven talent acquisition strategies (Sasi, 2024). Technological advances including AI are transforming recruitment by enabling platforms to filter and match candidates to jobs more effectively through direct or third-party applications (Van Esch et al., 2018). AI has the potential to revolutionize career guidance by supporting career planning, enhancing counselling interactions, recognizing and mapping skills, identifying competence gaps, anticipating guidance needs and leveraging networks for employment opportunities (Westman et al., 2021). This leads to better talent acquisition and retention strategies.

3 Organizational and economic impacts of AI – examples from the practice

AI is transforming entrepreneurship by driving significant organizational and economic changes. It significantly influences various business areas, such as risk management – by improving predictive analytics and fraud detection (Arsic, 2021); cost efficiency – through automation and resource optimization (Waqar et al., 2024); market agility – by enabling personalized experiences and adaptive strategies (Kumar et al., 2019) and customer relationships – by enhancing engagement through advanced algorithms (Wang et al., 2022). The following subchapters will explore these four areas, illustrating how AI is helping businesses grow. When it comes to risk management and market agility, two smaller companies highlight the benefits of early AI adoption, using its capabilities long before companies became widely popular. Their success demonstrates how AI empowered smaller businesses to adapt quickly and achieve remarkable results in competitive markets. On the other hand, improved cost efficiency and strengthened customer relationships are presented by two of the world's largest corporations. Large companies are highlighted because entrepreneurs usually avoid sharing their strategies or knowledge early on to protect their business interests (Connelly et al., 2011). These four examples demonstrate that both emerging startups and leading global enterprises can benefit by strategically integrating AI into their operations.

3.1 Risk management

AI can support companies throughout the risk management process, including identifying risk exposure, measuring, estimating and evaluating its effects (Sanford & Moosa, 2013), presented in Figure 2. An example from the practice is the company »Kabbage«, a small fintech company, that offers eligible small businesses flexible lines of credit from $2.000 to $250.000, helping them manage cash flow and growth (American Express, 2022). This company has successfully utilized AI with machine learning algorithms to enhance credit risk management by analyzing data from public online profiles, social media and news reports (Deepthi & Nagajyothi, 2017). This allowed »Kabbage« to build comprehensive credit risk profiles for small businesses, enabling faster and more accurate lending decisions. In 2020, »Kabbage« was bought by American Express and renamed in »American Express Business Blueprint« (Treece & Tarver, 2022).

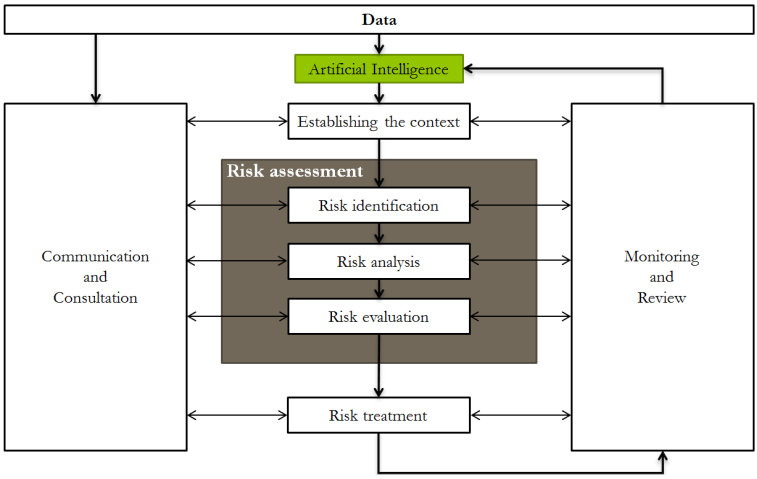

Figure 2: Risk management process empowered by AI
Source: (Žigienė et al., 2019)

3.2 Cost efficiency

AI application helps cost reduction by optimizing procurement, supply chain and maintenance processes through data-driven strategies, efficient sourcing and predictive problem-solving (Parekh & Mitchell, 2024). It also enables manufacturers to optimize key performance indicators and monitor them in real time, for instance, virtual modeling helps in predicting, identifing and preventing staffing and material bottlenecks, improve energy efficiency and proactively alert engineers to potential issues while suggesting solutions (Dash et al., 2019). AI-driven manufacturing, not only enhances the efficiency of assembly line operations but also reduces costs and waste (O'Reilly & Binns, 2019). Table 1 provides a few additional examples of how AI tools can be applied to reduce manufacturing costs. Company »Siemens« is transforming manufacturing processes with AI, making them more efficient, scalable and sustainable while providing powerful solutions, because company »Siemens« (Siemens, 2024):

- Collaborates with partners, academia and customers to create robust systems: AI-based predictive maintenance, autonomous robots for item picking, packing and AI-accelerated search engines;

- Provides accessible AI tools, lifecycle support and industrial foundation models: AI-assisted accelerated problem solving, engineering with the Industrial Copilot, AI-based visual quality inspection and »Green hydrogen« with GenAI;
- Offers AI solutions for quality assurance and sustainability: AI-based leak detection, AI-based soft sensor, product design with generative AI and simulation and computer vision-based Printed Circuit Board (PCB) assembly inspection.

Table 1: Cost reduction through AI implementation in manufacturing

	Examples of cost reduction areas
AI-based predictive maintenance	Predicting failures in advance reduces unplanned downtime; early detection of issues prevents damages; efficient scheduling of maintenance tasks minimizes overtime; preventing malfunctions ensures consistent production quality and reduces waste.
Autonomous robots for item picking and packing & AI-based visual quality inspection	Reducing reliance on manual labour for repetitive tasks lowers workforce expenses; minimizing picking and packing errors; automating tasks eliminates the need for overtime during peak periods; reducing the costs of training new employees.
AI-based leak detection	Early detection of leaks prevents damages; identifying and fixing leaks minimizes energy waste and decreases utility costs; proactively addressing leaks avoids production stoppages.

Source: The authors of the paper

3.3 Market agility

Agility in manufacturing and marketing is the capacity to adapt processes with minimal costs, foster innovation by responding to customer needs and adjust to changing environments, allowing businesses and suppliers to meet varied demands and explore new opportunities (Alghamdi & Agag, 2023). Similarly, agility principles are evident in how »Duolingo« rapidly adapts its platform to emerging language needs and user feedback. »Duolingo« is an application that offers a wide range of foreign language learning materials that help users strengthen their foreign language skills. By the third quarter of 2022, »Duolingo« had over 500 million users worldwide, with around 56.5 million active every month (Nugraha et al., 2023). »Duolingo« leverages AI in several ways to enhance its market agility and broaden global reach (Wodzak, 2023): personalized learning (AI customizes lessons based on

user strengths and weaknesses, corrects grammar, improves pronunciation and suggests writing tips), fun and accessible tools (AI powers engaging features like character voices and makes the language tests faster, cheaper and available from home) and safe and responsible AI (»Duolingo« uses advanced AI responsibly, ensuring fairness, security and transparency in tests). »Duolingo« started as a free platform developed at Carnegie Mellon University in 2009 and attracted millions of users with its engaging approach. Figure 3 illustrates the success of the company »Duolingo«, where the left side presents the revenue growth trend and the right side highlights the growth trend of monthly active users.

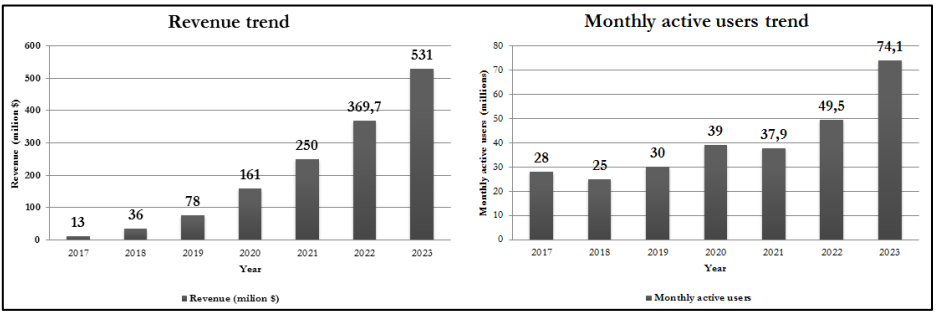

Figure 3: »Duolingo« growth trend – revenue (left) and monthly active users (right)
Source: (Curry, 2024)

3.4 Customer relationship

There are many ways to strengthen customer relationships but one of the most effective methods is using AI, particularly through the use of chatbots (Wang et al., 2022). Chatbot is a computer program that interacts intelligently through text or voice, understanding one or more human languages using Natural Language Processing (Khanna et al., 2015). The strength of relationships with customers was largely influenced by the chatbot's ability to deliver accurate, credible and competent communication, even while offering various relationship maintenance functions (Cheng & Jiang, 2021). Company »Amazon« enhances its self-service customer experience with AI through »Amazon Lex«, that provides chatbots with advanced speech and text recognition capabilities to understand and fulfil user intent accurately (Hunt, 2017; Nadeem et al., 2024):

- When the user calls »Amazon«, »Amazon Connect« integrates with an »Amazon Lex« bot;
- If the bot cannot identify the caller's intent it usually leads to failed interactions that frustrate users (they may need to repeat themselves, experience incorrect routing or be unnecessarily escalated to live agents). To prevent this, a »AWS Lambda« is activated;
- The function sends the customer transcript to a foundation model in »Amazon Bedrock« that analyzes and determines the caller's intent;
- The »AWS Lambda« function routes the call to the correct intent for a solution. A customer scheduling query triggers »AWS Lambda« to access Customer Scheduling software and »Amazon Connect« confirms the appointment via SMS.

4 Conclusion

AI boosts efficiency, promotes adaptability and enables data-driven decision-making across areas ranging from product development to risk management. Through the use of AI, companies can innovate faster, nhance customer experiences and identify different types of risks. By integrating AI into the product lifecycle, companies can continuously adapt to changing customer needs. This encourages innovation and strengthens customer loyalty. Because the automated iterative approach allows companies to innovate more effectively, entrepreneurs can experiment more with new ideas and with fewer risks, by application of AI-powered tools for design and product development. Besides that, AI has shown great utility in enhancing credit risk management by processing vast amounts of data from different sources which increases financial certainty. In manufacturing, AI optimizes processes through predictive maintenance and automation, leading to cost reductions and improved efficiency. Its role in market agility is evident in the successful adaption to individual needs. AI-powered chatbots have transformed the way companies connect with customers offering accurate and efficient support, allowing them to focus on other challenges. All of these advancements highlight AI's role in supporting business growth and innovation. The examples presented in this paper show that companies, despite size, can significantly improve their business by integrating AI into their businesses. Smaller companies can achieve remarkable success by adopting AI early, while larger corporations, with their vast resources and data, show how AI can

achieve cost efficiency and keep customer engagement at a very high level. By using AI, entrepreneurs can unlock growth opportunities. Examples show that the key to improvements lies in aligning AI capabilities with the willingness to adapt and innovate.

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