

Envisioning the Entrepreneurial University 2.0: A Foresight Study on Creativity and Digitalization

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ABSTRACT

This study explores the growing importance of creativity and digitalization in the entrepreneurial university model, focusing on integrating AI-powered tools to foster innovation and entrepreneurship. The study examines how universities are evolving into dynamic hubs for entrepreneurship, driven by the increasing need to cultivate creativity as a core soft skill. In particular, AI-powered tools such as personalized learning platforms, virtual collaboration environments, and digital prototyping software play an essential role in shaping the future of entrepreneurial education. Two future scenarios were developed through scenario analysis: (1) The AI-Augmented Entrepreneurial University, where AI-driven tools enhance creativity and innovation, providing students with personalized educational experiences; (2) The Digital Divide in Entrepreneurial Education, where disparities in the adoption of AI and digitalization create unequal outcomes among universities. The study highlights the need for universities to embrace digitalization and creativity to stay competitive and equip students with the skills required for future entrepreneurial success. It recommends that universities adopt AI-powered tools to support creative learning and innovation, ensuring that graduates are business-ready in an increasingly digitalized world. This foresight study, utilizing scenario-based analysis, provides a roadmap for how entrepreneurial universities can integrate creativity and digitalization to flourish in educational and business environments.

Keywords: Creativity, Digitalization, Entrepreneurial University, AI-driven Learning, Scenario-based Analysis, Digital Inequality Soft Skills.

INTRODUCTION

The clock is ticking, and we are running out of time. With every passing hour, we draw closer to the singularity, which Kurzweil (2014) defines as a "period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed." If we are to co-evolve with machines, we must harness our greatest asset—creativity—in tandem with technology, which is advancing at an unprecedented speed. As we approach this transformative era, it becomes crucial to understand how educational institutions can adapt to foster the skills necessary for thriving alongside these advancements. Singularity concept reveals the urgency for educational institutions to adapt and prepare students for a world where technological advancements, particularly artificial intelligence (AI), play a dominant role. The purpose of this study is to examine how creativity and digitalization, especially through AI-powered tools, are essential components of entrepreneurial universities that aim to prepare students for modern business challenges. Entrepreneurial universities prioritize creativity to foster innovative problem-solving and adaptability, skills that are crucial for success in a rapidly evolving digital landscape (Prokopenko et al., 2024; Rosienkiewicz et al., 2024; Senivongse & Bennet, 2024). Digitalization plays a key role in this setting by providing tools such as adaptive learning platforms, virtual collaboration environments, and digital prototyping software that enable students to personalize their learning, collaborate across disciplines, and simulate real-world business scenarios

(Hung & Nham, 2023; Isaksson et al., 2018; J. Xu et al., 2022). However, implementing these tools presents challenges, including the need for resources and training, as well as addressing disparities in digital access. By exploring how creativity and digitalization can be effectively integrated, this study underlines their combined importance in shaping capable, innovative graduates who are well-equipped for entrepreneurship in an increasingly digital world.

However, implementing these tools presents challenges, including resource constraints, faculty training needs, and addressing digital access disparities. To illustrate these dynamics, the study employs scenario analysis to propose two future scenarios: (1) the AI-Augmented Entrepreneurial University, where AI-driven tools enhance creativity and innovation, offering students personalized learning experiences; and (2) the Digital Divide in Entrepreneurial Education, which highlights the unequal outcomes stemming from disparities in digital adoption. By exploring how creativity and digitalization can be effectively integrated, this study underlines their combined importance in shaping capable, innovative graduates who are well-prepared for entrepreneurship in an increasingly digital world.

Concept and Characteristics of the Entrepreneurial University

The concept of the entrepreneurial university, first articulated by Clark (1998), highlights a university's proactive approach to risk-taking, innovation, and collective learning, all steered by strong leadership and a shared vision. This model has since evolved into a multi-faceted framework that encompasses policymaking, academic initiatives, research efforts, and entrepreneurial activities, all of which are vital to fostering a dynamic and flexible institutional culture (Etzkowitz, 2004; Guerrero-Cano & Urbano, 2012; Salamzadeh et al., 2011). While the concept varies across different academic perspectives, core characteristics are shared, such as the ability to innovate, create opportunities, take risks, and engage with real-world challenges (Etzkowitz, 2004, 2012; Kirby, 2006; Pires da Cruz et al., 2021;; O'Shea et al., 2005).

A prominent framework for implementing an entrepreneurial mindset within higher education institutions (HEIs) is provided by Guerrero-Cano et al. (2006), who classify the essential elements of the entrepreneurial university into formal and informal categories. Formal elements include organizational structure and governance, which necessitate committed leadership from various stakeholders, including government, industry, academia, and students. Such collaboration is key to establishing an adaptable organizational culture aimed at flexibility, quality, and entrepreneurship (Clark, 1998; Staniškis, 2016).

Supporting mechanisms to promote business creation play a crucial role, as entrepreneurial universities often provide students with research facilities, incubators, and other resources that encourage them to challenge norms, innovate, and develop pioneering ventures. Increasingly, AI-powered tools are transforming these environments by automating routine tasks, generating insights from big data, and personalizing educational experiences. This infusion of AI empowers students to accelerate innovation, identify trends in emerging markets, and develop tech-driven solutions, thereby fostering a culture where students are inspired to think creatively and pursue impactful ideas (Etzkowitz, 2004; Keast, 1995; Zaharia, 2002).

Equally important is the integration of entrepreneurship education across diverse fields of study, from engineering to psychology, where AI-driven learning tools can play a vital role. Graduates of such programs are expected to possess key skills including analytical thinking, creativity, complex problem-solving, and technological proficiency, with AI proficiency becoming increasingly crucial in the modern digital landscape. Familiarity with AI applications, such as machine learning and predictive analytics, enhances students' abilities to adapt to rapidly evolving industries (Lewis et al., 2005; Van Vught, 1999).

Informal elements also significantly shape the entrepreneurial ethos within universities. The community's positive attitude towards entrepreneurship, cultivated through formal and informal education and reinforced by public policy, is essential (Ajzen, 2002; OECD, 2009). In addition, innovative teaching methodologies—such as problem-based learning, simulations, and design-based approaches—are enhanced by AI-driven simulations and adaptive learning platforms, which provide personalized learning experiences, simulate complex real-world scenarios, and develop critical skills in a controlled environment (Brockbank & McGill, 2007; Carrier, 2007). Role models and reward systems further support the development of entrepreneurial behavior, as these elements provide motivation and benchmarks for students aiming to achieve ambitious goals and pursue non-traditional career paths (Bosma et al., 2012).

The role of the environment in fostering entrepreneurship is underscored by the work of Guerrero-Cano et al. (2006) and others (Zhu, 2014; Lewis et al., 2005), who argue that a supportive context enables entrepreneurial activity to flourish. This environment, influenced by macro and microeconomic factors, should enable students to develop innovative ideas, generate start-ups, and engage in income-generating ventures beyond traditional teaching and research missions. The integration of AI into entrepreneurial environments further amplifies opportunities by enabling predictive market analysis, optimizing operational efficiencies, and fostering an agile mindset crucial for navigating digital disruptions (Markman et al., 2005; Soliman, 2005). An entrepreneurial university thus becomes a space not only for academic learning but also for cultivating the skills and mindsets necessary for entrepreneurial success in an AI-driven world.

The Digitalization of the Entrepreneurial University: Leveraging Technology and AI for Innovation

Digital technology has dramatically transformed nearly every aspect of modern life, including higher education. Recent advancements—ranging from social media and business analytics to the Internet of Things, big data, 3D printing, and cloud computing—have reshaped teaching and learning processes and fueled the growth of digital entrepreneurship within universities (Fitzgerald et al., 2014). Additionally, artificial intelligence (AI) has emerged as a critical tool in this transformation, enabling data-driven decision-making, personalized learning experiences, and automated administrative processes. Digitalization, defined as the use of technology to streamline and enhance tasks, products, and processes, impacts both formal and informal aspects of entrepreneurial universities by facilitating administrative tasks, library services, international collaborations, and access to educational resources (Urbach & Röglinger, 2018).

Rippa and Secundo (2018) describe the key components of digital academic entrepreneurship, which collectively form the digital entrepreneurial university. First, the motivation for adopting digital and AI technologies within academia is crucial; research indicates that academics' positive attitudes towards technology, including AI, significantly influence the integration of digital competencies into the curriculum (Ertmer et al., 2012; Fernet et al., 2008; Jääskelä et al., 2017). By using AI-driven tools, educators can analyze student performance data to tailor teaching methods, thereby enhancing the learning experience and improving academic outcomes. This proactive approach to digitalization and AI integration is essential in preparing students with the competencies needed for the modern digital economy.

The second component is stakeholder engagement through digital platforms, which enables active collaboration among various sectors. By linking partners across industries, academia, and research communities, as well as involving students and alumni, digital technologies and AI-powered communication tools foster an inclusive and networked entrepreneurial ecosystem within universities (Mallett, 2019; Cao & Zhou, 2018). AI also supports collaboration by facilitating efficient information sharing and identifying relevant industry trends, helping universities to stay aligned with the fast-paced changes in digital entrepreneurship.

The processes supported by digital technology and AI in entrepreneurial universities encompass various stages that lead to innovation and commercialization. According to Wood's (2011) model, key stages include disclosure of innovation, intellectual property protection, partnership building, and selection of commercialization mechanisms. AI tools aid in these processes by analyzing market needs, predicting successful innovation pathways, and identifying optimal commercialization strategies. These AI-enhanced stages enable academics and practitioners to generate financial, reputational, and societal benefits, thereby reinforcing the entrepreneurial impact of the institution.

Finally, digital academic entrepreneurship takes various forms within universities, uniting stakeholders to create digital spin-offs, start-ups, and other entrepreneurial initiatives (Rippa & Secundo, 2018). By fostering a culture of innovation and adaptability, AI enhances these efforts by providing predictive insights and automating routine tasks, thus allowing human resources to focus on creative and strategic pursuits. This digital and AI-driven shift accelerates changes in organizational culture, enhancing the ability to adapt to evolving digital landscapes and helping HEIs to think, act, and collaborate in innovative ways.

Despite significant research on digital entrepreneurial universities in Europe (Henderson et al., 2015; Lombardi et al., 2019; Secundo et al., 2020), there remains a notable gap in studies linking higher education, entrepreneurship, and digitalization, including AI.

Importance of Creativity as a Soft Skill in the Entrepreneurial University

As universities evolve into entrepreneurial hubs driven by digital transformation and AI, creativity emerges as a critical soft skill that complements technical expertise. Beyond fostering innovation, creativity equips students to address complex, real-world problems, essential in dynamic, interdisciplinary fields from engineering to business. Within the entrepreneurial university, creativity is foundational for individual development and societal and economic impact. This section examines the theoretical foundations of creativity and its critical role in driving innovation and success within organizations.

Historically, creativity was perceived as a rare, divine attribute, sometimes linked to abnormality. However, twentieth-century shifts highlighted creativity as an accessible, valuable trait, fostering the idea that every individual holds creative potential (Albert, 2011). Contemporary definitions often portray creativity as a dual process of originality and applicability, where new ideas or products meet both innovative and functional needs (Barron, 1988; Guilford, 1967; Sternberg & Kaufman, 2010). Guilford's concept of divergent thinking, which emphasizes ideational fluency, flexibility, and originality, remains a foundational component in creativity studies (Guilford, 1950).

In the digital age, creativity is indispensable for both individuals and organizations to maintain a competitive edge (Ritter & Mostert, 2016). It is particularly critical for entrepreneurial universities, where innovation-driven frameworks are essential for adapting to digital transformation and AI advancements. These institutions benefit from fostering creativity at both individual and collective levels, recognizing it as a key driver for organizational innovation, adaptation, and strategic advantage (Blomberg et al., 2017; Muñoz-Pascual & Galende, 2017). Organizational creativity, as conceptualized by Woodman, Griffin, and Sawyer (1993), emerges from collaborative efforts within complex social systems to generate novel, valuable ideas, processes, or products. Their model underscores the influence of individual, group, and organizational dynamics on fostering creativity, offering a structure to guide entrepreneurial universities in enhancing their creative capacity and innovation potential in an AI-integrated future (Woodman et al., 1993; Olszak, 2018).

In organizations, creativity emerges from a dynamic "creative situation," where individual, group, and organizational characteristics interact to shape creative behavior. This situation is influenced by both social and environmental factors, which encourage actions that go beyond compliance to produce valuable, novel outcomes (Spencer et al., 2022; Woodman et al., 1993). Creative behavior is thus defined by acts of innovation and problem-solving that transcend cognitive functions alone, enabling individuals to overcome self-imposed and external limitations to innovate, design, and think independently (Byrge & Hansen, 2009; Uribe & Cabra, 2013).

The organizational creative process is deeply affected by the synergy between creative situations and the behaviors of individuals and groups. A multi-level model of organizational creativity describes this process as an intricate interaction between personal, group, and organizational creativity, encompassing both internal and external influences (Amabile, Goldfarb, & Brackfield, 1990; Woodman et al., 1993). Research links organizational effectiveness closely to employee creativity, though effectiveness measures vary based on mission, work nature, and environmental context. Understanding an organization's structure, values, and operational methods is crucial to evaluating its effectiveness (Heerwagen, 2016).

Amabile (2011, 2016) highlights three core elements for nurturing organizational creativity: domain-relevant skills, creativity-relevant cognitive processes, and intrinsic task motivation. Domain-specific

expertise, built on extensive knowledge and technical skills, is essential for generating innovative technological solutions and recognizing alternative solutions (Bettencourt et al., 2016). Creativity-relevant processes - such as flexible thinking, inquiry, and openness to diverse perspectives - enhance problem-solving by promoting ideation and resilience (Khoiriyah & Husamah, 2018). These processes, including personality traits like risk-taking and tolerance for ambiguity, support both idea generation and disciplined execution (Amabile, 2011; Byrge & Hansen, 2009).

Conceptually, creativity might be seen as a combination of personal traits, resources, and contextual factors, with process models delineating the steps for synthesizing these elements over time. Amabile's framework identifies five critical environmental factors that shape organizational creativity: encouragement of creativity, autonomy, resources, pressures, and constraints (Amabile et al., 1996; Tuan & Rajagopal, 2019; Qian & Kee, 2023). These are divided into specific dimensions to form a structured assessment of work environments that foster the development of creative ideas, providing a reliable tool for evaluating and cultivating organizational creativity.

In the context of entrepreneurial universities, particularly with an emphasis on digitalization and artificial intelligence (AI), creativity emerges as a crucial soft skill that underpins innovation and problem-solving. The dynamic interaction between individual, group, and organizational characteristics fosters a "creative situation," which serves as a context conducive to creative behaviors both at the individual and collective levels. A "creative situation" refers to the social and environmental factors that shape and influence creative behavior, encompassing both contextual and interpersonal elements (Spencer et al., 2022; Woodman et al., 1993). Creative behavior itself transcends simple compliance, involving actions that lead to novel and valuable outcomes, which are not limited to cognitive reasoning but also include creative processes that produce original and useful results (Byrge & Hansen, 2009; Uribe & Cabra, 2013). Such behaviors enable individuals to overcome both internal and external constraints, fostering individualism, creation, innovation, and the capacity to solve complex problems.

Within organizations, the creative process is significantly impacted by these "creative situations" and the behaviors that emerge from them, which are illustrated through a multi-level model of organizational creativity. This model highlights the intricate relationships between individual creativity, group dynamics, and organizational structures, all of which contribute to both the creative process and its outcomes. The model also incorporates external factors that influence creativity, such as intra-organizational and individual dynamics (Amabile, Goldfarb, & Brackfield, 1990; Woodman et al., 1993).

Research has consistently shown a strong link between organizational effectiveness and the creativity of employees. The specific criteria for assessing organizational effectiveness vary based on factors such as the organization's mission, environmental context, the nature of its operations, and the demands of its customers. Understanding the mechanisms, structure, and core values of an organization is essential for assessing its effectiveness (Heerwagen, 2016). Amabile (2011, 2016) identifies three key components necessary to foster creativity within organizations: 1) domain-relevant skills, 2) creativity-relevant cognitive processes, and 3) intrinsic motivation for the task at hand. Domain-relevant expertise, including an individual's knowledge, skills, and experience, is essential for technological innovation, as it provides the foundation for generating and integrating new ideas and addressing complex challenges (Bettencourt, Bond, Cole, & Houston, 2016). Creativity-relevant processes, such as creative thinking and idea evaluation, are critical for generating novel solutions and fostering an open-minded approach to problem-solving (Khoiriyah & Husamah, 2018). These processes include cognitive styles and personality traits, such as risk-taking, independence, and the ability to approach problems unconventionally, as well as the capacity for disciplined effort and idea generation. The ability to synthesize information flexibly and break free from rigid cognitive schemas is essential for creativity, alongside traits like self-discipline and a tolerance for ambiguity (Amabile, 2011; Byrge & Hansen, 2009).

Promoting creativity in organizations requires a strategic, supportive approach. As Zhou (2008) argues, innovation is the result of creativity, which involves both generating and implementing new ideas.

Leading organizations prioritize employees who exhibit creative problem-solving skills, understanding that while creativity may seem unstructured, introducing focused constraints can enhance it. Structured approaches, such as clear task organization, targeted training, and effective leadership, are shown to boost team creativity (Macerauskiene & Turcinskaite-Balciuniene, 2018; Sauber & Tschirky, 2006). Research suggests that creativity often flourishes in diverse groups, where varied backgrounds, whether in knowledge, culture, or experience—lead to a broader range of perspectives and innovative solutions (Jarboe, 1999; Paulus & Nijstad, 2003). As Byrge and Hansen (2009) note, diverse teams are better at generating ideas because creativity thrives in collaborative environments where individuals bring different viewpoints and problem-solving approaches.

For entrepreneurial universities focused on the digital transformation and the integration of AI, fostering creativity is not just a soft skill but a strategic priority. Creative thinking enables students, faculty, and staff to navigate the challenges of a rapidly changing technological landscape, creating innovative solutions to complex problems. As digitalization and AI continue to reshape industries, the ability to think creatively becomes a core competency for organizational success, driving the development of new technologies, business models, and educational frameworks. By cultivating an environment that stimulates creativity while minimizing obstacles, universities can enhance their capacity for innovation and remain competitive in an increasingly digital world.

This study aims to explore how creativity and digitalization, supported by AI-powered tools, can be effectively integrated into the entrepreneurial university model to prepare students for the challenges of a digital economy. The research seeks to answer the following question: How can entrepreneurial universities leverage creativity and digitalization to foster innovation and reduce disparities in access to AI-driven tools?

METHODOLOGY

In this study, a qualitative foresight study was conducted using scenario analysis to investigate the significance of creativity and digitalization in entrepreneurial universities. Scenario analysis is an established foresight method that anticipates diverse potential futures by exploring the interplay between key factors and uncertainties. Scenario analyses are used to inform decision-makers (Hurmekoski & Sjølie, 2018). Unlike single-outcome predictions, scenario analysis accommodates the complex, uncertain nature of future developments by constructing multiple, plausible scenarios. This approach is particularly suited for complex fields like development policy and education, where evolving digital tools and skills can influence future trajectories (Kosow & Gaßner, 2008). Scenario development as a planning tool involves creating diverse visions of the future, often looking a decade or more ahead, which is a longer time horizon than most other foresight methods. Scenario planning, or scenario learning, has shown itself to be a structured approach for envisioning potential futures, allowing decisions to be tested in various hypothetical contexts (Schoemaker, 1995). It is an effective way to pose “what if” questions that probe the impacts of uncertainty. By examining distinct possible futures, the focus shifts from predicting the most probable outcome to considering the consequences and identifying the most suitable actions for various potential situations (Duinker & Greig, 2007). Since one author is an expert in creativity methodology, with extensive experience in teaching and practicing creativity in both higher education and business settings, her background provided an informed perspective on how creativity can be applied and taught effectively in entrepreneurial environments. The other author holds a PhD in distance education and has published several articles discussing how to integrate AI in higher education, enhancing their understanding of digital learning strategies and AI's role in remote and blended learning environments. This expertise helped in exploring the intersection of digital tools and education within entrepreneurial universities.

To validate the scenarios, a two-step process was implemented. First, the initial draft scenarios were reviewed by two experts to assess their plausibility, relevance, and coherence. Feedback was incorporated to refine the scenarios, ensuring alignment with the identified critical factors. Second, the scenarios were cross validated against historical and current trends in entrepreneurial education

Scenario analysis, while a valuable tool for exploring future possibilities, has certain limitations. Its speculative nature means that scenarios rely on assumptions and projections about trends and

uncertainties, which may not fully materialize. The method's outcomes are influenced by the expertise and perspectives of participants, making it susceptible to biases and gaps in knowledge. Additionally, while cross-validation against historical and current trends enhances plausibility, it cannot guarantee the accuracy of long-term predictions. Furthermore, the complexity of the method and its reliance on qualitative data can make it challenging to quantify outcomes or provide definitive guidance. Despite these challenges, scenario analysis remains a powerful approach for addressing uncertainty and informing strategic decisions, especially when used alongside other planning tools.

Scenario-Building Process



Figure 1. Scenario Building Process

Scenario analysis process

The scenario analysis process followed the phases outlined by Kosow and Gaßner (2008) to explore how creativity and digitalization could transform entrepreneurial education. The initial phase involved defining the focus area—entrepreneurial universities—and highlighting key aspects, such as creativity and digitalization, that influence entrepreneurial success, digital transformation, and skill development. In the next phase, critical factors were identified through a systematic process that included expert input, literature review, and iterative discussion sessions, including digital collaboration tools, AI-powered adaptive learning platforms, and virtual prototyping tools for student projects, along with uncertainties like institutional investment in technology, faculty training, and student access to AI resources. Authors' expertise contributed to identifying and refining the key drivers of change and uncertainties that shaped the scenarios. Factors such as faculty training, institutional investment, and student access to AI resources emerged as critical components through a combination of thematic analysis of expert insights and a review of current academic literature. Each of these factors was analyzed for potential future states, assessing how developments such as AI-powered learning might either enhance personalized learning or widen digital divides. These insights informed the creation of two scenarios: (1) AI-Augmented University, where high digital adoption drives creativity and innovation; (2) The Digital Divide in Education, in which unequal access to digital tools creates disparities among institutions. Finally, insights from these scenarios were applied to develop strategic recommendations for entrepreneurial universities, emphasizing policy support, investment in technology, and faculty training to ensure that creativity and digitalization can enhance student outcomes and institutional competitiveness.

Scenario 1: The AI-augmented Entrepreneurial University

As Laima walks into the university campus, her AI-powered assistant, integrated into her device, greets her with a personalized daily plan. It highlights her upcoming classes, project deadlines, and even suggests tailored resources based on her recent performance and interests. Her first stop is an "Innovation Lab" session, where students are grouped by AI algorithms that consider their skills, project needs, and learning styles. Today, Laima is paired with a mix of students from different backgrounds to work on a sustainable product design challenge, with AI providing instant feedback and suggestions as they brainstorm ideas. In the lab, Laima accesses her project on a large interactive screen. The AI-driven platform reviews her past work, identifying areas for improvement and suggesting new angles based on the latest industry trends. She quickly runs a virtual prototype of her design, adjusting materials and features as the AI models different outcomes in real time. By lunch, Laima has refined her prototype and has a clearer vision for the final product, thanks to the AI's support in concept development and feasibility testing. Later, in her "Entrepreneurial Strategies" class, Laima's AI mentor has prepared a customized simulation based on her strengths and development areas. She navigates a scenario where she must make decisions about scaling a startup, facing real-time challenges and data-driven obstacles. The simulation adapts as she progresses, pushing her to refine her decision-making skills. By the end of the day, Laima reviews her achievements and areas for growth, with AI summarizing her performance and suggesting resources to prepare her for tomorrow's tasks.

Key aspects of the ai-augmented entrepreneurial university

Personalized learning

In the AI-Augmented Entrepreneurial University, it can be said that personalized learning is the basis for every student's educational experience, adapting to their unique strengths, needs, and goals (Sajja et al., 2024; Strielkowski et al., 2024). Upon enrollment, each student is assigned an AI-powered learning assistant that acts as a personal guide throughout their academic journey. This AI assistant constantly monitors and analyzes their progress, preferences, and performance, providing tailored recommendations and adjustments in real time. The result is a dynamic, customized educational pathway that grows with the student, optimizing their learning experience day by day.

Adaptive Learning Platforms: Every course Laima takes is hosted on a platform that adapts to her learning style. For example, if Laima excels in conceptual problem-solving but struggles with technical details, the AI-driven system automatically adjusts her curriculum, offering more in-depth resources, tutorials, and practice exercises on the areas she needs to develop. The adaptation occurs seamlessly, with the system generating new content that aligns with Laima's pace, interests, and comprehension level.

Real-Time Feedback: Laima receives instant, actionable feedback on her assignments, projects, and class participation. After submitting an assignment, she doesn't have to wait days for an evaluation; instead, the AI immediately assesses her work, highlighting areas where she did well and pinpointing sections where improvement is needed. The feedback goes beyond simple grading, offering suggestions for additional resources or activities to strengthen her understanding.

Mentorship Matching and Networking: The AI also connects Laima with mentors based on her evolving interests and career goals. Through data-driven matching, Laima can engage with faculty, alumni, or industry professionals who align with her specific entrepreneurial ambitions. For example, if Laima is working on a sustainable product, the AI assistant might connect her with a mentor who has experience in eco-friendly startups. The AI schedules virtual or in-person meetings with mentors, ensuring that Laima builds a network that supports her growth and opens doors to future opportunities.

Customizable Learning Goals and Milestones: Laima's AI assistant helps her set personalized learning goals and milestones that are meaningful to her career aspirations. For instance, if Laima aims to launch a startup by graduation, AI structures her learning path to include business planning, financial modeling, and pitch practice as priority skills. The assistant tracks her progress toward these goals, prompting her with new tasks, challenges, or projects that keep her on track and aligned with her ambitions. At the end of each semester, the AI assistant provides a progress report, showing how close Laima is to achieving her targets and suggesting the next steps.

Contextualized Learning Resources: The AI system constantly provides a library of resources for Laima, from articles and research papers to videos and hands-on exercises, based on the latest trends in her field. It even integrates live data from industry sources, making Laima's education highly relevant and

up-to-date. If Laima is interested in learning about sustainable materials, the AI assistant might recommend recent articles, connect her with ongoing university projects, or offer simulation exercises to test her knowledge.

Creativity and innovation enhancement

In the AI-Augmented Entrepreneurial University, creativity and innovation are at the heart of the learning experience, empowered by advanced AI tools that encourage students to think outside the box, experiment with new ideas, and develop solutions to real-world problems. The AI-rich environment actively supports students like Laima in exploring unique concepts, refining them into viable projects, and collaborating with peers in a way that mirrors industry practices. This approach produces a mindset of continuous innovation, preparing students to be proactive, adaptable entrepreneurs.

AI-Driven Idea Generation: The university's AI tools are designed to stimulate creative thinking and help students generate unique ideas. Laima begins each project with an AI-powered brainstorming assistant that guides her through structured thinking exercises and prompts her to explore a variety of angles she might not consider on her own. For instance, if Laima is working on a project related to sustainable design, the AI provides targeted questions, relevant market insights, and examples from similar industries to inspire innovative solutions. The assistant uses data from industry trends, market research, and even social media to present Laima with emerging topics and patterns, ensuring her ideas are fresh and aligned with current demands. AI- ideation tool also adapts based on Laima's past projects and feedback, encouraging her to continuously refine her creative process and deepen her understanding of complex problems.

Digital Prototyping: Once Laima has a concept, she can move into the prototyping phase using AI-powered digital design tools. These tools allow her to bring her ideas to life, experimenting with various materials, structures, and designs in a virtual space before committing to a physical prototype. For instance, if Laima wants to test a new product design, the AI prototyping software enables her to visualize and manipulate the design in 3D, assessing factors like durability, environmental impact, and usability. The AI provides real-time feedback on each iteration, suggesting improvements and highlighting potential issues that may affect the product's viability. Laima can also run simulations to predict how her prototype might perform under different conditions, saving her time and resources by identifying flaws early. This digital prototyping capability accelerates the innovation process, empowering Laima to quickly test and refine her ideas before taking them further.

Collaborative Virtual Environments: Collaboration is the key part of the entrepreneurial learning process (Hannon et al., 2005; Marques et al., 2023), and AI-enhanced virtual environments provide Laima with the tools she needs to work effectively with her peers, regardless of their physical location. These collaborative platforms replicate a real-world team setting, allowing Laima to interact, share ideas, and build projects with classmates from diverse backgrounds. For example, Laima might join a virtual workspace where she and her team use AI-driven brainstorming boards, shared design tools, and project management applications to organize their work. The AI continuously tracks the team's progress, sending reminders, suggesting resources, and offering feedback on their tasks. Laima can even collaborate on 3D models in real-time, discussing design changes and testing ideas with her team instantly. This immersive, collaborative environment encourages teamwork, problem-solving, and creativity, equipping Laima with essential skills for the entrepreneurial world where cross-functional and remote teams are increasingly common.

Entrepreneurial skill development

In the AI-Augmented Entrepreneurial University, the development of entrepreneurial skills is central to preparing students for real-world business challenges (Khan & Ahmad, 2023; Marques et al., 2023). This environment is enriched by AI tools that simulate real-world scenarios, provide data-driven insights, and offer hands-on experience in essential business practices. Through interactive, AI-powered learning experiences, students like Laima are equipped with the skills needed to launch, manage, and grow their ventures. This approach combines theory with practical, scenario-based exercises that help students build a foundation in entrepreneurship, enhancing their ability to make informed decisions, analyze market trends, and manage resources effectively.

Scenario-Based Learning: The university integrates scenario-based learning modules that allow students to engage in simulated business situations, preparing them for the complexities of real-life

entrepreneurship (Ahmad, 2020). For example, Laima might participate in an AI-generated scenario where she is tasked with launching a product in a competitive market. Throughout the simulation, the AI introduces various challenges, such as managing production delays, handling customer complaints, or responding to market shifts. Each decision Laima makes within this virtual environment affects the outcome, and the AI offers feedback on her choices, helping her understand the potential impacts of her strategies. By navigating these realistic business scenarios, Laima learns to make quick, informed decisions under pressure, building skills in risk assessment, adaptability, and strategic thinking—qualities essential for successful entrepreneurship.

Business Analytics and Forecasting: Understanding market dynamics and customer preferences is crucial for any entrepreneur (Khandare et al., 2022; Morrish, 2011; Stokes, 2000), and the university's AI-powered business analytics tools help students develop these insights. Laima has access to platforms that analyze real-time market data, consumer behavior, and industry trends, allowing her to make data-driven decisions. For instance, if Laima is working on a business plan, the AI system can forecast potential revenue based on market trends, helping her assess the profitability of her idea. Additionally, the AI platform can conduct competitor analysis, track emerging market patterns, and evaluate customer sentiment from social media and other sources. This access to comprehensive data analytics allows Laima to anticipate changes in the market, identify growth opportunities, and develop a competitive strategy. By using these tools, she gains practical experience in business intelligence, an essential skill for modern entrepreneurs.

Financial and Operational Modeling: Financial literacy and operational planning are fundamental to launching and sustaining a successful business and its importance is well-emphasized in the literature (Dahmen & Rodríguez, 2014; Khandare et al., 2022; Stokes, 2000; Urefe et al., 2024), and AI-powered modeling tools at the university help students build these skills. Laima can use these tools to create detailed financial projections, budget plans, and operational workflows for her projects. For example, if she wants to forecast expenses and revenue for a startup idea, the AI platform guides her in constructing a model that includes costs, funding sources, and profit margins. As Laima inputs different variables—such as pricing changes or scaling production—the AI adjusts her projections, showing her the potential financial outcomes. Additionally, the operational modeling tools allow Laima to simulate production timelines, supply chain logistics, and staffing requirements, enabling her to see how various factors interact and affect overall efficiency. This hands-on practice in financial and operational modeling provides Laima with a realistic understanding of resource management, cost control, and long-term planning.

Expected outcomes for scenario 1

Enhanced Innovation: The use of AI tools in this scenario encourages a culture of continuous innovation among students and faculty. With access to AI tools, digital prototyping software, and real-time market analysis, students can explore new ideas and develop them into tangible products or services more efficiently. AI helps them to see connections between different concepts, identify emerging trends, and test their ideas quickly through virtual simulations. This not only speeds up the creative process but also allows students to take more risks and experiment without the high costs typically associated with failure in real-world settings. As a result, the university becomes a breeding ground for fresh, inventive solutions that can be directly applied to real-world problems.

Tailored Learning Pathways: One of the key benefits of the AI-enhanced learning environment is the creation of tailored educational experiences for each student (Pawar, 2023; Sundari et al., n.d.; Z. Xu, 2024). Through adaptive learning platforms and AI-powered assistants, students like Laima receive customized guidance that aligns with their strengths, interests, and career goals. For example, if a student excels in creative problem-solving but needs more support in financial planning, the AI adjusts the curriculum to provide additional resources and exercises in those areas. This personalized approach ensures that students' progress at their own pace, allowing them to master skills more deeply and efficiently. It also helps them to focus on areas most relevant to their entrepreneurial ambitions, making their education more meaningful and directly applicable to their future careers.

Strengthened Entrepreneurial Skills: Through scenario-based learning exercises, AI-driven business simulations, and data analytics tools, students gain hands-on experience in decision-making, strategic planning, and market analysis. They learn how to navigate challenges such as scaling a business, managing resources, and adapting to market changes, all within a safe, simulated environment. This

kind of practical training helps students build resilience, adaptability, and strategic thinking, which are essential for thriving in competitive markets. By graduation, students have a comprehensive toolkit of entrepreneurial skills that position them to succeed in both startup and corporate environments.

Increased Engagement and Collaboration: Virtual collaborative environments powered by AI allow students to work together seamlessly on projects, regardless of location, fostering a global perspective and a spirit of teamwork. AI systems can analyze group dynamics and suggest optimal team configurations, matching students with complementary skills to maximize their potential in group projects. Additionally, the immediate feedback and personalized learning pathways provided by AI keep students more engaged in their coursework, as they can see their progress in real-time and adjust their learning strategies accordingly. Engagement in education not only enhances the overall learning experience but also encourages a culture of mutual support and continuous improvement, where students learn from each other and push the boundaries of what they can achieve together.

Scenario 2: The Digital Divide in Entrepreneurial Education

In an AI-powered classroom at a top-tier university, Antanas logs into his personalized learning platform, which greets him with an overview of his progress and customized resources. His AI assistant suggests project ideas based on current market trends and connects him with a mentor specializing in sustainable startups. Antanas's course on business analytics involves real-time data simulations, allowing him to explore market changes and forecast outcomes for a mock business he's developing. He collaborates with teammates in a virtual workspace, using AI-driven tools to refine their ideas, adjust financial projections, and even prototype their product in 3D. By the end of the day, Antanas receives instant feedback from the AI on his project, along with suggestions for next steps. Antanas feels empowered, supported, and prepared for his future career in entrepreneurship.

Meanwhile, across town at an under-resourced university, Daiva attends her entrepreneurship class in a traditional lecture hall. Without access to digital resources, her learning consists of printed handouts and slides projected by her instructor. Unlike Antanas, Daiva has no AI assistant to offer personalized guidance, so she follows the same curriculum as everyone else, with few options to tailor her learning to her interests. During her break, Daiva checks online resources and watches public tutorials, trying to fill the gaps in her learning, but she struggles to keep up with the rapid advancements in AI-driven entrepreneurship. Her course lacks hands-on experiences with data analysis or business simulations, and project feedback comes weeks later, making it challenging to make timely adjustments. Daiva finishes her day feeling uncertain and underprepared, aware of the growing gap between what she's learning, and the skills demanded by today's market.

Key aspects of the digital divide in entrepreneurial education

In this scenario, the digital divide between universities becomes a defining feature of entrepreneurial education (Hill & Lawton, 2018; Soomro et al., 2020). Key differences emerge between well-funded institutions with advanced digital resources and those with limited access to AI and digital tools. These disparities affect not only the quality of education but also students' ability to develop critical skills, experience hands-on learning, and compete in a technology-driven job market. The following elements illustrate how the digital divide impacts various aspects of entrepreneurial education.

Access to AI and Digital Resources

At his well-funded university, Antanas benefits from a suite of AI-powered tools, including a personalized learning assistant that tracks his progress, offers tailored resources, and suggests projects aligned with his career goals. He also has access to virtual labs and business simulators, which allow him to explore hands-on concepts and practice essential skills in a controlled environment. With these resources, Antanas gains a deep understanding of digital tools and develops practical skills that will serve him well in his entrepreneurial endeavors.

At her university, Daiva's access to digital tools is limited. Without AI support or adaptive learning platforms, she must rely on traditional lectures and printed materials. She has no personalized guidance, and there are no virtual labs where she can experiment with entrepreneurial concepts. This lack of access to modern digital resources makes it difficult for Daiva to develop hands-on experience with the

technologies that are becoming crucial in today's business world, putting her at a disadvantage compared to peers like Antanas.

Educational Quality and Curriculum Design

Antanas's university offers an innovative curriculum that evolves with industry trends. His classes are interactive, incorporating AI-driven case studies and real-world simulations that challenge him to think critically and creatively. The curriculum is flexible, allowing Antanas to choose courses and projects that align with his goals, making his education highly relevant to the current entrepreneurial landscape.

At Daiva's university, the curriculum is largely traditional and lecture-based, with limited opportunities for interactive or technology-driven learning. Daiva's education lacks the hands-on projects and adaptive coursework that are available to Antanas, leaving her with fewer options to tailor her studies to her entrepreneurial ambitions. Without a dynamic, tech-focused curriculum, Daiva's education feels disconnected from the demands of the modern business world.

Skill Development and Practical Training

Antanas's university emphasizes skill-building through practical training. He regularly works with AI-driven business simulators that allow him to practice decision-making, analyze market trends, and experiment with startup ideas in a risk-free environment. These experiences help Antanas develop a foundation in data analysis, market forecasting, and digital collaboration, preparing him with the skills that will give him a competitive side.

Without access to advanced digital tools, Daiva's university focuses more on theory than practical training. She lacks opportunities to engage with tools like business simulators or market analysis software, which are necessary to developing entrepreneurial skills. Daiva graduates with a primarily theoretical knowledge base, with limited experience in applying her learning to real-world situations. This skill gap makes it harder for her to compete with peers who have had hands-on training in advanced digital tools.

Competitiveness and Employability of Graduates

By the time he graduates, Antanas is highly prepared for the job market. His experience with AI tools, digital simulations, and data-driven decision-making makes him attractive to employers and gives him the confidence to consider launching his own business. The skills Antanas developed at his university position him well in a competitive, tech-driven landscape.

Daiva finds herself at a disadvantage when she enters the job market. Her limited experience with AI tools and lack of practical training make it difficult for her to compete with graduates from more digitally advanced institutions. Daiva's struggle to adapt to the technology-driven demands of today's entrepreneurial world limits her career options and diminishes her confidence as an aspiring entrepreneur.

Institutional Reputation and Funding Challenges

Antanas's university is widely recognized as an innovative leader in entrepreneurial education, attracting high-caliber students, faculty, and funding from industry partners. This reputation allows the university to continually improve its digital resources and maintain a forward-thinking curriculum, reinforcing its status as a top institution.

Daiva's university faces challenges in securing funding and partnerships, as its lack of digital infrastructure makes it less appealing to potential stakeholders. This funding gap further limits the university's ability to modernize its curriculum or provide students with advanced digital tools. As a result, the university's reputation makes it more difficult to attract resources that could help bridge the digital divide.

Expected outcomes for scenario 2

Diverging Educational Quality: Students at well-funded universities enjoy a robust educational experience that includes access to advanced digital tools, AI-driven learning platforms, and interactive simulations. This digital integration enables hands-on learning opportunities that bring entrepreneurial concepts to life. For example, students can engage in real-time data analysis, use virtual labs, and participate in business simulations that mimic real-world challenges. By contrast, students at under-resourced universities often rely on traditional, lecture-based education with minimal access to interactive tools. Without AI support or adaptive learning platforms, their curriculum is more static, limiting their ability to engage with practical, real-world applications. This creates a gap in educational quality between students at well-equipped institutions and those at universities with fewer resources, impacting students' overall learning experiences and career readiness.

Widening Skill Gaps: Graduates from universities that embrace digitalization develop crucial skills in data analysis, digital collaboration, and AI-assisted decision-making—abilities that are highly sought after in today's job market. Through exposure to digital tools, these students learn to analyze trends, work with market data, and make informed decisions, all of which are essential in entrepreneurship and modern business roles. Conversely, students at universities with limited digital resources graduate with theoretical knowledge but lack practical skills. Without hands-on training in digital tools and AI systems, these students may struggle to adapt to environments that demand tech-savvy, innovative thinking. This gap in skill development can hinder their competitiveness and may require them to seek additional training post-graduation to bridge these deficiencies.

Institutional Inequality and Reputation Disparity: Universities with advanced digital infrastructure build reputations as leaders in innovation and entrepreneurship, attracting top-tier students, faculty, and industry partnerships. These institutions often receive more funding and support from government bodies and private investors, allowing them to continue improving their digital capabilities and strengthening their position in the higher education landscape. On the other hand, universities that delay digital adoption face challenges in attracting funding, partnerships, and top students. The perception of being “behind the times” can make these institutions less appealing to stakeholders, limiting their ability to upgrade their infrastructure and integrate digital tools. This maintains a cycle of inequality, as well-funded universities become stronger while under-resourced institutions struggle to keep up.

Increased Economic and Social Inequality: Students from well-funded, digitally advanced universities gain access to high-quality education that prepares them for well-paid, tech-driven careers. They are better equipped to enter high-paying industries, start their own businesses, or secure competitive roles in established companies, leading to greater economic stability and upward mobility. Students from under-resourced universities, however, may face limited job prospects and fewer opportunities for career advancement. The lack of digital training and practical experience can affect their earning potential, contributing to broader social and economic inequalities. This disparity may be particularly evident in technology-intensive fields, contributing to the widening socioeconomic gap as graduates from various institutions pursue distinct professional paths.

DISCUSSION

As entrepreneurial universities attempt to produce business-ready graduates, it becomes essential to integrate creativity and digital tools as core components of the educational experience. This approach not only prepares students to navigate the evolving demands of the digital economy but also fosters innovation and adaptability—qualities crucial for entrepreneurship. However, the identified scenarios, particularly the Digital Divide in Entrepreneurial Education, raise concerns about inequality in educational access and outcomes, pointing to the need for a balanced, inclusive approach to digitalization in higher education.

The AI-Augmented Entrepreneurial University scenario illustrates how AI can significantly enhance students' creative and innovative capacities, aligning with literature that highlights AI's role in fostering novel ideas and adaptive problem-solving skills (Huang & Rust, 2018). Personalized learning systems, adaptive feedback, and AI-driven ideation tools enable students to think creatively, develop entrepreneurial skills, and refine their projects in real-time as mentioned by Guerrero-Cano et al. (2006), who argue that the entrepreneurial university model must provide a supportive infrastructure for student-driven innovation. By equipping students with tools to experiment, iterate, and innovate, entrepreneurial universities create a conducive environment for the cultivation of creativity as a core soft skill. Furthermore, existing research indicates that AI's potential to generate, evaluate, and refine ideas

(Schwab, 2017; Jackson, 2016). For example, students can use AI-driven digital prototyping tools to simulate and test their business concepts, helping them to identify viable solutions and streamline the ideation process (Westermann et al., 2019). This enhanced capacity for creative problem-solving and innovation provides entrepreneurial university graduates with a competitive edge in the workforce, as they are better equipped to adapt to and lead within rapidly changing industries (Bakhshi et al., 2017).

The Digital Divide in Entrepreneurial Education scenario highlights inequalities in access to AI and digital tools across institutions. Universities with limited resources often struggle to implement advanced digital infrastructure, resulting in reduced educational quality and a lack of hands-on, experiential learning opportunities for students. This finding reinforces the conclusions of prior research by De Freitas and Oliver (2005), which emphasizes the importance of technology in providing meaningful, skills-based learning experiences in higher education. Without access to AI-powered tools and platforms, students in under-resourced institutions may be at a disadvantage in developing critical digital skills, thereby limiting their employability and entrepreneurial potential (Vincent-Lancrin & Pfothenauer, 2020). The consequences of the digital divide are particularly pronounced in entrepreneurial education, where practical, tech-driven skills are essential for success. As Schwab (2016) notes in discussions on the Fourth Industrial Revolution, access to advanced technologies is a determinant of both individual and institutional success in a highly competitive global economy. The digital divide risks reinforcing inequalities between students at well-resourced institutions, who are equipped with cutting-edge tools, and those at under-resourced universities, who may lack exposure to critical technological competencies. This gap can widen socioeconomic inequalities, as graduates from digitally advanced universities enter higher-paying industries with competitive skills, while those from institutions with fewer resources struggle to secure comparable roles (Urbach & Röglinger, 2018).

According to Rippa and Secundo (2018), the digital transformation of universities must be supported by a combination of governmental funding, industry partnerships, and institutional commitment to innovation. Investment in digital infrastructure and training for educators is essential for enabling all universities to provide equitable access to technology, regardless of resource constraints (Salamzadeh et al., 2011). Universities can also foster partnerships with technology companies, leveraging industry expertise and funding to enhance their digital capabilities. Such collaborations could help bridge the gap between resource-rich and resource-limited institutions, creating a more inclusive entrepreneurial education landscape (Guerrero-Cano & Urbano, 2012). Additionally, the literature suggests that an inclusive approach to digitalization in higher education should focus on building digital competencies and entrepreneurial skills across diverse fields of study. As Zhao and Frank (2003) point out, interdisciplinary collaboration in digital learning environments can promote the sharing of resources and best practices, thus fostering a more balanced distribution of digital tools and skills. By prioritizing policies that support digital equality, educational institutions can help to reduce skill disparities, ensuring that all students—regardless of their institution's funding level—have access to essential learning tools.

Several recommendations emerge to guide universities in adapting to a digitalized entrepreneurial model. First, universities should prioritize the integration of AI-powered tools and personalized learning platforms to support the development of creativity and innovation skills. Consistent with the recommendations of Van Vught (1999), entrepreneurial universities can implement adaptive learning systems and scenario-based simulations to provide students with realistic, practical experiences in business problem-solving and innovation. Second, universities must address the digital divide by advocating for funding initiatives and partnerships that ensure equitable access to digital resources. Studies by Etzkowitz (2004) and Rippa & Secundo (2018) suggest that university-industry collaboration can be an effective strategy for sharing costs and expanding access to digital tools, particularly for institutions with limited resources. By engaging with policymakers and industry leaders, universities can establish sustainable partnerships that foster a more inclusive, technology-driven educational environment. Lastly, entrepreneurial universities should develop strategic policies that encourage ongoing faculty development in digital competencies, particularly in areas involving AI and digital entrepreneurship. As noted by Etzkowitz (2012), entrepreneurial universities need faculty who are not only experts in their fields but also skilled in using digital tools to enhance learning outcomes. Faculty training initiatives, supported by institutional resources, are essential for creating a teaching force capable of guiding students in the use of AI and digital tools effectively (Fitzgerald et al., 2014).

CONCLUSION

The integration of AI and digital tools into entrepreneurial universities has profound implications for the future of education and the workforce. While the AI-Augmented Entrepreneurial University scenario demonstrates the potential for AI to enrich educational experiences and develop critical entrepreneurial skills, the Digital Divide scenario highlights the challenges of ensuring equitable access to these technologies. It is essential to acknowledge that recent global trends highlight widening gaps in educational access, particularly as digital tools become more integral to learning. For instance, UNESCO (2023) report indicates that unequal access to technology exacerbates disparities in skill acquisition, leaving under-resourced institutions and students at a significant disadvantage. This underscores the critical need for immediate and sustained efforts to bridge the digital divide. Moreover, this study contributes to the theoretical framework of entrepreneurial universities by emphasizing the dual importance of creativity and digitalization as interconnected drivers of innovation. By integrating scenario-based foresight analysis, the research provides a structured approach to understanding how these elements can be leveraged to address both opportunities and challenges in entrepreneurial education. This contribution enriches the literature on entrepreneurial universities, offering a nuanced perspective on how AI-powered tools and creative methodologies can prepare institutions to navigate and thrive in an evolving digital landscape. Addressing these challenges requires institutional commitment, strategic partnerships, and supportive policy frameworks that prioritize digital inclusivity. By embracing these approaches, entrepreneurial universities can equip all students with the skills and mindset needed to succeed in an increasingly digitalized world, fostering innovation and reducing socioeconomic disparities in the process.

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