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The Role of Higher Education in Driving Innovation and Economic Growth: Literature Review

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Abstract

Higher education is a primary pillar of modern economic development, playing a crucial role in knowledge development, human capital formation, and innovation creation. In a knowledge-based economy, universities function not only as educational institutions but also hold a strategic role in research, technological innovation, and cross-sector collaboration through models such as the Multi-Helix. This study employs a Systematic Literature Review (SLR) approach and bibliometric analysis using the PRISMA method on 128 Scopus-indexed articles from the 2015–2025 period. The analysis was conducted to map publication trends, geographical distribution, collaboration networks, and key research themes using VOSviewer software. The results indicate that publication trends increased significantly after 2022, reaching a peak in 2024, with dominant contributions from European countries, particularly the United Kingdom, as well as China, Italy, and Spain. Central themes dominating the literature include "economic growth" and "innovation," which are linked through mechanisms of human capital, academic entrepreneurship, technology transfer, and the development of innovation ecosystems. Higher education plays a strategic role in driving innovation and economic growth by strengthening university innovation capacity, fostering cross-actor collaboration, developing entrepreneurial ecosystems, and improving the quality and distribution of human capital. However, these contributions are highly dependent on the regional context, institutional governance, integration with public policy, and the ability to effectively measure and manage the impact of innovation.

Keywords: Higher Education, Innovation, Economic Growth, Multi-Helix, Knowledge-Based Economy

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INTRODUCTION

Higher education serves as a hub for knowledge development, the cultivation of educated human resources, and a key driver of innovation. In the era of the knowledge-based economy, universities play a strategic role not only as educational institutions but also as research and innovation institutions (Olzhebayeva et al., 2025).

Higher education institutions contribute by producing high-quality graduates, conducting scientific research, and creating new technologies that enhance industrial competitiveness, national productivity, and long-term innovation capacity (Uddin & Khan, 2024; Ferretti et al., 2015). Higher education thus makes a crucial contribution to a country's economic advancement through improvements in human capital quality and technological innovation (Yanagiura & Tateishi, 2024; Volchik et al., 2018).

In the economic literature, particularly in endogenous growth theory, investment in higher education and scientific research has been demonstrated to be a primary driver of innovation (Križanič et al., 2021). Universities act as knowledge producers through research and development (R&D) activities, scientific publications, patents, and innovation incubation centers (Cheah & Yu, 2016).

Universities also facilitate collaboration among academia, industry, and government through the Triple Helix model, thereby promoting the transfer of technology and the commercialization of research outputs (Cheah & Yu, 2016; Kopczynska & Ferreira, 2021). However, these contributions are not automatic. The effectiveness of higher education in generating innovation is strongly influenced by institutional quality, research funding, the competence of lecturers and researchers, international networks, and national policy support.

Several studies suggest that higher education can foster innovation, which in turn positively impacts economic growth (Budac & Ilie, 2024; Narbaev et al., 2025). Innovation acts as a mediating pathway linking investment in higher education and economic growth (Tóth et al., 2020). Countries with robust higher education and research ecosystems—such as the United States, South Korea, Japan, and several European countries—display a strong correlation between innovation capacity and economic growth.

However, empirical findings are not always consistent (Kálmán et al., 2025). In many developing countries, improvements in higher education have not been matched by corresponding increases in innovation or economic growth due to weak R&D capacity, limited university–industry collaboration, and ineffective innovation policies (Li et al., 2024; Volchik et al., 2018).

Although research on higher education, innovation, and economic growth continues to expand, existing studies remain dispersed and fragmented. Most research focuses on only one dimension—higher education, innovation, or economic growth—without comprehensively mapping the interrelationships among all three.

Furthermore, relatively few studies integrate bibliometric mapping with a Systematic Literature Review (SLR) to examine how scientific developments, core concepts, academic collaboration, and empirical evidence intersect within this research domain. This gap underscores the relevance and importance of the present study.

Bibliometric analysis is essential for identifying global research developments,

collaboration networks, influential scholars, dominant research themes, and emerging topics in the fields of higher education and innovation. This approach provides an objective overview of scientific trajectories, shifts in research trends, and the world's most productive research centers.

Bibliometric methods also reveal the intellectual structure and conceptual evolution of the field through co-citation, co-authorship, and keyword co-occurrence analyses. Such insights are essential for positioning current research and identifying new areas for scholarly contribution.

Meanwhile, a Systematic Literature Review (SLR) is required to conduct an in-depth synthesis of existing studies on the relationship between higher education, innovation, and economic growth. Through SLR, researchers can systematically assess the quality of empirical findings, theoretical frameworks, research methodologies, and key variables shaping these relationships.

Based on this background, the present study seeks to address the following research questions. First, will studies on the role of higher education in enhancing innovation and economic growth remain a relevant and important research topic in the future? Second, What are the current distributions and publication trends in research on the role of higher education in driving innovation and economic growth?

Third, What theoretical contributions and practical implications can be derived from existing studies on the role of higher education in fostering innovation and economic growth, and how can these findings guide future research? Fourth, How does empirical evidence explain the mechanisms through which higher education contributes to innovation and economic growth?

Accordingly, the objectives of this study are to: First, assess the future relevance and importance of the role of higher education in innovation and economic growth; Second, analyze the distribution and recent publication trends related to this topic; Third, identify theoretical contributions and practical implications from prior research as well as directions for future studies; and fourth, explain the empirical mechanisms through which higher education contributes to innovation and economic growth.

RESEARCH METHODS

This study employs a combined approach, integrating a Systematic Literature Review (SLR), bibliometric analysis, and the PRISMA procedure to examine the relationship between higher education, innovation, and economic growth. This approach is selected because the topic continues to evolve both theoretically and empirically, necessitating a comprehensive method to map publication patterns, research trends, and research gaps that remain insufficiently addressed in the literature.

First, the Systematic Literature Review (SLR) is employed to systematically select articles based on predefined inclusion and exclusion criteria. The SLR provides a structured framework for identifying, evaluating, and synthesizing relevant research findings from multiple sources (Nightingale, 2009; Xiao & Watson, 2017). The primary data source for this study is the Scopus database, from which 128 articles were retrieved.

Second, bibliometric analysis is employed to measure and visualize the relationships among concepts, authors, keywords, and

publication trends related to the role of higher education in fostering innovation and economic growth. The bibliometric analysis is conducted using VOSviewer software to map co-occurrence networks and identify thematic research clusters.

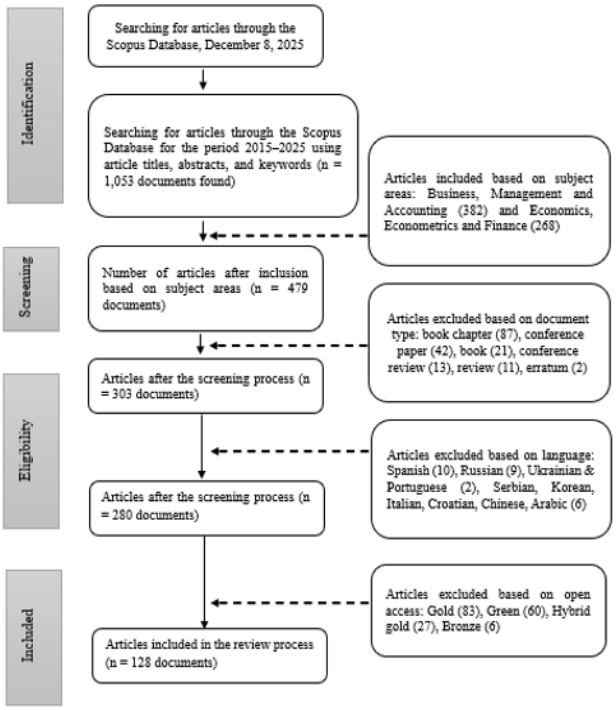

Figure 1. Information Flow of the Systematic Literature Review Using the PRISMA Framework Source: Data processed, 2025

Third, this study applies the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method as a guideline for the article screening process (Sarkis-Onofre et al., 2021). The PRISMA stages include: (1) Identification, in which all relevant articles are collected from the Scopus database; (2) Screening, which involves removing duplicates and selecting articles based on titles, abstracts, and keywords; (3) Eligibility, in which the content of articles is assessed against predefined eligibility criteria; and (4) Inclusion, which determines the final number of articles incorporated into the SLR and bibliometric analyses as shown in figure 1.

Figure 1 illustrates the article selection flow in this study, which applies a Systematic Literature Review using the PRISMA framework based on the Scopus database. The process begins with the Identification stage, during which articles published between 2015 and 2025 were retrieved using a Boolean search strategy.

The Boolean search string employed in this study was: ("higher education" OR "university") AND ("innovation" OR "research and development" OR "R&D" OR "knowledge creation") AND ("economic growth" OR "innovation-driven economy"), yielding a total of 1,053 documents.

Subsequently, the Screening stage was conducted based on subject areas, resulting in 479 articles. A further exclusion was applied based on publication type, removing documents such as book chapters, conference papers, review articles, and errata, which reduced the dataset to 303 articles.

During the Eligibility stage, articles were further screened based on publication language, with non-English publications excluded, leaving 280 articles. The next step involved screening based on open-access status, resulting in 128 articles that met all inclusion criteria. In the final stage (Included), these 128 articles constituted the dataset used for the systematic review and bibliometric analysis.

RESULTS AND DISCUSSION

The findings of this study focus on the results derived from 128 articles indexed in the Scopus database that examine the impact of higher education on innovation and economic growth. The data were obtained by identifying

the number of published articles, publication trends over a ten-year period, and the journals in which these articles appeared. This study also highlights the most influential elements related to the role of higher education in innovation and economic growth, including authors, institutional affiliations, and contributing countries in this field.

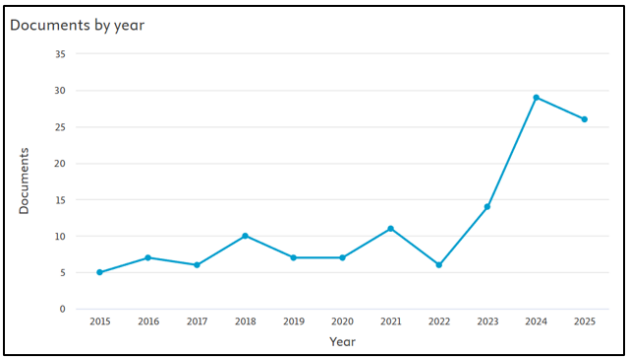

Figure 2. Article Distribution by Year
Source: Scopus database, 2025

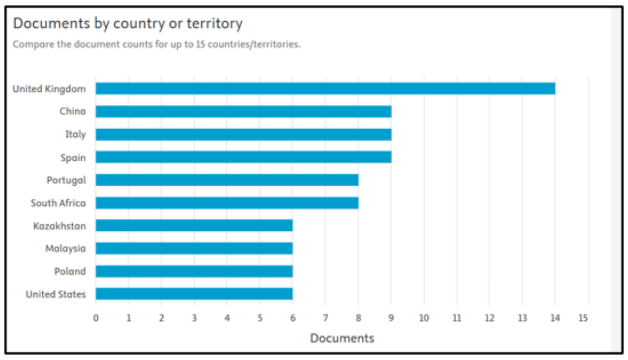

Figure 3. Article Distribution by Country
Source: Scopus database, 2025

RQ1: Will studies on the role of higher education in enhancing innovation and economic growth remain a relevant and important research topic in the future? Figure 2 illustrates that, based on data retrieved from the Scopus database, a total of 128 scholarly articles on the role of higher education in fostering innovation and economic growth have been published over the past decade. Research on higher education, innovation, and economic growth has shown a progressively upward trajectory.

During the period from 2015 to 2021, publication trends were relatively stable, with minor fluctuations ranging from 5 to 11 documents per year. A decline occurred in 2022; however, this was followed by a substantial surge in 2023–2024, with 2024 marking the peak at 29 published documents. Although there was a slight decrease in 2025, the number of publications remained high at 26 documents, indicating that research interest in higher education, innovation, and economic growth has continued to intensify in recent years. Overall, the graph shows a sharp upward trend after 2022, indicating that this topic has become increasingly relevant and widely studied in recent years.

Between 2015 and 2021, the number of publications on the role of higher education in driving innovation and economic growth remained relatively low and stagnant, indicating that this topic had not yet garnered significant scholarly attention at that time. In contrast, a notable shift occurred after 2022, when the publication trend exhibited a sharp increase, signaling growing academic interest in this issue.

This rise may reflect two key factors: first, the presence of research gaps in earlier years that researchers have begun to address; and second, the increasing global need to understand the contribution of higher education to innovation and economic development in the post-pandemic era and amid new economic dynamics. As this upward trend has continued through 2025, the topic has become increasingly relevant and strategic, with strong potential for further development in future research.

RQ2: What are the current distributions and publication trends in research on the role of higher education in fostering innovation and economic growth? Figure 3 presents the distribution of research on the role of higher education in promoting innovation and economic growth across different countries and regions.

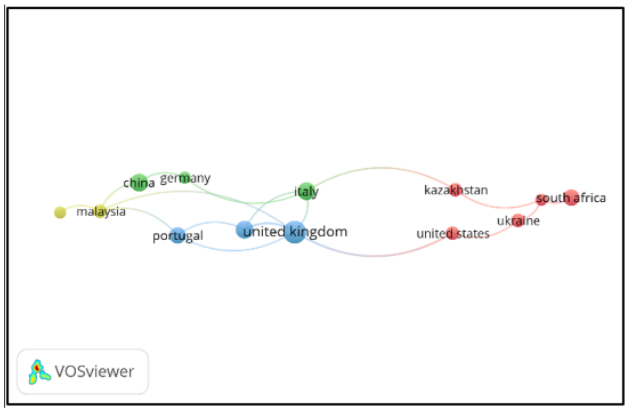

Figure 4. Country Network Visualization
Source: Data processed, 2025

An analysis of the 128 articles was conducted by categorizing them according to several classifications, including country, institutional affiliation, publication source, and author, with a focus on the top ten entries in each category. This in-depth analysis of the distribution of studies on higher education, innovation, and economic growth provides valuable insights for both academics and practitioners, particularly in guiding the development of future research agendas.

Figure 3 illustrates the distribution of publications from 2015 to 2025 by country, indicating that the United Kingdom (UK) is the leading contributor, with a total of 14 documents. This finding suggests that the UK places strong emphasis on understanding how higher education contributes to innovation and economic development, consistent with its long-standing research tradition and well-established innovation ecosystem. China, Italy, and Spain also rank highly, each contributing nine documents, reflecting strong national efforts to understand and strengthen the synergy between universities, industry, and economic growth.

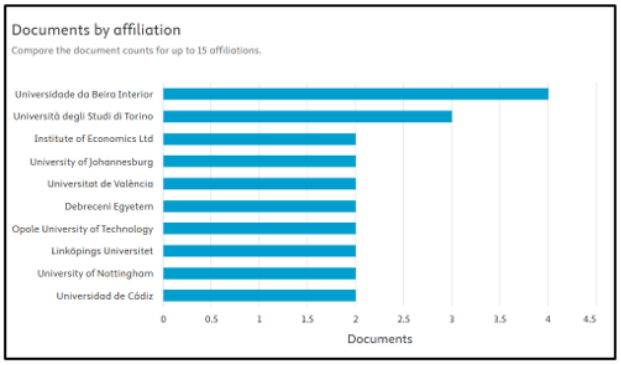

Figure 5. Distribution of Articles by Affiliation
Source: Scopus database, 2025

Countries such as Portugal and South Africa (each with eight documents), as well as Kazakhstan, Malaysia, Poland, and the United States (each with six documents), demonstrate relatively active participation, although at a lower level than the leading group. This suggests that interest in higher education and innovation is not limited to developed countries, but is also evident across diverse regions that seek to enhance their economic competitiveness by strengthening their higher education systems.

Overall, Figure 3 illustrates that research on the role of higher education in innovation and economic growth is a global phenomenon, rather than being concentrated in a single region. The variation in publication output across countries also reflects differing national priorities and research capacities in developing higher education–based policies and strategies to promote economic growth.

Figure 4 illustrates the relationships among countries involved in research on the role of higher education in enhancing innovation and economic growth, as analyzed using VOSviewer software. The distribution of scientific studies by country or region reveals the dominance of the United Kingdom, with 14 documents (Ferretti et al., 2015; Becker, 2015; Cowling & Lee, 2017; Hamdan & Hamdan, 2020; García-Vega & Vicente-Chirivella, 2020; Salamzadeh et al., 2022; Arthur et al., 2023; Serrano Lopez et al., 2023; Joyce, 2024; Bell & Bell, 2025; Maciuk et al., 2025; Chapman et al., 2025; Iqbal et al., 2025; Tucker et al., 2025), followed by China, Italy, and Spain, each with nine documents.

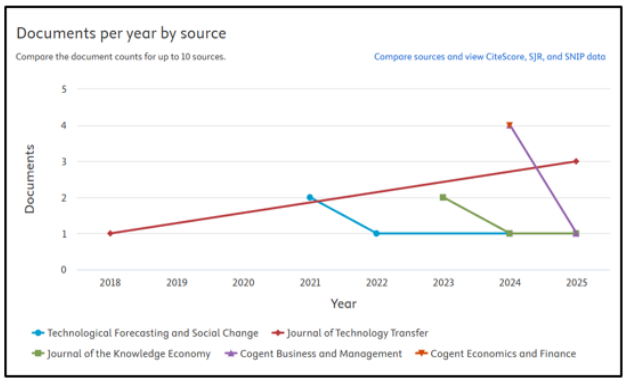

Figure 6. Number of Articles by Sources (Top 10 Sources)
Source: Scopus database, 2025

The updated visualization indicates that scholarly contributions in this field are distributed across a diverse set of countries, with the United Kingdom emerging as a central hub of collaboration, strongly connected with Portugal, Italy, China, and Germany.

This central positioning reflects the United Kingdom's substantial role in shaping international research networks related to higher education, innovation, and economic growth. Other countries, such as the United States, Ukraine, Kazakhstan, and South Africa, form an interconnected cluster, suggesting active but more regionally concentrated research engagement. Meanwhile, Malaysia appears as a smaller yet visible contributor, indicating growing participation from Southeast Asia in this research domain.

These patterns confirm the global relevance of higher education as a driver of innovation and economic growth, demonstrating that the topic has attracted scholarly attention not only from countries with well-established research infrastructures but also from emerging and developing economies that are actively strengthening their innovation ecosystems.

The variation in network size and connectivity suggests differing national contexts, research capacities, and policy priorities in leveraging higher education for economic development. Developed countries such as the United Kingdom, China, Germany, and Italy tend to exhibit stronger international linkages and higher visibility, reflecting more mature research systems. In contrast, countries such as Malaysia, Kazakhstan, Ukraine, and South Africa demonstrate increasing engagement, signaling a growing recognition of the strategic role of higher education in national and regional development agendas.

Overall, the visualization highlights that the role of higher education in innovation and economic growth is a dynamic and evolving global issue that transcends geographical boundaries, underscoring the importance of strengthening collaboration among universities, industry, and policymakers to address contemporary economic challenges.

Figure 5 illustrates the distribution of scholarly studies examining the role of higher

education in driving innovation and economic growth, categorized by institutional affiliations. Figure 5 presents the number of publications by institutional affiliation that have examined the role of higher education in fostering innovation and economic growth.

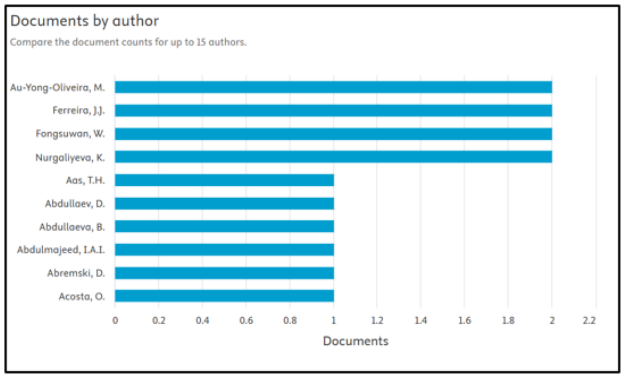

Figure 7. Number of Articles by Author (Top 10 Authors)
Source: Scopus database, 2025

Universidade da Beira Interior emerges as the most productive institution, with four publications (Patrício & Ferreira, 2024; Martín-Navarro et al., 2023; Kopczynska & Ferreira, 2021; Moutinho et al., 2015), followed by Università degli Studi di Torino, which contributed three publications (Filippelli et al., 2025; Pernagallo, 2024; Antonelli & Fassio, 2016).

Other institutions—including the Institute of Economics Ltd, the University of Johannesburg, the Universitat de València, Debreceni Egyetem, Opole University of Technology, Linköpings Universitet, the University of Nottingham, and the Universidad de Cádiz—each contributed two publications.

This pattern indicates that research on this topic is widely distributed across universities in different countries, although it is predominantly led by European institutions. The strong dominance of Europe is evident, with most contributing institutions located in Western, Southern, and Central Europe, reflecting the continent's substantial focus on the role of higher education in innovation and economic development. The involvement of institutions from Africa and Asia further demonstrates that this topic is receiving increasing global attention.

Figure 6 illustrates the distribution of studies on the role of higher education in driving innovation and economic growth based on publication sources. In terms of publication outlets, *Cogent Business & Management* and *Technological Forecasting and Social Change* occupy the top positions, each publishing five articles, indicating that these journals serve as the most productive platforms for research in this field. Both journals are widely recognized as leading academic forums for studies on organizational strategy, innovation management, and socio-economic transformation dynamics.

Subsequently, *Cogent Economics & Finance*, *Journal of Technology Transfer*, and *Journal of the Knowledge Economy* each contributed four articles, demonstrating their significant role in disseminating research on the contribution of higher education to innovation and national as well as global economic development.

These journals focus on the knowledge economy, technology transfer, and the relationships between educational institutions and economic productivity growth. Overall, these findings indicate that the topic attracts interdisciplinary attention and is consistently published across a range of reputable journals relevant to innovation, economics, and organizational development. Figure 7 illustrates the distribution of articles by authors based on

data retrieved from the Scopus database. The figure shows that several authors Au-Yong-Oliveira, M., Ferreira, J. J., Fongsuwan, W., and Nurgaliyeva, K. each contributed two publications, indicating their active roles in advancing research in this field. The consistent productivity of these authors suggests a sustained research focus on the role of higher education, innovation, and economic development.

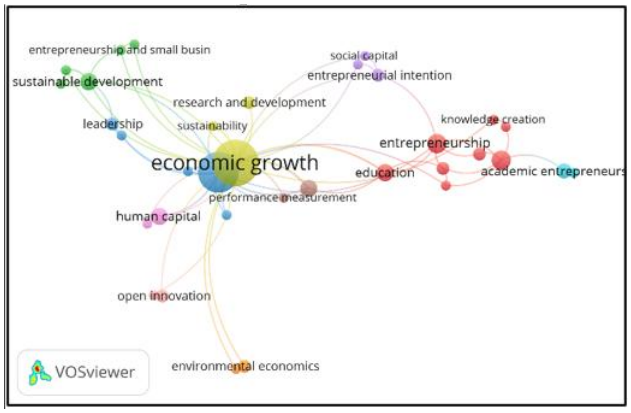

Figure 8. Keywords by authors
Source: Data processed, 2025

Meanwhile, other authors such as Aas, T. H., Abdullaev, D., Abdullaeva, B., Abdulmajeed, I. A. I., Abremski, D., and Acosta, O. each contributed one publication. Although their individual contributions are more limited, they nonetheless play a crucial role in broadening the scope and perspectives of research in this area.

RQ3: What theoretical contributions and practical implications can be derived from existing studies on the role of higher education in driving innovation and economic growth, and how can these findings guide future research? An examination was conducted of 128 articles retrieved from the Scopus database. VOSviewer software was employed to demonstrate that the findings of this study have both theoretical and practical implications for future research on the role of higher education in promoting innovation and economic growth.

Table 1. Keywords by authors

Rank	Keyword	Occurences	Total Link Strength
1	Economic growth	28	51
2	Innovation	22	35
3	Entrepreneurship	6	10
4	Intellectual Capital	5	10
5	Technology Transfer	6	8
6	Education	5	8
7	Entrepreneurial University	5	8
8	Sustainable Development	5	8
9	Environmental Economics	3	7
10	Open innovation	3	6

Source: Data processed, 2025

Metadata analysis using VOSviewer facilitates a deeper understanding of the underlying assumptions and key findings related to higher education, innovation, and economic growth. Bibliometric analysis with VOSviewer highlights which variables have been extensively studied and which remain underexplored, thereby providing a foundation for future research directions.

From a practitioner's perspective, literature analysis using VOSviewer can support efforts to strengthen the role of higher education in fostering innovation, which may ultimately contribute to enhanced economic growth. Based on Figure 8 and Table 1, the emergence of topics

related to the role of higher education in driving innovation and economic growth, as revealed by keyword analysis, indicates strong interconnections among these concepts.

According to their frequency in the table, the largest node is economic growth, signifying that this theme represents the central focus of the literature and serves as a primary link connecting various related concepts. Surrounding this core theme are several major clusters representing interconnected research foci.

The red cluster illustrates strong relationships among education, entrepreneurship, intellectual capital, and the entrepreneurial university, suggesting that higher education plays a crucial role in driving economic growth by developing intellectual capital and fostering entrepreneurial ecosystems. The blue cluster highlights themes such as technology transfer, knowledge transfer, and knowledge management, illustrating the mechanisms through which knowledge flows from universities to the industrial sector as key drivers of innovation.

Meanwhile, the green cluster encompassing industrial development, startups, environmental economics, and industrial performance demonstrate how innovations generated by higher education institutions impact industrial performance and broader economic development.

The yellow and purple clusters reveal linkages among research and development (R&D), innovation capability, leadership, and sustainable development, reflecting the role of university research in enhancing innovation capacity while supporting sustainable development. Overall, these findings demonstrate that higher education contributes to economic growth through complex and interconnected mechanisms, including human capital development, research commercialization, academic entrepreneurship, technology transfer, and the creation of innovation ecosystems. These results underscore universities' strategic position within the knowledge-based economy and their key role in driving innovation dynamics across multiple sectors.

Table 1 shows that economic growth is the most dominant keyword in the analyzed literature, with the highest number of occurrences (28) and the strongest total link strength (51). This finding confirms that economic growth constitutes the primary focus and central thematic node in studies examining the role of higher education in innovation-driven development. The keyword innovation ranks second, with 22 occurrences and a total link strength of 35, indicating that innovation is a core mechanism frequently associated with higher education's contribution to economic growth.

Furthermore, entrepreneurship and intellectual capital, each with moderate occurrences (6 and 5, respectively) and a total link strength of 10, highlight the growing emphasis on entrepreneurial activities and intangible assets as important drivers within the higher education–innovation nexus. Keywords such as technology transfer, education, entrepreneurial university, and sustainable development each show comparable link strengths (8), illustrating the main pathways through which higher education supports economic development, particularly through institutional transformation, knowledge commercialization, and sustainability-oriented strategies.

In addition, the presence of environmental economics and open innovation, although less frequent, indicates an emerging research orientation toward sustainability and collaborative innovation models. Overall, the distribution of keywords suggests that while economic growth and innovation remain the dominant themes, the literature increasingly integrates entrepreneurship, intellectual capital, and sustainable development to explain the multifaceted role of higher education in fostering innovation and economic growth.

RQ4: How does empirical evidence explain the mechanisms through which higher education contributes to innovation and economic growth? Of the 128 articles identified in the Scopus database based on the Boolean search strategy employed in this study, 37 articles were found to be relevant and specifically addressed the role of higher education in driving innovation and economic growth.

The analysis of prior studies suggests that the contribution of higher education to innovation and economic performance is not direct, but rather mediated by a range of institutional and structural mechanisms (Hamdan & Hamdan, 2020). Empirical studies across different national and regional contexts suggest that strengthening human capital, research capacity, and the quality of university governance constitutes essential prerequisites for the effective role of higher education (Joyce, 2024; Kuzior et al., 2024; Assanova et al., 2025).

These findings further demonstrate that the economic impact of higher education becomes more pronounced when universities adopt an innovation-oriented approach, align with industry needs, and are supported by public policies that facilitate collaboration and the downstream commercialization of innovation. Based on the results of the Systematic Literature Review of 37 relevant scholarly articles, it is evident that higher education institutions play a strategic and multidimensional role in driving innovation and economic growth.

The literature consistently highlights a shift in the role of universities from traditional academic institutions toward central actors within national and regional innovation systems. Universities no longer function solely as centers of education and research, but increasingly act as agents of economic transformation through active engagement in collaboration with industry, government, and society.

Conceptual frameworks such as the Triple Helix, Quadruple Helix, and Quintuple Helix dominate the literature, emphasizing that innovation emerges from dynamic interactions among multiple actors, with universities serving as the key link between knowledge production and economic utilization.

In terms of contribution mechanisms, the review suggests that the role of higher education in promoting innovation and economic growth is realized through several primary pathways. First, through the creation and diffusion of knowledge, both basic and applied research, which generates knowledge spillovers for industry and the surrounding regions.

Second, through the commercialization of research outputs, manifested in patents, technology licensing, academic spin-offs, business incubators, and the activities of technology transfer offices. Third, through the development of human and intellectual capital, whereby the quality of graduates, innovative competencies, and entrepreneurial skills become critical factors in enhancing productivity and economic competitiveness. Fourth, through the

institutional role of universities as anchor institutions capable of shaping regional innovation agendas and economic development trajectories.

However, the literature also emphasizes that the impact of higher education on innovation and economic growth is highly contextual and not universal. In developed countries, universities tend to demonstrate stronger and more consistent effects on economic growth, reflecting mature innovation ecosystems, high industrial absorptive capacity, and stable policy support.

In contrast, in developing countries, the contribution of higher education is often constrained by weak university–industry linkages, limited research funding, low commercialization capacity, and regulatory barriers. Nevertheless, several studies suggest that universities in developing countries still possess substantial potential to act as catalysts for economic growth when supported by adaptive and collaborative innovation policies.

From an analytical perspective, the 37 reviewed studies span micro-, meso-, and macro-level dimensions. At the micro level, the focus is placed on the roles of academics, university leadership, and academic entrepreneurial culture in stimulating innovation activities. At the meso level, research highlights institutional governance, collaboration models, and innovation-supporting infrastructure within higher education institutions.

At the macro level, the literature examines the relationship between university innovation performance and regional or national economic growth indicators, such as productivity, regional GDP, and spatial inequality. This cross-level integration demonstrates that the role of higher education in economic growth constitutes a systemic process that cannot be understood in isolation.

Overall, higher education institutions play a key role in driving innovation and economic growth through knowledge creation, human capital development, and the enhancement of innovation ecosystems. However, the effectiveness of this role is strongly influenced by institutional contexts, public policy frameworks, and the capacities of the actors involved.

Accordingly, the literature underscores the importance of context-sensitive and differentiated policy approaches, as well as governance reforms that render universities more entrepreneurial and responsive to socio-economic needs. These findings reinforce the argument that optimizing the role of higher education is a critical prerequisite for sustainable, innovation-driven economic development.

Based on the synthesis of empirical findings from the literature review, this study subsequently formulates stages of higher education contributions that reflect recurring and identifiable mechanisms observed in prior research. These stages illustrate how strategic higher education inputs are transformed through core university processes, enabling governance and policy mechanisms, multi-helix ecosystem collaboration, and the downstream commercialization of innovation, ultimately generating economic outputs and macro-level outcomes.

Accordingly, the staged framework presented below represents an empirically grounded interpretation of research evidence, offering an operational explanation of how higher education contributes to enhanced

innovation, productivity, competitiveness, and inclusive and sustainable economic growth.

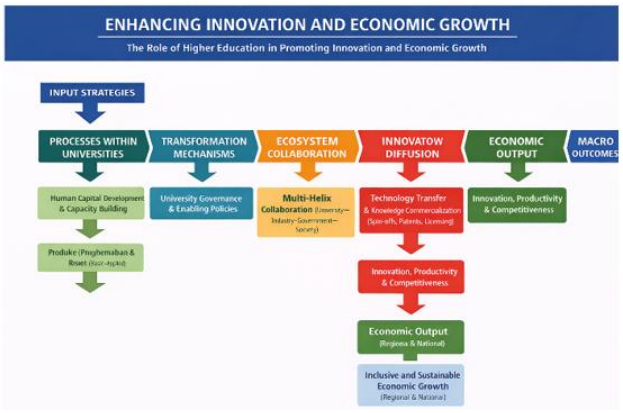

Figure 9. Stages of Higher Education in Enhancing Innovation and Economic Growth
Source: Data processed, 2025

Figure 9 presents a sequential and interconnected framework illustrating the strategic role of higher education in driving innovation toward inclusive and sustainable economic growth. The process begins with strategic inputs, where universities strengthen human capital and research capacity through faculty and student development, as well as investments in research infrastructure and information technology. These inputs form the essential foundation for generating knowledge and innovation that respond to economic needs.

The framework then advances to core university processes and transformation mechanisms. Core processes emphasize knowledge creation through basic and applied research, with basic research supporting long-term innovation and applied research accelerating solutions to industrial and societal challenges.

To ensure meaningful impact, these processes are supported by effective transformation mechanisms, including university governance, institutional autonomy, incentive systems, and policies that encourage collaboration and academic entrepreneurship, enabling research outputs to be converted into usable innovations.

Next, innovation is strengthened through ecosystem collaboration and commercialization. Collaboration among universities, industry, government, and society aligns innovation with socio-economic contexts, thereby accelerating the diffusion of technology. Commercialization transforms research into economic value through technology transfer, the creation of startups and spin-offs, incubators, and effective intellectual property management.

These stages generate economic outputs, including increased innovation, productivity, and competitiveness, which ultimately lead to macro-level outcomes such as inclusive and sustainable economic growth, higher-quality employment, reduced inequality, and a stronger knowledge-based economy.

Higher education plays a strategic role as a central node within the innovation and economic growth ecosystem through its functions in knowledge development, technological innovation, and the formation of high-quality human capital. Numerous studies emphasize that universities no longer function solely as institutions of education and research, but have increasingly become key actors in cross-sector collaboration that enhances economic competitiveness (Cheah & Yu, 2016; Rantala et al., 2021; Kopczynska & Ferreira, 2021).

Within the framework of University–Enterprise Collaboration (UEC), synergy between universities and industry is viewed as capable of improving research outputs, job creation, and economic growth (Tucker et al., 2025). Nevertheless, the effectiveness of such

collaboration is highly dependent on complex, context-specific, and long-term-oriented governance to ensure that the resulting economic benefits are sustainable (Yazgan & Yalcinkaya, 2018; Aljaaidi et al., 2025).

In developing countries, the contribution of higher education to economic growth is strongly influenced by the scale and effectiveness of R&D investment within the higher education sector (Chamsuk et al., 2017; Yazgan & Yalcinkaya, 2018; Kuzior et al., 2024). Comparative studies indicate that research and development expenditure in universities has a positive and significant effect on GDP growth, job creation, and physical capital accumulation (Moutinho et al., 2015; Yanagiura & Tateishi, 2024).

Conversely, an increase in the number of institutions and students without alignment to industrial needs does not generate optimal economic impacts (Abdullaeva et al., 2024). These findings underscore the need for higher education to focus on quality improvement, the relevance of applied education, and the strengthening of research capacity in order to function effectively as a driver of economic growth and unemployment reduction.

From a global perspective, a country's innovation performance is also largely determined by the quality of human capital and research capacity produced by higher education. Analyses based on the Global Innovation Index suggest that highly educated labor, reputable universities, R&D investment, and knowledge absorption capacity are the primary pillars of national innovation performance (Coutinho & Au-Yong-Oliveira, 2024; Vekic et al., 2020).

Higher education contributes not only through knowledge production but also through the creation of advanced business ecosystems, strategic partnerships, and sustainability-oriented approaches. However, because innovation determinants are dynamic and context-dependent, higher education policies must remain adaptive to global changes and national economic structures (Assanova et al., 2025; Hussein et al., 2022; Križanič et al., 2021).

The role of higher education in driving innovation is further strengthened through university–industry collaboration. Cross-country evidence shows that collaborative R&D between universities and industry significantly enhances innovation transfer and startup performance (Kuzior et al., 2024; Brito, 2018; Kochetkov et al., 2017).

Entrepreneurial-oriented universities have been shown to be more effective in commercializing research outputs and building productive startup ecosystems (Leal et al., 2023; Budac & Ilie, 2024; Patrício & Ferreira, 2024; Nor et al., 2025). These findings confirm that higher education should not focus solely on scientific publications, but must also strengthen commercialization functions and industrial engagement to generate tangible economic impacts.

Interestingly, research on research orientation within university–industry collaboration suggests that many collaborative projects remain predominantly focused on basic research, even when sponsored by industry (Cabanes et al., 2024). This finding challenges the assumption that applied research is always more economically relevant and reinforces the argument that fundamental research remains a critical foundation for long-term innovation. Accordingly, higher education plays a strategic role in maintaining a balance between basic and applied research as part of a sustainable national innovation strategy.

In the era of the Fourth Industrial Revolution, universities are also required to develop capabilities for breakthrough innovation (Ostrovska et al., 2022; Kruger & Steyn, 2024). Case studies in South Africa demonstrate that innovation mechanisms within university ecosystems—such as makerspaces and interdisciplinary collaboration spaces—support innovation processes from the design to the implementation stages (Kruger & Steyn, 2024).

In this context, higher education serves as an experimental space that facilitates the diffusion of innovation and multidisciplinary collaboration, thereby enhancing universities' contributions to technology-based economic growth.

The effectiveness of higher education's role in innovation is also strongly influenced by the quality of public governance (Joyce, 2024; Wiedenhofer et al., 2017). Countries with strategic governance systems and autonomous universities that actively engage with industry demonstrate higher levels of technological adaptation and innovation capacity.

Public policies that grant strategic autonomy to universities while encouraging local collaboration among regional governments, businesses, and higher education institutions have been shown to enhance the relevance of universities in innovation-driven economic development. However, knowledge transfer from universities to industry does not always yield uniformly positive outcomes.

Studies on micro and small enterprises suggest that university-generated intellectual property can have a negative impact on innovation performance in middle-income countries, while exhibiting positive effects in economically constrained countries (Anzules-Falcones et al., 2021). This finding suggests that institutional context and government funding support act as critical moderating factors in determining the effectiveness of university–industry collaboration for innovation.

The linkage between higher education and economic growth dynamics is also evident at the regional level. Studies in Kazakhstan have demonstrated that higher education determinants, such as the number of academic staff, university ICT infrastructure, and institutional innovation capacity, have causal relationships with regional economic performance (Karabayev et al., 2023; Narbaev et al., 2025; Zhangaliyeva et al., 2025).

However, the number of students alone does not automatically exert a significant impact on regional GDP per capita or household income. The economic impact of higher education becomes more pronounced when universities develop strong innovative functions and effective knowledge management systems.

Within the Triple Helix framework, the role of higher education in driving innovation is increasingly evident through collaboration with industry and government. Research on the management of university–industry collaborative projects reveals that universities are no longer merely knowledge producers, but also active participants in joint innovation operations (Anzules-Falcones et al., 2021; Kopczynska & Ferreira, 2021; Cheah & Yu, 2016).

However, the effectiveness of such contributions is highly dependent on performance measurement systems. Evaluation practices that remain focused on administrative reporting are considered insufficient for capturing the long-term impacts of innovation and economic growth.

More broadly, multi-helix approaches (Triple, Quadruple, Quintuple, and even Penta-

Helix) suggest that higher education's contribution to innovation and economic growth is optimized when universities are integrated with other societal actors, including communities, media, and the environment. A study on tourism village management in Yogyakarta demonstrates that the involvement of higher education alongside government, industry, media, and communities improves the quality of local economic governance, thereby expanding the role of universities as catalysts for community-based and sustainable economic development (Sumarto et al., 2020).

Universities also function as promoters and integrators of regional innovation ecosystems. A case study of the University of Porto reveals that the success of university-based innovation ecosystems depends heavily on the availability of talent capable of transforming knowledge into economically valuable solutions, long-term relationships with industry, and the integration of diverse actors and resources (Brito, 2018). In this context, higher education serves as a strategic hub orchestrating interactions among knowledge, technology, and markets.

In the era of globalization and digitalization, higher education has become a critical factor in enhancing the socio-economic performance of regions and countries. Institutional reforms in higher education, investments in tertiary education, and improvements in human capital quality have been demonstrated to yield substantial economic returns for both individuals and nations.

Studies in the European Union suggest that higher education enhances national economic competitiveness in global markets, particularly through its contributions to labor mobility and economic integration (Volchik et al., 2018).

The transformation of universities' roles is also reflected in the concept of the entrepreneurial university. Universities are no longer limited to R&D and technology transfer functions; they are increasingly contributing to the creation of new knowledge-based industries (Kuzior et al., 2024). Studies in Russia indicate that universities with high entrepreneurial capacity make significant contributions to regional economic growth by creating new technology-based firms, despite ongoing structural and policy-related barriers (Labadze et al., 2021).

Moreover, higher education plays a crucial role in attracting, distributing, and utilizing talent. Studies in the United Kingdom demonstrate that the presence of universities, entrepreneurial culture, and urban environments influences the geographic distribution of talent and economic growth. However, regional disparities in talent distribution remain a policy challenge that must be addressed through more balanced higher education and regional development strategies (Cowling & Lee, 2017).

From an impact evaluation perspective, measuring the contribution of higher education–driven innovation to economic growth continues to face significant challenges. A study in Singapore shows that the economic impact of university research is often inadequately captured by traditional indicators.

The development of evaluation frameworks based on endogenous growth theory and the Triple Helix model, including indicators such as realised imputed commercial value (RICV), offers a more comprehensive approach to assessing the economic contribution of

academic innovation (Cheah & Yu, 2016). Overall, these studies confirm that higher education plays a crucial role in promoting innovation and economic growth by strengthening university innovation capacity, fostering cross-actor collaboration, developing entrepreneurial ecosystems, and enhancing the quality and distribution of human capital.

However, the magnitude of this contribution is highly dependent on regional contexts, institutional governance, integration with public policy, and the ability to effectively measure and manage the impacts of innovation. Therefore, higher education should be positioned as a key actor within inclusive and sustainable knowledge-based economic development strategies.

CONCLUSION

This study analyzes 128 Scopus-indexed articles on the role of higher education in innovation and economic growth, finding that publication trends increased sharply after 2022, reaching a peak in 2024, thereby confirming the growing relevance of this topic. The research has a global scope, with European countries, particularly the United Kingdom, playing a dominant role, alongside significant contributions from China, Italy, and Spain. The studies are published in reputable, multidisciplinary journals, indicating the maturity of this research field. Bibliometric analysis using VOSviewer underscores higher education as a key actor in the knowledge-based economy, with economic growth and innovation emerging as central themes that provide strategic direction for future research and policy development.

Higher education plays a strategic role as a central node in the innovation and economic growth ecosystem through human capital development, research activities, knowledge transfer, academic entrepreneurship, and cross-actor collaboration involving industry, government, and society. The magnitude of this contribution is highly dependent on regional context, governance quality, the effectiveness of R&D investment, the balance between basic and applied research, and universities' capacity to build relevant and sustainable innovation ecosystems. Overall, the findings emphasize that higher education should be positioned as a key actor in adaptive, inclusive, and impactful knowledge-based economic development strategies, supported by more comprehensive frameworks for evaluating the impacts of innovation.

The main limitation of this study lies in its reliance on bibliometric data drawn exclusively from the Scopus database and metadata analysis, which may not fully capture empirical dynamics, policy contexts, or the real-world impacts of higher education on innovation and economic growth at micro and regional levels. Therefore, future research is recommended to integrate data from multiple databases, employ qualitative approaches or comparative case studies, and conduct deeper empirical analyses to explore causal mechanisms, variations in institutional contexts, and the long-term impacts of higher education's role.

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