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AI-BASED BUSINESS MODELS: LEVERAGING ARTIFICIAL INTELLIGENCE FOR ORGANIZATIONAL GROWTH

Abstract:

This research paper addresses the use of artificial intelligence (AI) in startup ecosystems, focusing on the impact on growth strategies as well as clarifying expansion opportunities and barriers. Utilizing a qualitative methodology, the study conducts an in-depth analysis of diverse startup scenarios to unravel the complexities of AI integration. It categorically differentiates between 'purist' and 'pragmatist' paradigms of AI application.

The empirical results of this investigation underscore the central role of AI in fostering sustainable corporate advancement. Specifically, AI is found to catalyze growth opportunities, with a significant increase in productivity and operational efficiency, while providing better opportunities to secure financing through private equity and public funding mechanisms. However, the advantageous impacts of AI are moderated by several challenges, most notably the substantial resource allocation required for its implementation.

This contribution is significant to the scholarly discourse by articulating the distinct methodologies of 'purist' versus 'pragmatist' AI implementation in the context of startups, providing a holistic perspective on the ensuing opportunities for growth and the associated challenges. This nuanced exploration extends the existing academic discourse by shedding light on the strategic incorporation of AI within startup environments.

However, the applicability of the study's conclusions is acknowledged to be confined to certain startup settings, suggesting a potential limitation in their generalizability across broader business landscapes. The study points a way forward for future research to assess the relevance of these insights in varied organizational contexts.

From a practical perspective, the findings from this research endeavor can serve as a strategic guide for startups considering the integration of AI, enabling a calibrated approach to leveraging growth opportunities while navigating the attendant challenges. Furthermore, this study highlights the transformative impact of AI on venture growth strategies, implies extensive implications for economic proliferation and job creation within the technological sector.

Keywords:

Artificial Intelligence (AI); Startup Ecosystems; Growth Strategies

JEL Classification: L26, O32, M13

1 Introduction

The ongoing global trend towards new technologies like Blockchain, the Internet of Things (IoT) and especially Artificial Intelligence (AI) is transforming various sectors. With the integration of Chat GPT across virtually every industry, AI has become irreplaceable. AI is recognized for its significant economic potential (Bresnahan, 2010; Brynjolfsson & McAfee, 2017; Davenport, 2018a; Taddy, 2019) and is increasingly adopted by startups for their business models. These technology-driven startups are excellent in establishing themselves in markets or with specific customer segments, benefiting from the digital native generation's ability to innovate using these technologies (Hora, Gast, Kailer, Rey-Marti, & Mas-Tur, 2018; OECD, 2017). This paper explores how startups integrate these technologies into their operations, impacting business strategies and market engagement. To understand the technical aspects of AI is crucial but it is described as a responsive, learning entity (Poole & Mackworth, 2011). AI, broader than Machine Learning or Deep Learning, necessitates a precise definition focusing on problem-solving (Brynjolfsson & McAfee, 2017; Raschka & Mirjalili, 2017; Wade, Joshi, Greeven, Hooijberg, & Ben-Hur, 2020). It enables more efficient, competitive marketing strategies and can lead to business growth (Palanivelu & Vasanthi, 2020). AI and Big Data are vital across fields like economics (Acemoglu & Restrepo, 2018; Brynjolfsson, Rock, & Syverson, 2017), policy (Agrawal, Gans, & Goldfarb, 2019), and innovation (Aghion, Jones, & Jones, 2017), significantly contributing to entrepreneurship research. This study, through case studies of Austrian startups integrating AI in their value chains, examines growth potentials, challenges and AI integration aiming to address the research gap in entrepreneurship (Giuggioli & Pellegrini, 2023; Obschonka & Audretsch, 2020).

2 Theoretical background and research questions

2.1 Growth potentials and challenges with AI

Despite prevailing concerns about AI's risks (Brynjolfsson et al., 2017; Davenport, 2018a; Gibbs, 2014; World Economic Forum, 2016), current management discussions underscore AI's capacity to augment human efforts and stimulate innovation in products and business models, offering particular advantages to startups (Jarrahi, 2018; Obschonka & Audretsch, 2020; Wilson & Daugherty, 2018). AI's role in reducing labor costs and potentially replacing certain jobs, while also facilitating higher-level work and job creation, shows its dual impact on the labor market (Acemoglu & Restrepo, 2018; Brynjolfsson et al., 2017; Ransbotham, Kiron, Gerbert, & Reeves, 2017; Susskind & Susskind, 2015). Additionally, AI contributes to business efficiency and productivity through improved processes (Wilson & Daugherty, 2018). The attractiveness of AI for marketing and the increase in private equity investment in AI startups highlight its economic potential (Su, 2019; Wade & Joshi, 2020). Yet, startups face challenges in adopting AI, including resource limitations, data processing needs, and competition for skilled personnel, which may hinder their growth and innovation capacity (Chalmers, MacKenzie, & Carter, 2020; Obschonka & Audretsch, 2020; Ransbotham et al., 2017; Wade & Joshi, 2020). Another challenge is the difficulty in measuring the impact of AI implementation on business growth. These considerations prompt further investigation into how AI's integration influences startup growth, leading to the question:

What are the growth potentials and barriers for startups in integrating AI into their business model?

2.2 Integration of artificial intelligence in businesses

The potential applications of AI in economic sectors seem to be limited only by human creativity in public discourse. In the corporate context, AI's affinity with statistical methods, business analytics tools, and big data applications is often highlighted (Davenport, 2013, 2018b). However, the specifics of AI integration in companies remain less documented. Studies point to a gap between the enthusiasm for AI and its adoption, especially noted by Ransbotham et al. (2017) in large corporations, but this research often misses the unique challenges and opportunities startups are facing (Brynjolfsson & McAfee, 2017; Davenport, 2018a). This oversight leads to a focused inquiry on how startups are weaving AI into their operations, encapsulated in the question:

How do startups integrate AI into their business model?

3 Methodology

This study's methodology employs a case-study approach as recommended by Yin (2018), focusing on AI's recent application within startups, a relatively uncharted territory. Utilizing a holistic, explorative multiple-case study design, it treats each company as an independent unit of analysis to understand AI's strategic impact. Initial identification of around 200 Austrian companies using AI in their value chains, informed by the 'AI Landscape Austria 2023' report (Wasner, 2023), led to a focus on 13 companies in the Greater Graz area, known for its unique startup ecosystem. The EU Startup Monitor 2018's startup definition (Steigertahl, Mauer, & Say, 2018) and AI utilization in significant parts of the value chain refined the selection to four participating companies. The data collection took place between August and October 2020 involved semi-structured interviews with founders/CEOs, and public data analysis, using MaxQDA for transcription and analysis per Yin (2018)'s analytical strategies, incorporating established theories.

4 Results

In this section, the investigation's results are outlined, including a table summarizing the corporate profiles of the examined cases. This is followed by an in-depth analysis of the study's two core research questions.

Table 1: Descriptive overview of the cases

	Case A	Case B	Case C	Case D
Industry	MedTech	HR tech	Audioproduction	AgriTech
Product/Service	Enzyme and active ingredient catalyst platform	Job matching platform for job seekers	Audio software and hardware	Animal health monitoring
AI Development	Mostly In-house	Development with partners	Mostly In-house	Development with partners
AI Implementation Timing	Planned before inception	Planned before inception	Post-inception technology pivot	Post-product redesign

					technology pivot
AI Solution	Recommendation system for biochemical macromolecules	User and job recommendation system	Audio data enhancement and repair		Anomaly detection system for animal behavior
AI System Strength	Strong	Moderate	Moderate		Rather weak
Sales Type	B2B	B2B, B2C	B2B, B2C, B2G		B2B
Year Founded	2017	2017	2013		2010
Founding Team (Number of Members)	3	4	3		3
Qualification in Founding Team	Diverse technical backgrounds	Diverse Business and technical backgrounds	Diverse technical backgrounds		Diverse technical backgrounds
Employees 2019	4	9	11,5		40
Revenue 2019 (thousands of Euros)	250-500	250-500	> 1,000		> 1,000

4.1 Growth potentials and constraints

Regarding the growth potentials and challenges associated with AI integration, Case C saw significant product innovation through AI-generated innovative thinking patterns. In Case A, AI produced unique outcomes, uncovered insights not achievable by traditional methods. The attraction of "AI" as a term also emerged prominently, with Cases A and C experienced customer base expansion and revenue growth. In Case B and C, AI's introduction positively affected investment appeal, enhanced company valuation, with funding opportunities crucial for AI development, and ensured foundational financial support.

All cases acknowledged AI's role in streamlining and enhancing business processes. Case A reported faster operations and quality enhancements, forecasted long-term savings via AI. Case B noted performance boosts and heightened customer engagement, while Cases C and D found AI to be an efficient, high-quality alternative to previous methods. However, challenges persist, notably in Case A, which outlined the resource-heavy nature of AI training and interpretation. Case B also confronted the "black box" issue and the lag between AI investment and resource allocation. Case C stressed the resource demands of analyzing AI outputs. Data acquisition and processing posed a unique challenge in Case A, necessitating adaptation of database and customer data for targeted AI training, including re-use of data from failed experiments.

Despite these obstacles, all four cases continually assess AI impacts against alternatives and regularly re-evaluate AI performance to ensure its effective application, highlighting the dynamic balance between the transformative potential of AI and the practical challenges of its integration.

4.2 Variants of AI-system integration in startups

The four cases exhibit differences in the integration of AI systems based on numerous criteria. In Cases A and B, the use of AI was planned from the outset, significantly influencing the design of their business models. In contrast, Cases C and D gradually implemented a technology shift after several years. While Cases A and B clearly view AI as a major technological leap, Cases C and D point to more gradual distinctions between AI and conventional algorithms.

All four companies utilize their AI as a core element of their product or service, solving different types of problems and targeting various industries. Case A emphasized independent development work, implemented with the help of specifically recruited specialists, addressing complex problems with stringent AI solutions. Case C, while also relying mainly on internal expertise, followed a different development path intended to initiate a gradual technology transition. Cases B and D predominantly used external providers of AI systems, with Case D employing them after a product redesign.

In Case A, reliance was solely on an AI system as the central solution, with human labor as a comparison option. Case B set up their AI-supported solution alongside a 'conventional' recommender system, using the comparison of the two systems to assess the AI's learning progress. Case C initially created a system with 'conventional' algorithms, which was gradually transformed into an AI system. In Case D, a 'conventional' algorithm system was replaced by an AI system. For evaluating the new system, the companies mainly relied on external criteria, such as customer feedback and reviews in industry media.

5 Discussion

Through analysis of four AI startup case studies, this study illustrates the opportunities and challenges and the integration of AI into companies. It underscores that AI's deployment offers tangible benefits, and even the intent to use AI can be advantageous, leveraging the 'AI' term for strategic marketing. AI's early adoption can be a significant competitive edge, aiding in attracting venture capital and providing financial support opportunities in the startup's nascent phase. AI is also linked with innovative business models, significantly enhancing company valuation (Gundolf, Géraudel, & Cesinger, 2019). The case studies offer insights into varied approaches to AI system implementation, showing that companies either develop AI systems alongside conventional technology systems or set up a standalone AI system from the beginning. The choice between these paths depends on the availability of suitable comparison systems and the company's resources. While much of the existing literature (Brynjolfsson et al., 2017; Davenport, 2018a, 2018b; Ransbotham et al., 2017) focuses on resource-rich established companies, this study highlights that for resource-constrained startups, access to resources is a key determinant in AI implementation strategies. In exploring growth potentials and challenges associated with AI integration, it's found that enhancing efficiency and productivity in business processes stands out as the most consistent potential, despite the initial resource investment in AI development and training. Drawing on Obschonka and Audretsch (2020), AI's role driving product and service innovation, while reducing personnel

costs is seen as less critical. Startups mainly see AI as augmenting, rather than replacing human labor (Jarrahi, 2018). Moreover, the influence of political, public, and funding bodies' discussions around 'AI' is noted to benefit business growth opportunities. Contrary to the recent literature (Chalmers et al., 2020; Ransbotham et al., 2017) about the challenges in hiring AI-qualified personnel, the studied cases do not report such difficulties. Contrary to concerns about the measurability of AI's impact on growth (Brynjolfsson et al., 2017; Jarrahi, 2018), the startups in this study have also developed customized metrics to assess the effectiveness and appropriateness of their AI implementations, indicating an approach to overcoming potential barriers. The case studies show varying perceptions and methodologies for AI integration, leading to distinct approaches to AI system implementation. This divergence in understanding gives rise to two archetypical approaches: purist and pragmatist. The purist view, which aligns with the perspective of pioneers in Ransbotham et al. (2017)'s typology, considers AI systems with the hope of quickly reaping technological benefits, sometimes at the expense of other business areas. They focus on creating 'high-tech' or 'cutting-edge' solutions with their AI. On the contrary, the pragmatist view, based on Wade et al. (2020), regards AI as an evolutionary step from existing technologies, blending AI with conventional systems. Entrepreneurs adopting this pragmatic approach prioritize efficiency over a singular focus on AI, leading to a more measured allocation of resources towards AI development compared to their purist counterparts.

6 Limitations and future directions

This study contributes to entrepreneurship and innovation research by enhancing understanding of how 21st-century megatrends, particularly AI, influence startup innovation behavior and long-term growth. It provides insights into practical AI implementation strategies for startups, offering valuable perspectives for practitioners on AI's role in promoting sustainable growth. The research underscores the importance of AI implementation approaches based on the company's specific needs and goals for long-term success. It highlights the significance of a long-term managerial perspective over short-term AI investment views and shows how AI can positively impact customer and investor relations, advocating for a strategic approach to AI integration to sustain growth. Public funding is also identified as a key policy tool for supporting technological innovations, with societal concerns about AI, such as potential job losses, not significantly preventing startups from AI adoption.

However, this study is not without limitations, which include its methodology, context, and scope. The multiple-case study approach offers in-depth insights but lacks quantitative generalizability, aiming instead for analytical generalizability as per Yin (2018). The selection of startups does not adhere to a sampling logic but follows a replication logic with specific context variables. The focus on startups from the Graz area introduces regional conditions that may affect business operations, not accounting for larger companies' experiences with AI integration. Future research could expand by contrasting the AI implementation strategies of large enterprises with those of startups or directly comparing the two, addressing the limitations noted and building upon this study's findings.

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