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Heru Wijayanto Aripradono
Faculty of Economy and Business, Indonesia Open University; Information Technology Department, Batam International University, Indonesia. (email: heruwijayantoa@gmail.com)

Idayanti Nursyamsi
Post Graduate Department, Hasanuddin University, Indonesia.

Abdul Wahab
Faculty of Economics and Islamic Business, Alauddin State Islamic University, Indonesia.

Zulkifli Sultan
Faculty of Economy and Business, Indonesia Open University, Indonesia.

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Wijayanto, Heru is a seasoned practitioner and academic who began his professional journey as a developer. Born in Palembang, Indonesia, on 5 August 1979, Heru has built a diverse and extensive career over the years. He graduated from informatics engineering at the Sekolah Tinggi Teknik Surabaya (1997-2002). After finishing his Undergraduate degree, he continued to pursue his Master's degree in Information Technology Management at Sepuluh Nopember Institute Technology Surabaya (2003-2007). With a strong desire to learn something new, he pursued his dream to study International Business Management at IMI, Belgium (2007). Now, he is a lecturer and researcher in the Information Technology Department at Batam International University and a co-founder of Sociopreneur Indonesia.

Nursyamsi, Idayanti is a lecturer, researcher, and professor in economy and business. She was born in Ujung Pandang on 27 June 1969 and graduated from the Economic Management, Hasanuddin University, Makassar, Indonesia, with a specialization in Economic Management. Her Master of Economic Management academic degree is obtained from the University of Airlangga, Surabaya, Indonesia. She earned a doctoral degree in economic management from Brawijaya University, Malang, Indonesia, in 2008. Now, she is a

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Educational Technology for Digital Transformation of Higher Education Institutions into Entrepreneurial Universities

Abstract

Digital technology is transforming higher education institutions into entrepreneurial universities, which, in turn, supports economic development and knowledge generation. The integration of education technology enhances access, equity, inclusion, and the quality of learning experiences. This research aims to uncover how educational technology promotes digital transformation in Indonesia's higher education, fosters an entrepreneurial mindset, and contributes to social and economic growth. This study uses a quantitative approach with a survey method, with the data collected using purposive sampling. The questionnaire was designed to represent the indicators set in the variables, and the results were analyzed using the structural equation modeling (SEM) method. This study analyzes 45 universities aiming to become entrepreneurial institutions, with 155 respondents filling out the questionnaire. The integration of educational technology and digital transformation in higher education has significant implications, affecting teaching methods, administrative efficiency, and the educational environment. The entrepreneurial university model emphasizes collaboration and responsiveness to market needs, preparing graduates for a competitive job market. This shift requires a reassessment of traditional teaching methods and a shift in mission. The successful integration requires strategic planning, transformational leadership, investment in digital infrastructure, and fostering a culture of innovation.

Keywords:

education technology; digital transformation; entrepreneurial university

lecturer, researcher, and professor at the Postgraduate School of the Faculty of Economy and Business, Hasanuddin University, Makassar, Indonesia. She encourages students to develop the Spirit of Entrepreneurship and helps create young entrepreneurs who contribute to the economy and the community.

Wahab, Abdul lecturer at the Faculty of Islamic Economics and Business (FEBI) UIN Alauddin Makassar, was born in Bulukumba, South Sulawesi, Indonesia, on April 21, 1972. He obtained his Master's Degree (M.Si.) in Resource Economics at Hasanuddin University in 1998. Then he completed his doctoral education (Dr.) at the Doctoral Program in Economics (PDIE) at Hasanuddin University Makassar in 2008. Since 1998, he taught at several private universities in LLDIKTI region IX Sulawesi, Makassar City. In 2008, he started working as a lecturer and researcher in the Department of Economics, Faculty of Islamic Economics and Business, and in 2010, he started teaching at the Postgraduate Program at Alauddin State Islamic University, Makassar. From 2014 to 2019, he was appointed as Deputy Dean for General Administration, and since 2019, he has been a Chair of the Quality Assurance Group (GPM) in the Postgraduate Sharia Economics Study Program.

Sultan, Zulkifli is a lecturer and researcher in Economy and Business, especially in Human Resources Management. He graduated from the Economic Department, UIN Alauddin Makassar, in 2011 and earned his bachelor's degree. He then obtained his Master's in Management from Indonesia Muslim University, Makassar, in 2015. Then, he completed his Doctoral Degree at the Doctoral Program in Economics at Sekolah Tinggi Ilmu Ekonomi Tri Dharma Nusantara Makassar in 2020. Now, he works as a lecturer and researcher at the Management Science Graduate Program, Faculty of Economy and Business, Indonesia Open University. He is the managing editor of *Humanis*: Human Resources Management and Business Journal.

Introduction

Over the past three decades, the role of higher education institutions (HEIs) and their relationship with the surrounding environment have evolved (Berbegal-Mirabent et al., 2024; Berbegal-Mirabent & Ribeiro-Soriano, 2015; Ventura et al., 2023). A notable shift is in their functions that have become more entrepreneurial (Feola et al., 2021), aligned with the entrepreneurial university concept. Articulated by Etzkowitz in the triple helix model, the concept entails universities engaging in a third mission that fosters economic development by integrating research and educational outcomes into the economic framework (Etzkowitz, 2004, 2016; Etzkowitz et al., 2022). Therefore, universities must promptly respond to global developments to adapt and change to fit into the economic system.

Numerous internal and external factors have contributed to the transition to entrepreneurial universities. Internally, universities respond to the evolving environment by adopting entrepreneurial culture and practices (Etzkowitz et al., 2022). Externally, governments promote and facilitate this transition as part of their economic development strategy, as universities will become a critical driver of the knowledge-based economy and more relevant to external stakeholders (Guerrero et al., 2016; Guerrero & Menter, 2024; Klofsten et al., 2019). The efforts to transform into an entrepreneurial university have instigated significant alterations in the operational and interactive dynamics of universities within the broader social and economic context (Ferreira et al., 2018; Patrício & Ferreira, 2024). A primary internal driver of this transition is the necessity to survive and thrive in a progressively competitive and rapidly changing economic and employment landscape. Adopting entrepreneurial culture and practices enables universities to innovate, establish strategic business relationships, and commercially leverage their intellectual resources.

The idea of the entrepreneurial university originated in the 1980s and was subsequently adopted as a foundational reference by many universities globally. The concept was introduced and developed in 1983 at the Massachusetts Institute of Technology (MIT) and Stanford University, which characterized an entrepreneurial university as an institution that seeks novel funding sources, including patents, contract research, and industrial partnerships (Etzkowitz, 1983). The term was first introduced by Etzkowitz in 1998 in response to regional economic growth (Etzkowitz, 1998). The triple helix model delineates the interaction among universities, industry, and government entities to foster innovation (Erosa, 2012), establish incubating and support frameworks for faculty and students that allow them to initiate new enterprises (Alexander & Evgeniy, 2012), and promote entrepreneurship awareness and adoption (Bezanilla et al., 2020).

MIT and Stanford were initially regarded as oddities expected to fit the new model into the existing system (Etzkowitz, 2004). Today, however, they are celebrated as pioneers in shaping the concept of the entrepreneurial university. Their advancement impacted policymaking and inspired universities globally to replicate their model and that of Silicon Valley (Etzkowitz, 2003, 2004; Etzkowitz et al., 2019), thereby causing this academic paradigm to evolve and assume various functions within societal and eco-innovation systems (Redondo et al., 2022; Sam & van der Sijde, 2014; Wakkee et al., 2019). Universities that promote entrepreneurial initiatives are deemed more effective in the commercialization of scientific knowledge, particularly via patents and licensing or through the establishment of business and technology incubators (Dalmarco et al., 2018).

With such rising trends, studies on entrepreneurial universities have increased dramatically since Etzkowitz's 1983 research, reaching a notable peak in 2015. This has resulted in various clusters of information, as well as complexity and fragmentation in the literature (Arroyabe et al., 2022; Audretsch & Belitski, 2022). Nonetheless, previous research seems to agree on the definition of an entrepreneurial university: an institution that develops and fosters an entrepreneurial mindset and actively engages with external stakeholders to increase the social and economic value of the generated knowledge. This encompasses cultivating an entrepreneurial culture within the university (Treviño, 2020), delivering entrepreneurial education and training (Gianiodis & Meek, 2020), partnering with industry to advance entrepreneurship (Ruiz et al., 2020), facilitating technology transfer and commercialization of research outcomes (Cunningham & Menter, 2021; Saiz-Santos et al., 2017), promoting entrepreneurial leadership among faculty and administration (Tavella & Bogers, 2020), pursuing governmental support and policies to stimulate entrepreneurial activities (Al-Omar et al., 2024; Yoon & Son, 2023), and contributing to regional development through entrepreneurial initiatives (Bizri et al., 2019; Feola et al., 2021; Saiz-Santos et al., 2017).

The rise of entrepreneurial universities signifies a transformative change in higher education, as HEIs now function as both knowledge generators and active participants in global economic and social advancement (AR et al., 2021; Temel & Durst, 2018). In this context, HEIs serve not only as hubs for knowledge generation and transmission but also as active contributors to global economic and social advancement (Bizri et al., 2019; Feola et al., 2021). As such, they assume multifaceted responsibilities as contributors to global advancement and development.

The Indonesian government released Presidential Regulation No. 2 of 2022, aiming for a 3.95% entrepreneurship ratio and 4% new entrepreneurial development by 2024 (Presidential Regulation of Republik Indonesia, 2022). This directive directs ministries, institutions, and stakeholders, including HEIs, to implement National Entrepreneurship Development for 2021-2024, fostering creativity, innovation, and sustainability. HEIs can support the achievement of such goals by transforming from organizational entities into instruments of national economic development.

The *Tridharma* of Higher Education in Indonesia is the responsibility of universities in carrying out and coordinating education, research, and community service, according to Regulation of the Minister of Education, Culture, Research, and Technology Number 53 of 2023 concerning Quality Assurance of Higher Education (Ministry of Education, 2023). In transforming HEIs into entrepreneurial universities, the deliveries of the *Tridharma* of Higher Education could orient towards innovation, value creation, or both, and positive contributions to the environment and society.

Educational technology plays a pivotal role in the transformation of HEIs into entrepreneurial

universities, enhancing access, equity, inclusion, and quality of learning experiences. However, it also poses challenges, such as ensuring data privacy and security. Entrepreneurial universities are responding to this shift by adapting their educational frameworks to the digital economy, enhancing digital literacy, fostering innovation, and contributing to regional development (Aripradono, 2023; UNESCO, 2023). This transformation is crucial for addressing the evolving needs of students and the labor market, a shift accelerated by the COVID-19 pandemic (Zhang, 2022). Embracing digital transformation is thus critical for entrepreneurial universities to thrive in the modern educational environment.

For example, education technology enhances learning experiences through innovative teaching methods like blended and flipped classrooms, which may help promote autonomous learning, hence entrepreneurial skills (Akhmetshin, Kuderova, et al., 2019; Akhmetshin, Larionova, et al., 2019; Safiullin & Akhmetshin, 2019). Digital tools and platforms also provide access to resources, fostering a culture of continuous learning (Mavlutova et al., 2023; Pano & Gjika, 2020), and promote collaboration and networking among students, faculty, and industry partners, facilitating partnerships and innovation opportunities (Guerrero et al., 2015; Guerrero & Menter, 2024). Furthermore, data-driven decision-making informs curriculum development and teaching strategies (Cunningham & Menter, 2021), with their scalability and flexibility enabling HEIs to adapt to changing market demands and student needs (Wegner et al., 2020).

Genç et al. (2020) and Uslu et al. (2019) emphasize the role of educational technology in transforming HEIs into entrepreneurial entities. They believe that the commercialization of academic activities increases institutional revenue and helps shape the entrepreneurial identity of universities, emphasizing the necessity for a balanced strategy. Both results underscore the necessity for the intentional deployment of educational technology to facilitate HEIs' entrepreneurial ambitions.

While indicators related to knowledge and technology have improved significantly in Indonesia, the country's innovation performance still lags behind six other ASEAN nations. According to the Global Innovation Index 2023, Indonesia is ranked 61st globally in knowledge and technology (WIPO, 2023). This element is evaluated based on the number of technology patents generated, technology production, human resources factors, and research and development investments by multinational corporations. Despite the need for improvement, the rank still indicates the level of technology acceptance and utilization in Indonesia, including in the higher education sector. This makes the transformation of HEIs into entrepreneurial universities feasible, and they can become hubs of creativity and innovation and partner with industry to create entrepreneurs—the drivers of economic growth.

The integration of educational technology plays a pivotal role in the transformation of HEIs into entrepreneurial universities, whose process is multifaceted, involving a strategic alignment of educational practices, institutional support, and cultural shifts within universities (Dal-Soto et al., 2021). Educational technology, especially online learning platforms, has been recognized as a vital element in fostering entrepreneurial attitudes among students. For example, Zhang (2022) highlights that the affordance of online learning technology significantly impacts students' cognitive development and entrepreneurial behaviors as it diversifies interactions, such as learner-learner and learner-content engagements. Likewise, Uslu et al. (2019) argue that the concept of the entrepreneurial university has emerged, in part, from the need for universities to adapt to changing economic conditions, including leveraging technology for revenue generation and innovation. The incorporation of technology not only enhances the educational process but

also fosters an entrepreneurial mindset among students, which is crucial for the transformation into entrepreneurial institutions.

Entrepreneurial universities play a crucial role in fostering entrepreneurial growth and economic development in Indonesia. By advancing research and development, they not only impart knowledge but also stimulate economic activity. Furthermore, integrating entrepreneurial education into university curricula can enhance students' entrepreneurial intentions, leading to the establishment of new ventures that contribute to economic growth. However, the impact of entrepreneurship on economic growth in Indonesia has shown mixed results. For instance, research by Kadarusman (2020) shows that entrepreneurial ventures had a non-significant impact on GDP per capita growth from 1985 to 2017. To address such challenges, the entrepreneurial university model emphasizes aligning educational outcomes with market needs and fostering strong university-industry partnerships. This approach ensures graduates are equipped with the skills required for success in the entrepreneurial ecosystem. Collaboration between education, entrepreneurship, and educational technology is crucial for maximizing the potential of entrepreneurial universities to contribute to Indonesia's economic growth.

This research identifies the role of educational technology in facilitating HEIs' digital transformation to become entrepreneurial universities that produce graduates with an entrepreneurial mindset and spirit, thereby contributing to social and economic growth in Indonesia. This research analyzes Indonesian HEIs—both public and private—that leverage educational technology to facilitate the transformation into entrepreneurial institutions. The unit of analysis in this research is the university study programs.

The remainder of this paper is organized as follows. The next section outlines the backgrounds and phenomena relevant to the study, followed by the methodologies employed, results and discussion, and conclusions and recommendations.

Education Technology and Digital Transformation

Technology is rapidly transforming HEIs, influencing the design and development of educational delivery mechanisms. This transformation affects technical capacity, pedagogical practices, stakeholder acceptance, and administrative frameworks. Educational technology involves the systematic study and ethical application of methods to enhance learning and performance. It achieves this through the creation, utilization, and management of appropriate technological processes and resources (Chugh et al., 2023). Education technology involves the implementation and management of technology resources to improve learning, promote collaboration, and offer interactive and personalized learning experiences (Chugh et al., 2023; Cunningham & Menter, 2021; Flores et al., 2024).

Educational technology plays a crucial role in digital transformation by improving teaching effectiveness and equipping students with digital skills and competence. Integrating technologies such as smart lecture halls into educational settings improves learning efficiency and helps students develop critical digital competencies. Moreover, digital transformation in education enhances learning quality, reduces costs, and increases accessibility, making education more inclusive (Shenkoya & Kim, 2023).

The rapid growth of digital tools requires educational institutions to modify their curricula to build digital literacy and equip teachers and students to use emerging technologies effectively (Qazimi, 2023; Vaskov et al., 2021). Digital learning environments foster inclusivity and equity, which have always been the objectives of education worldwide (Deroncele-Acosta et

al., 2023; Palacios-Rodríguez, 2023; Zhou et al., 2023). As such, education technology is a fundamental requirement for institutions seeking to succeed in the digital age. The five indicators of technology implementation in education are Learning Management Systems (LMS), Interactive Technologies, Visualization and Mobile Technologies, Web-based tools, and Social Media Applications (Chugh et al., 2023; Cunningham & Menter, 2021; Flores et al., 2024).

H_1 : Education Technology (X) significantly influences Digital Transformation (Y1) leading to Entrepreneurial University.

Digital Transformation and Entrepreneurial University

Digital transformation is the thorough incorporation of digital technologies across all facets of university operations, encompassing teaching, research, administration, and community engagement (Kliewe et al., 2019). The objective of this transformation is to improve the university's capacity for innovation, collaboration with external stakeholders, and effective response to the changing requirements of the knowledge economy (Garcez et al., 2022; Jafari-Sadeghi et al., 2021). The adoption of digital tools and platforms enhances learning experiences, improves data-driven decision-making, and fosters partnerships with industry and government, thereby positioning the university as a key driver of economic and social development.

Digital transformation is essential for entrepreneurial universities as it enhances operational efficiency, brand identity, and educational effectiveness. It also optimizes administrative and educational processes, promotes innovation, and enables personalized learning experiences. An entrepreneurial ecosystem supported by technology allows universities to respond to market dynamics and societal demands, thereby establishing their leadership in education and innovation (Díaz-García et al., 2022; Mohamed Hashim et al., 2022). The five indicators of digital transformation in the context of the entrepreneurial university are enhanced learning experiences, collaboration and networking, data-driven decision-making, innovation ecosystems, and access to resources and funding (Díaz-García et al., 2022; Kliewe et al., 2019; Kuzu, 2020).

H_2: Digital Transformation (Y1) accelerates Higher Education transformation into Entrepreneurial University (Y2).

Education Technology and Entrepreneurial University

An entrepreneurial university is an HEI that promotes an entrepreneurial culture, conducts educational activities, engages with industry, enables technology transfer, and supports regional development (Audretsch & Belitski, 2021, 2022; Moussa et al., 2019). This approach integrates academic and entrepreneurial endeavors, fostering economic growth, facilitating knowledge transfer, and enhancing social impact, thereby equipping students for innovation and adaptability in a dynamic environment. It highlights the importance of innovation, collaboration with external stakeholders, and fostering an entrepreneurial mindset among students and faculty members (Kliewe et al., 2019). These universities serve as regional innovation centers, facilitating collaborations with industry and government to promote economic development and societal impact (Bukhari et al., 2021). They adapt to evolving market demands and pursue alternative funding sources to improve their independence and sustainability.

Educational technology is revolutionizing entrepreneurship education by improving its delivery and accessibility. This facilitates the incorporation of novel pedagogical approaches and materials, thereby improving students' entrepreneurial knowledge and competencies

(Gianiodis & Meek, 2020; Saiz-Santos et al., 2017). This approach notably affects graduates' choices to establish enterprises and contribute to economic growth (Secundo et al., 2019). The integration of technology in entrepreneurship education cultivates an entrepreneurial mindset in students, providing them with market opportunities and promoting economic and social development. The six indicators of an entrepreneurial university are orientation, strategy, people and capacity development, drivers and enablers, education and research, and innovation and impact (Audretsch & Belitski, 2021, 2022; Moussa et al., 2019).

H_3: Education Technology (X) significantly influences HEI's transformation into an Entrepreneurial University (Y2).

Methods

This research employed a quantitative methodology via a survey for data collection. Quantitative research methods are defined as approaches grounded in positivism to study specific populations or samples. The sampling techniques are random, and the data analysis is quantitative using statistical analysis, aiming to test the established hypotheses. This study employs an explanatory research design that investigates each variable to ascertain the existence or non-existence of a link based on the hypotheses constructed from the variables (Creswell & Creswell, 2018).

Research Model

This study utilizes three variables: (1) Education Technology (X), (2) Digital Transformation (Y1), and (3) Entrepreneurial University (Y2). This research focuses on entrepreneurship study programs and universities committed to becoming entrepreneurial institutions. The literature review, encompassing various concepts, theories, and empirical studies, establishes a correlation between the variables, illustrated as follows:

The hypotheses are:

H_1 : *Education Technology (X) significantly influences Digital Transformation (Y1) leading to Entrepreneurial University.*

H_2 : *Digital Transformation (Y1) accelerates Higher Education transformation into Entrepreneurial University (Y2).*

H_3 : *Education Technology (X) significantly influences HEI's transformation into an Entrepreneurial University (Y2).*

Data Collection and Analysis

This study uses purposive sampling as the primary data collection method, strategically selecting participants relevant to the research rather than relying on random sampling (Bryman, 2012). The subjects of this study are universities in Indonesia, both public and private, that aim to evolve into entrepreneurial institutions. The unit of analysis for this study was the study program organization, comprising the following

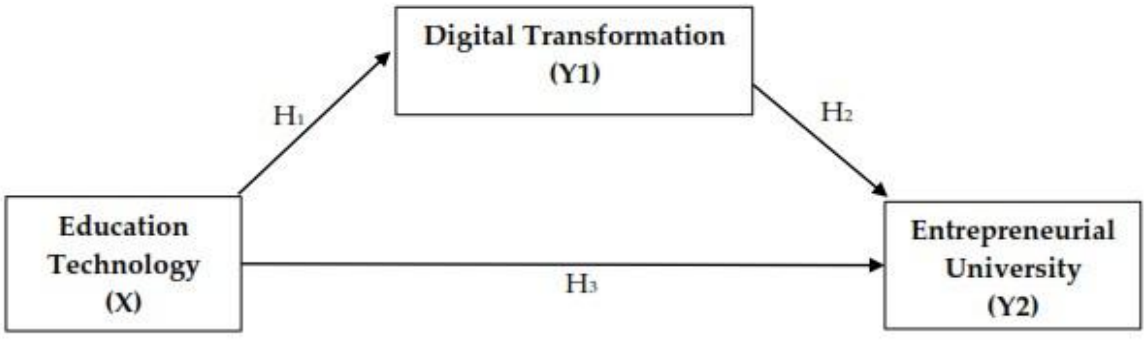

Figure 1. Research Model

Source: Processed by Author

respondents: (1) Heads of Study Programs, (2) Secretaries of Study Programs, and (3) Lecturers.

A study employing the Structural Equation Model (SEM) necessitates a sample size of at least 5 to 10 times the number of indicators in the questionnaire for data collection (Kline, 2015). According to the sampling theory, the total number of questionnaire items in this study model is 16 items multiplied by 5. The sample required for this study consists of a minimum of 90 respondents.

This study also gathers data through literature reviews. This technique aims to gather relevant secondary data from associations, universities (internal sources), Internet resources, public libraries, and educational institutions, as well as from books, reports, and other materials pertinent to the research problem.

Research Variables and Operational Definitions

This study employs a questionnaire survey instrument based on prior research. This study examines three variables: Educational Technology, Digital Transformation, and Entrepreneurial University.

Table 2.
Research Variables and Operational Definitions

No	Variable	Indicator	Operational Definitions
I	**Education Technology** **Definition:** Strategic application and administration of technological resources to enhance the learning process, promote collaboration, and deliver interactive and personalized learning experiences (Chugh et al., 2023; Cunningham & Menter, 2021; Flores et al., 2024).	1. Learning Management Systems (LMS)	A digital platform utilized for the delivery and management of online educational and training resources.
		2. Interactive Technologies	A digital platform facilitating user engagement and interaction in the learning process.
		3. Visualization and mobile technologies	Dynamic visualization enhances material delivery, while mobile technology offers convenience and flexible learning opportunities for users.
		4. Web-based tools	The utilization of websites or tools accessible by users without the need for installation on mobile devices enhances collaboration and communication among users.
		5. Social media applications	Integration of social media applications to facilitate user connections within a virtual community space in educational settings. This study also gathered data through literature reviews.
II	**Digital Transformation** **Definition:** Integrating digital technologies into all aspects of operations, including teaching, research, administration, and community engagement, to enhance innovation, collaboration, and knowledge economy response, positioning it as a key driver of economic and social development (Garcez et al., 2022; Jafari-Sadeghi et al., 2021; Kliewe et al., 2019).	6. Enhanced Learning Experiences	Digital transformation enables Entrepreneurial Universities to create innovative pedagogical approaches, including online courses and interactive platforms, promoting an entrepreneurial mindset among students.
		7. Collaboration and Networking	Digital tools facilitate collaboration among universities, industry, and stakeholders, enabling entrepreneurial universities to establish networks for knowledge exchange, research initiatives, and entrepreneurial activities, strengthening their regional innovation hub position.
		8. Data-Driven Decision Making	Digital technologies improve university decision-making by enhancing data collection, analysis, and strategic planning, aligning educational programs with market needs, and enhancing entrepreneurial objectives.
		9. Innovation Ecosystems	Digital transformation fosters innovation ecosystems among universities, startups, businesses, and government entities, enhancing their capacity to promote economic development and societal impact through entrepreneurship.
		10. Access to Resources and Funding	Digital platforms provide Entrepreneurial Universities with innovative funding opportunities, partnerships, and resources, promoting financial sustainability and diversification of funding sources.

No	Variable	Indicator	Operational Definitions
III	***Entrepreneurial University*** **Definition:** An institution that cultivates an entrepreneurial mindset and actively collaborates with external stakeholders to enhance the social and economic value of the knowledge produced by the university (Audretsch & Belitski, 2021, 2022; Moussa et al., 2019).	11. Orientation	The institution aims to establish itself as an Entrepreneurial University through its vision and mission.
		12. Strategy	Having a strategy for contributing to socio-economic development.
		13. People and Capacity Development	The institution enhances its human resources and organizational capacity to engage in risk-taking and adopt intrapreneurial and entrepreneurial practices.
		14. Drivers and enablers	Establishment of an entrepreneurial ecosystem that facilitates innovation among individuals and groups.
		15. Education and Research	Education aimed at cultivating the mindset and skills of individuals with an entrepreneurial focus, alongside research that produces significant impact or demonstrates high potential for development.
		16. Innovation and Impact	Focused on social and economic impact, as well as innovation, based on the university's mission to offer optimal conditions for shaping the future.

Source: Processed Data, 2024

Data Analysis

The questions in the questionnaire were organized to reflect the independent factors or indicators specified in the variables and were examined using structural equation modeling (SEM). Model evaluation and assessment were conducted by data computation in SmartPLS, following the protocols of Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS was employed to validate hypotheses (theoretical testing) and to propose associations lacking a theoretical foundation (exploratory). The path analysis model of all latent variables in PLS comprised three sets of relationships: the Inner model, the Outer model, and the Weight relation. The questionnaire was created using Survey Monkey Platform and distributed online in July-August 2024, with a Likert scale of (5) for strongly agree and (1) strongly disagree.

Results and Finding

Respondents' Profiles

The study includes 45 universities. The 155 respondents who participated in the questionnaire were Heads of the Study Program (45 respondents), Secretaries of the Study Program (23 respondents), and Lecturers (87 respondents). Most of the respondents who filled out the questionnaire were male (92 respondents or 59,35%) and female (63 respondents or 40,65%).

Table 2.
Respondents' Profiles

Respondent	Criteria	Total	Percentage
Respondent's Position	Head of Study Program	45	29,03%
	Secretary of Study Program	23	14,84%
	Lecturer	87	56,13%
Gender	Male	92	59,35%
	Female	63	40,65%
Age	30 - 40 Years	45	29,03%
	40 - 50 Years	97	62,58%
	More than 50 Years	13	8,39%
Education	Master Degree	105	67,74%
	Doctoral Degree	50	32,26%

Source: Data is Processed, 2024

The majority of respondents are aged 40–50 years, totaling 97 individuals (62.58%). This age group is typically characterized by significant work experience, which may enhance the quality of their responses. Most respondents hold a Master's degree (67.74%, or 105 individuals), while the remaining 32.26% (50 individuals) have a Doctoral degree, representing various scientific disciplines

Instrument Validity and Reliability

The convergent validity assessment with Average Variance Extracted indicates that all

constructs exceed a value of 0.5 (Table 2), confirming that the set of indicators measuring each construct is cohesive and has strong convergent validity. In the reliability test, the values for composite reliability and Cronbach's alpha for all variables exceed 0.70 (Table 3). It can be concluded that all constructs in this study model exhibit strong dependability and can be further pursued within this framework.

Hypothesis Testing

This study employs three variables: Education Technology (X), Digital Transformation (Y), and Entrepreneurial University (Z). The Model Path diagram of this research is illustrated in Figure 2.

Table 4 presents the results of the bootstrapping analysis for the association test among variables. The table indicates that all correlations between variables are substantial and have a positive direction. The path coefficient values are all positive, and the T-statistic exceeds 1.96, with a P-value below 0.05. Consequently, it can be concluded that all hypotheses are substantial and accepted. This analysis presents the following research hypotheses:

H_1: *Education Technology (X) significantly influences Digital Transformation (Y1) leading to Entrepreneurial University: Accepted*

H_2: *Digital Transformation (Y1) accelerates Higher Education transformation into Entrepreneurial University (Y2): Accepted*

H_3: *Education Technology (X) significantly influences HEI's transformation into an Entrepreneurial University (Y2): Accepted*

Table 3
The Validity and Reliability Test of the Research Instruments

Variable	Average Variance Extracted (AVE) (>0.5)	Information Validity	Cronbach's Alpha (>0,7)	Composite Reliability (>0,7)	Information Reliability
X – Education Technology	0,740	Valid	0,912	0,918	Reliable
Y1- Digital Transformation	0,674	Valid	0,878	0,883	Reliable
Y2 - Entrepreneurial University	0,698	Valid	0,913	0,917	Reliable

Source: Processed Data, 2024

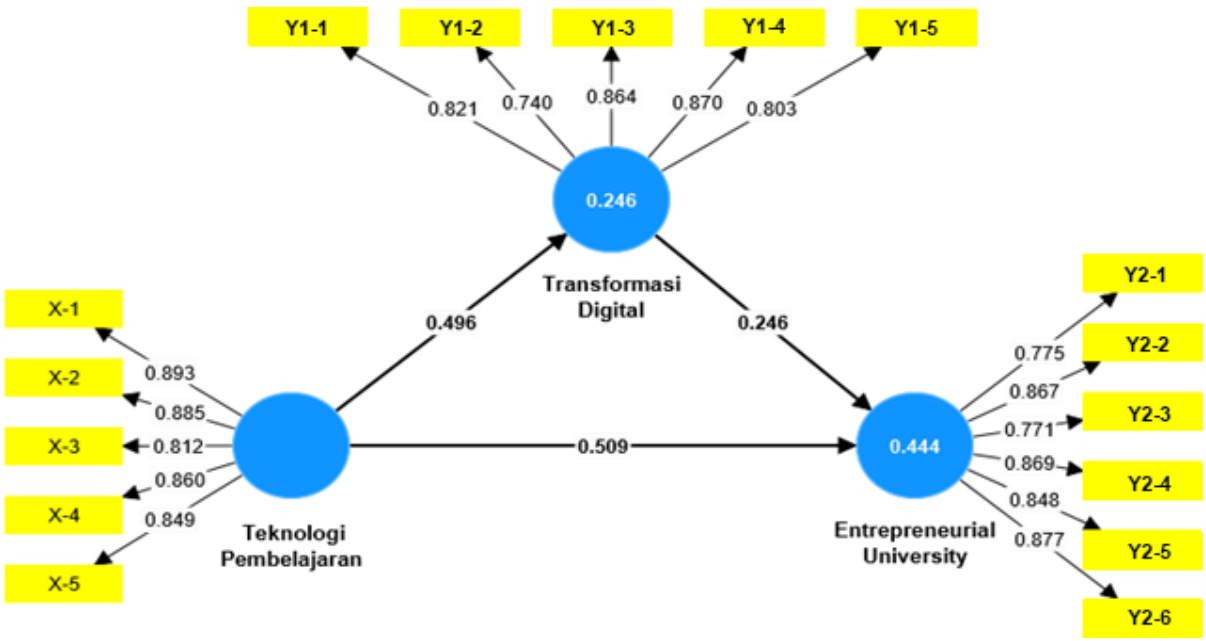

Figure 2. Model Path Diagram

Source: SmartPLS Output Data Processing (2024)

Table 4
Path Coefficient - T-Statistics Hypothesis

	Path Coefficients	T-Statistics	P-Values	Result
Education Technology -> Digital Transformation	0,496	4,931	0,000	H_1 Significant
Digital Transformation -> Entrepreneurial University	0,246	2,684	0,007	H_2 Significant
Education Technology -> Entrepreneurial University	0,509	5,458	0,000	H_3 Significant

Source: Processed Data, 2024

Results and Discussion

Within the educational technology variable, the highest-rated indicator is X-1, representing Learning Management Systems (LMS). This highlights universities' use of LMS to integrate educational technology and drive the digital transformation of HEIs into entrepreneurial institutions. Learning Management Systems (LMS) play a crucial role in digital transformation, supporting the entrepreneurial university by fostering innovation and promoting entrepreneurship. LMS facilitates not only the delivery of educational content but also the cultivation of entrepreneurial skills. It is essential to the HEI digital revolution and the advancement of entrepreneurial universities as it improves accessibility, enables experiential learning, offers data-driven insights, and cultivates collaborative ecosystems vital for instilling entrepreneurial mindsets.

In the context of digital transformation, the variable with the highest value is Y1-3, the Data-Driven Decision Making (DDDM) indicator. DDDM is essential for the digital transformation of enterprises, particularly within entrepreneurial universities. The shift from traditional decision-making to data-driven approaches allows institutions to adapt more effectively to the rapidly changing educational landscape. DDDM enhances organizational resilience by enabling swift, flexible responses during crises. This agility is vital for entrepreneurial universities as they navigate the complexities of modern teaching and research. A clear understanding of the importance of DDDM among leadership is vital for successful transitions. Integrating data analytics in education can also significantly influence teaching strategies, student engagement, and administrative efficiency. Strategic transformation requires robust data governance frameworks and investment in analytics infrastructure.

Drivers and enablers are key indicators within the Entrepreneurial University framework, shaping the development of entrepreneurial ecosystems that foster innovation among individuals and groups. The integration of digital technologies into teaching and learning serves as a primary driver of digital transformation, influencing the structural foundations of academic entrepreneurship and enabling universities to cultivate environments conducive to innovation and entrepreneurship. Enablers of digital transformation include strategic planning and fostering a digital-ready culture within institutions. Essential themes such as creativity, innovation, and strategic planning underpin digital entrepreneurship education, significantly shaping students' innovation intentions. These elements are critical enablers that institutions must develop to navigate the digital landscape effectively. Digital transformation profoundly impacts entrepreneurship education, requiring universities to go beyond knowledge dissemination and actively contribute to economic growth through startups and spin-offs. The interplay between drivers and enablers is pivotal for entrepreneurial universities, as they must strategically integrate digital technologies and nurture a culture of innovation to prepare students for the demands of the digital economy.

Education Technology and Digital Transformation

Educational technology plays a pivotal role in transforming higher education into entrepreneurial universities by integrating entrepreneurial principles into academic curricula and fostering student engagement in entrepreneurial activities. This shift is driven by innovative pedagogical methods and digital platforms that promote collaboration and knowledge sharing among students, educators, and industry stakeholders. The transformation involves integrating technology, restructuring methodologies, and realigning institutional frameworks to establish entrepreneurial ecosystems. This process shapes the entrepreneurial behavior of students and faculty, with studies like Zhang (2022) highlighting the impact of affordable online learning platforms on fostering entrepreneurial potential.

To drive educational innovation, universities must adopt and adapt technology to enhance user engagement and entrepreneurial capabilities. These include integrating advanced technologies, personalizing learning experiences, building digital competencies, and aligning institutional goals with entrepreneurial objectives. Personalized learning pathways, adaptive assessments, and tailored feedback enhance student engagement and equip them for the demands of the digital economy. The development of digital competencies among students and faculty creates an environment conducive to entrepreneurial skill-building (Rippa & Secundo, 2019; Secundo et al., 2019, 2020).

In addition, technological advancements, such as cloud computing and artificial intelligence, underscore the need for robust digital literacy initiatives. These competencies are critical for fostering an entrepreneurial mindset and enabling students to innovate and adapt to dynamic market conditions. Therefore, HEIs in Indonesia must adopt strategies that enhance digital competencies, promote a culture of innovation, and align with the entrepreneurial university model to advance creativity and efficiency in education.

Digital Transformation and Entrepreneurial University

The digital transformation of entrepreneurial universities involves the comprehensive integration of digital technologies across teaching, research, administration, and community engagement (Kliewe et al., 2019). This transformation enhances innovation, fosters collaboration with external stakeholders, and addresses the evolving demands of the knowledge economy. By adopting digital tools and platforms, universities improve learning experiences, enable data-driven decision-making, and strengthen partnerships with industry and government, positioning themselves as drivers of economic and social development.

Digital transformation also aligns with entrepreneurial universities' missions by embedding digital tools into core teaching and learning activities. Platforms like Massive Open Online Courses (MOOCs) exemplify how digital entrepreneurship education enhances students' entrepreneurial attitudes and prepares them for the digital economy. Collaboration between established firms and entrepreneurial ventures further accelerates digital innovation, showcasing the importance of partnerships in fostering an entrepreneurial ecosystem.

Supporting this shift requires universities to reassess their policies and practices to address challenges in knowledge dissemination and research commercialization effectively. Central to this transformation is digital literacy and entrepreneurial education, which play a critical role in shaping students' entrepreneurial intentions and preparing a workforce equipped to navigate the complexities of the digital economy. Transitioning from traditional to entrepreneurial universities involves enhancing digital competencies, fostering strategic industry partnerships, and embedding digital literacy

throughout institutional operations. By adopting these measures, universities can drive innovation, strengthen collaboration, and respond dynamically to the evolving demands of the digital economy, thereby cementing their position as pivotal contributors to sustainable economic and social development.

Education Technology and Entrepreneurial University

Educational technology, particularly online learning platforms, plays a pivotal role in shaping students' entrepreneurial tendencies. Research highlights that these platforms enhance cognitive development and entrepreneurial behavior through diverse interactions (Zhang, 2022). By leveraging emerging technologies, universities can create environments that encourage students to explore business opportunities and develop entrepreneurial skills (Uslu et al., 2019).

The entrepreneurial university model aims to adapt to economic challenges and foster a culture of innovation and entrepreneurship while diversifying revenue streams. LMS is instrumental in driving this transformation, enabling innovative pedagogical approaches and cultivating entrepreneurial mindsets among students. LMS fosters an entrepreneurial learning environment through interactive and experiential platforms, project-based learning, and access to entrepreneurial training and resources. In addition, universities must develop robust digital capabilities to enhance educational offerings and support entrepreneurial initiatives.

The integration of interactive learning technologies further supports HEI transformation by promoting active engagement and collaboration among students. These technologies enhance critical thinking and problem-solving skills while facilitating the exchange of diverse perspectives, improving comprehension and material retention. Besides LMS, DDDM is also critical in the transition from traditional HEIs to entrepreneurial universities. By integrating data analytics, institutions can inform strategic objectives, assess performance, and foster an entrepreneurial culture. This cultural and operational shift toward evidence-based strategies strengthens the foundation for innovation and entrepreneurship in higher education.

Discussion

The goal of the transformative process of digital transformation in higher education is to encourage students to think like entrepreneurs. This entails moving away from conventional educational paradigms and toward a learner-centric setting that integrates contemporary teaching techniques and technology. In line with connectivism theory, this change is essential for competitiveness and sustainability in the Industrial Revolution 4.0. Higher education leaders need to cultivate an innovative culture, acquire digital skills, and adjust to changing technologies. With strong leadership frameworks, HEIs can transform into entrepreneurial universities by emphasizing individualized learning experiences.

Entrepreneurial universities are using educational technology to incorporate entrepreneurial concepts into their courses and improve student participation, hence changing the environment to become more entrepreneurial. Through the use of innovative teaching methods and online resources, this shift encourages cooperation and information sharing between students, teachers, and business partners. The cost-effectiveness of online education platforms significantly influences entrepreneurial potential and behavior. This transformation involves developing digital competencies, personalizing learning experiences, and strategically aligning institutional goals with entrepreneurial objectives. Rapid technological advancements, such as artificial intelligence and cloud computing, require a comprehensive approach to enhance digital literacy and competencies. To foster innovation

and improve teaching and learning efficiency, universities must adopt creative solutions that support the entrepreneurial university model.

The integration of digital technologies into all aspects of entrepreneurial universities, including teaching, research, administration, and community engagement, is a key component of this transformation. This shift aims to enhance innovation, foster collaboration with external stakeholders, and meet the evolving demands of the knowledge economy. Digital tools and platforms promote data-driven decision-making, strengthen relationships with government and industry, and improve learning experiences. The collaborative nature of digital transformation influences students' entrepreneurial ambitions, aligning teaching methods with the entrepreneurial goals of the university. The development of digital entrepreneurship education, especially through MOOCs, exemplifies the relationship between digital transformation and the entrepreneurial university model.

Government and institutional support are crucial to this transformation. Governments can encourage innovation by facilitating research and development partnerships between universities and industry, enhancing the entrepreneurial ecosystem. Additionally, incorporating entrepreneurial outcomes into university assessments can further motivate institutions to embrace this shift.

Collaboration is central to the entrepreneurial university model, as it amplifies innovation, stakeholder engagement, and contributions to economic and social development. Effective collaboration enables knowledge transfer between universities and external organizations, ensuring research outcomes are applied in practical contexts. In the future, universities can further enrich the learning environment by optimizing Learning Management Systems (LMS) with interactive technologies and promoting collaboration through project-based learning.

The integration of educational technology and digital transformation has broad implications, revolutionizing teaching methods, administrative efficiency, and the overall educational experience. The entrepreneurial university model emphasizes innovation, collaboration, and responsiveness to the digital economy. Universities must align efforts with businesses and government to contribute meaningfully to the digital economy, creating environments where innovative research leads to practical applications. This shift underscores the importance of developing digital competencies among faculty to meet contemporary educational demands. The entrepreneurial university model, which fosters innovation and collaboration, strengthens institutional resilience and prepares graduates for a competitive job market. This model reflects a departure from traditional higher education missions, encouraging universities to engage more actively with their communities and industries, fostering a culture of innovation and entrepreneurship.

Conclusion

The digital transformation of HEIs into entrepreneurial universities involves integrating entrepreneurial principles into academic curricula, enhancing student participation, and utilizing digital platforms for collaboration and knowledge exchange. Educational technology, particularly online learning platforms, plays a significant role in shaping entrepreneurial behavior and potential within the university context. This transformation extends across all aspects of university operations, including teaching, research, administration, and community engagement. Digital platforms facilitate entrepreneurial ventures by providing skill development opportunities and aligning educational practices with the goals of the entrepreneurial university. The need for universities to adapt to economic challenges and create alternative revenue streams has given rise to the entrepreneurial university model, promoting a

culture of innovation and entrepreneurship. LMS is essential in this transformation, fostering an entrepreneurial mindset and supporting research and development partnerships.

The integration of educational technology and digital transformation has far-reaching implications for teaching methods, administrative efficiency, and the overall educational environment. It has enhanced pedagogical practices, improved administrative processes, and promoted equity in access to education. The entrepreneurial university model focuses on innovation, collaboration, and responsiveness to market needs. To contribute to the digital economy, institutions must align their efforts with businesses and governments. Faculty members must also develop digital competencies to meet contemporary educational demands. In this case, the entrepreneurial university model not only strengthens institutional resilience but also prepares graduates for a competitive job market. The applied technology in this context enriches learning experiences and encourages active engagement with communities and industries.

For the successful integration of educational technology in entrepreneurial institutions, a holistic approach is needed, including strategic planning, transformational leadership, investment in digital infrastructure, fostering a culture of innovation, and improving digital competencies among faculty and students. Universities must develop comprehensive strategic plans that position digital transformation as a core component of their mission, emphasizing learner-centric environments and aligning educational, scientific, and entrepreneurial objectives. Training programs for academic staff should also be implemented to address generational gaps and enhance digital literacy.

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