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Exploring Financing Mechanisms for Entrepreneurial Universities: A Systematic Review of Current Practices and Future Trends

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Review Article

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Abstract

Background/purpose. Entrepreneurial universities are vital for economic development and innovation, yet securing sustainable funding beyond traditional sources is a critical challenge. This study addresses the need to identify and understand diverse financing mechanisms employed by these universities to foster their entrepreneurial activities. The main purpose is to provide a comprehensive overview of these mechanisms and explore future funding trends.

Materials/methods. This research employs a systematic literature review of articles published between 2000 and 2023. A structured search strategy was used across Scopus and ScienceDirect databases, focusing on keywords related to financing mechanisms, entrepreneurial universities, and higher education. Data was extracted and analyzed thematically using Atlas.ti software.

Results. The review identifies a diverse array of financing mechanisms used by entrepreneurial universities, including public funding and grants, private investment and venture capital, industry partnerships, technology transfer, philanthropic donations and endowments, and tuition and fees. Each mechanism presents distinct benefits and challenges impacting entrepreneurial activities. The study also highlights emerging trends such as revenue diversification, increased external funding, commercialization of academic programs, and organizational transformation.

Conclusion. Entrepreneurial universities require a multifaceted approach to financial sustainability, utilizing diverse funding models and adapting to the evolving higher education landscape. This review emphasizes the importance of financial innovation, strategic partnerships, and supportive institutional policies to drive entrepreneurial activities and contribute to economic growth. Further research should focus on the long-term impact of these financing strategies and explore the role of emerging technologies in fundraising and financial management.

1. Introduction

Entrepreneurial universities have emerged as key drivers of economic development and innovation, playing a vital role in fostering entrepreneurship and collaboration between academia and industry. They contribute to the overall development of society through their research, knowledge transfer, industry partnerships, talent development, and community engagement efforts (Yokoyama, 2006). These institutions go beyond traditional academic activities and actively engage in entrepreneurial pursuits such as technology commercialization, spin-offs, and industry collaborations (Voisey et al., 2005; Sharma & Thandi, 2002). The importance of entrepreneurial universities lies in their ability to foster innovation, drive economic development, and facilitate knowledge transfer between academia and industry (Panigrahi, 2018; Sengupta & Rossi, 2023; Rasmussen & Barch, 2010; Soares & Torkomian, 2021; Adams & Mohadeb, 2005).

Entrepreneurial universities can play a crucial role in creating a conducive environment for technology commercialization, promoting spin-offs, and contributing to the development of national innovation systems (Hu, 2009). By forming partnerships with industry, entrepreneurial universities foster a collaborative environment that supports the development and commercialization of new ideas and technologies, leading to the creation of new businesses, job opportunities, and economic growth (Yokoyama, 2006). Technology diffusion, knowledge flow, and spillovers are important in the formation of national innovation systems. Entrepreneurial universities play a pivotal role in integrating academic resources, managing research and development (R&D) results effectively, and promoting the recognition of intellectual property and R&D achievements (Guan et al., 2005; Hu, 2009).

Entrepreneurial universities facilitate the transfer of knowledge and expertise to the broader community, including businesses, startups, and local organizations, leading to the development of new businesses, job creation, and the enhancement of local and regional economies. However, successfully carrying out these entrepreneurial ventures requires adequate financial resources. The search for innovative and sustainable funding mechanisms is essential for universities to ensure financial stability, foster an entrepreneurial culture, enhance academic quality, and drive research and innovation in higher education (Sharma & Thandi, 2002; Yokoyama, 2006).

However, successfully carrying out these entrepreneurial ventures requires adequate financial resources. Traditionally, higher education revenues come from government funding, tuition and fees, and philanthropic donations (Todea et al., 2011; Liu et al., 2020). The responsibilities and activities of higher education, mainly entrepreneurial universities, are becoming much bigger and more complicated (Sharma & Thandi, 2002). Thus, the importance of seeking innovative and sustainable funding mechanisms for universities cannot be overstated. Over the past several decades or centuries, only a few, mainly government funding sources have been used to support higher education across the world. However, with reduced public funding and increasing competition, universities are compelled to explore alternative sources of revenue to sustain and enhance their academic programs (Chattopadhyay, 2007; Sharma & Thandi, 2002). Therefore, it is important to search for alternative, innovative, and sustainable funding mechanisms for entrepreneurial universities to effectively fulfill their roles in driving economic and societal development (Yokoyama, 2006).

The search for innovative and sustainable funding mechanisms is essential for universities to ensure financial stability, foster an entrepreneurial culture, enhance academic quality, and drive research and innovation in higher education (Sharma & Thandi, 2002). Innovative and sustainable funding mechanisms that align with their unique goals and objectives are essential for entrepreneurial universities to conduct impactful research, facilitate knowledge transfer, establish

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industry partnerships, develop talent, engage with communities, and engage in long-term planning, all of which are critical for driving economic and societal development (Yokoyama, 2006).

Sustainable funding mechanisms enable universities to invest in the development of new academic programs, research initiatives, and infrastructure, fostering innovation and academic excellence. By seeking diversified funding, universities can cultivate an entrepreneurial culture that encourages creativity, risk-taking, and the pursuit of opportunities beyond traditional funding models (Julita, 2004; Sharma & Thandi, 2002). Sustainable funding mechanisms can lead to a higher average quality of service to students and societies, as universities have the resources to invest in improved facilities, faculty, and student support services. Searching for Innovative funding mechanisms can support increased investment in research and development, fostering a culture of innovation and contributing to societal and economic advancement (Sharma & Thandi, 2002; Massey & Milsom, 2000).

Competitive forces are becoming increasingly influential in determining the income sources of universities, encouraging higher education institutions to increasingly adopt more entrepreneurial approaches (Ahmad et al., 2016). Understanding the diverse ways in which these universities finance their activities is crucial in this changing landscape. Therefore, through a systematic review of existing literature, this paper aims to provide a comprehensive overview of the various financing mechanisms used by entrepreneurial universities. The review analyzes existing research papers, such as peer-reviewed journal articles, to identify the different funding strategies and their implications for entrepreneurial higher education institutions.

The systematic review focused on three key research questions regarding financing mechanisms for entrepreneurial universities. These questions are: What are the different financing mechanisms employed by entrepreneurial universities? How do these financing mechanisms impact entrepreneurial activities within universities? What are the future trends and directions of funding mechanisms in higher education?

By addressing these research questions, the review aimed to provide comprehensive insights into the financing mechanisms for entrepreneurial universities, including their impacts, challenges, opportunities, and future trends. The findings of this review contribute to the existing literature in the field by synthesizing current knowledge and identifying research gaps that could be addressed in future studies.

2. Literature Review

This section details the methodologies employed to conduct a systematic review of financing mechanisms for entrepreneurial universities. It explains the search strategy, selection criteria, and data extraction and analysis methods used to identify and synthesize relevant literature.

This study employed a structured, systematic literature review approach to identify and analyze relevant academic articles on financing mechanisms for entrepreneurial universities. The main objective of the literature review is to explore the various financing mechanisms adopted by entrepreneurial universities. It also identifies research gaps and provides directions for future research concerning new and novel ideas, theories, measures, methods, and novel research questions.

2.1. Search Strategy

To achieve the research objectives, we employed a systematic searching strategy by following widely applied procedures (Jahani et al., 2021), such as defining and applying appropriate keywords for searching, identifying relevant papers, and analyzing the extracted papers. The search process

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involved database selection, keyword utilization, initial search and document screening, supplementary database search, and consolidation of relevant articles from both databases.

The search was conducted in popular and commonly used academic databases such as Scopus and ScienceDirect. The choice of the Scopus database lies in the fact that it is more comprehensive than other databases. In addition, we have also used ScienceDirect to supplement the search with additional relevant documents. Initially, we searched documents from the database using specific keywords such as "Funding mechanism," "Financing models," "Entrepreneurial universities," and "Higher education." These keywords were combined with Boolean operators to ensure a focused and comprehensive search.

2.2. Selection Criteria

For this systematic review, the selection criteria applied to identify relevant articles include publication timeline (2000-2023), relevance to the topic, empirical studies or theoretical contributions, and availability of full-text articles. More specifically, only journal articles published in the field between 2000 and 2023 were considered for inclusion. The selection criteria focused on relevance to the topic, whether the articles presented empirical studies or theoretical contributions, and whether they were available in full text. The following selection criteria were applied to ensure the inclusion of relevant articles.

First, the publication timeline was restricted to journal articles published between 2000 and 2023, ensuring the inclusion of recent research in the systematic review. Second, ensuring the relevancy of the document to the topic. Accordingly. articles were included based on their relevance to the topic of financing mechanisms for entrepreneurial universities. This is to ensure that the selected articles selected directly addressed the research focus of the systematic review.

Third, articles were selected based on whether they presented empirical studies or theoretical contributions, allowing for a comprehensive analysis of the literature on financing mechanisms for entrepreneurial universities. Fourth, the availability of full-text articles. Only articles with full-text availability were considered for inclusion, ensuring that the review was based on complete and accessible sources. By applying these selection criteria, a focused and rigorous approach was taken to identify and include only relevant journal articles for the systematic literature review.

2.3. Data Extraction and Analysis

Data extraction involved a systematic process of collecting relevant information from selected articles, focusing on the financing mechanisms identified and their impacts on entrepreneurial activities. The following approach was employed for data extraction and analysis:

Initially, we developed key research questions to guide the data extraction process. These include the following questions.

- What are the different financing mechanisms used by entrepreneurial universities?
- What are the benefits and challenges of the different financing mechanisms?
- What are the outcomes and impacts of the financing mechanisms on entrepreneurial universities?
- What are the emerging trends and future directions in financing entrepreneurial universities?

We uploaded 77 articles for systematic review to Atlas.ti software for efficient extraction of information. This software allowed for detailed analysis and comparison of data segments. (Silver & Lewins, 2014). It Helps with preparing, exploring, and analyzing the literature. It offers an opportunity to recall and analyze literature thematically or topically.

The extracted data from the selected articles was then organized thematically to categorize related to financing mechanisms and their impacts. Then, we conducted a narrative synthesis to

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summarize the findings from the extracted data, providing a comprehensive overview of the literature on financing mechanisms for entrepreneurial universities.

3. Results and Analysis

This section analyzes the findings from the systematic literature review. It begins with an overview of search results and trends in publications before exploring various financing mechanisms utilized by entrepreneurial universities.

3.1. Overview of Search Results

The comprehensive literature review on funding mechanisms for higher education consists solely of journal articles published in the field between 2001 and 2023. Figure 2 illustrates the trends in article publications trend overtime during the specified period. The graph indicates a steady growth in publications since 2001, with the largest number of publications reported in 2022. Despite a slight decrease in the number of publications in 2019 compared to 2018, there was significant growth in 2021.

Table 1 presents the top 10 Journals that consistently published, on average, a high number of articles each year. These journals encompass diverse disciplines, with a focus on higher education. Community College Journal of Research and Practice and Higher Education Dynamics are the most dominant journals in terms of the weighted average number of articles published per year. Academic Medicine, with its specialization in medicine-related publication, is the second most dominant journal in publishing a higher number of research on university financing mechanisms. Tertiary Education and Management, along with the remaining three journals, have a relatively lower publication rate each year compared to the top six listed journals.

Moving on to Table 2, we explore the most highly cited articles according to Scopus recording. It is important to note that this ranking tends to favor articles published earlier. For instance, Yokoyama K. (2006) is one of the oldest and most cited articles on the list.

The initial search yielded 593 documents from the Scopus databases. By restricting our search to only journal articles and excluding documents not written in English, the list was narrowed down to 346 articles. After downloading the list of these articles with their detailed information as a CSV file and imported into a spreadsheet, we further screened the list based on titles, keywords, and abstracts, which resulted in 138 articles. The list of 138 articles was further examined, and the main body of the articles was reviewed to identify the most relevant articles for inclusion in the analysis. This process led to the selection of 61 suitable articles to be taken forward.

In addition to Scopus, we have also conducted a supplementary database search in ScienceDirect and other sources. The search resulted in the identification of 62 documents, all of which are written in English. After refining the search to include only journal articles, we arrived at 33 relevant articles. Further, we screened the articles by reviewing the main body of the paper; 16 articles were deemed suitable to be included in the analysis. The articles obtained from both databases were merged, resulting in a total of 77 articles for inclusion in the systematic literature review.

The PRISMA diagram, Figure 1, clearly and concisely presents the structured selection process, outlining the specific criteria used to identify and include articles for the systematic review. Initially, we identified 655 documents, 593 documents on Scopus and 62 documents on ScienceDirect and other Sources through searches using the above-mentioned keywords together. We removed more than 578 documents based on the screening criteria mentioned to reach a total of 77 articles for further analysis.

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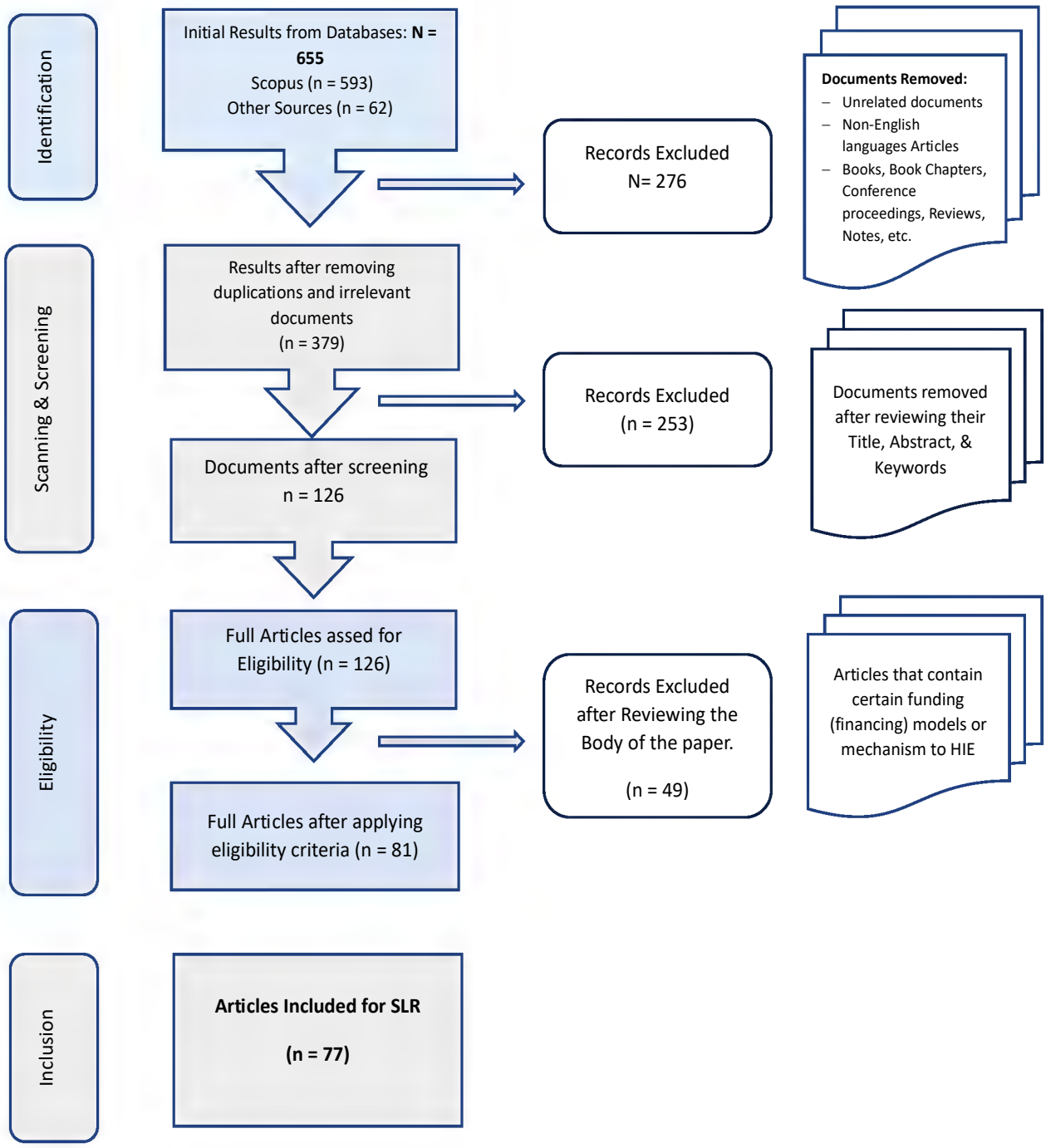

Figure 1. The PRISMA flow diagram illustrates the selection process

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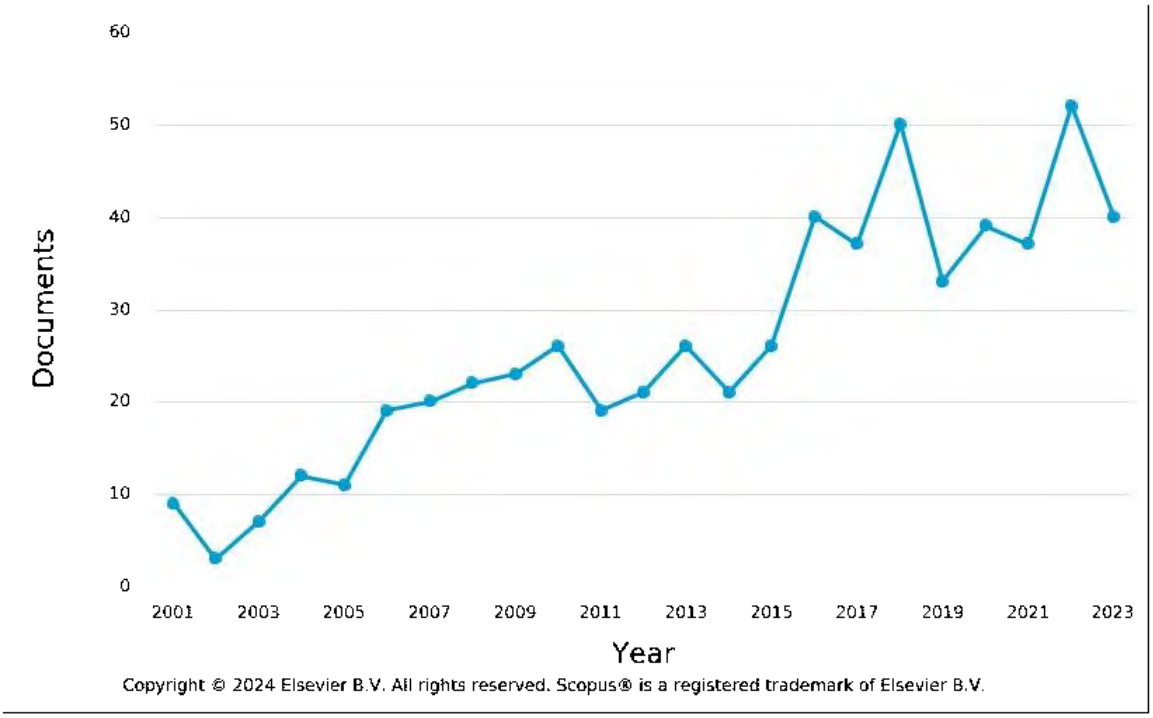

Figure 2. Article publication trends overtime

Table 1. List of Top 10 Journals that published many articles per year

Journals	Documents per Year
Community College Journal of Research and Practice	7
Higher Education Dynamics	7
Academic Medicine	6
International Journal of Educational Development	6
Higher Education	5
Studies In Higher Education	5
Journal Of Higher Education Policy and Management	4
Proceedings Of the International Astronautical Congress Iac	4
Research Evaluation	4
Sustainability Switzerland	4
Tertiary Education and Management	4

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Table 2. Top 10 highly cited articles based on Scopus recordings (2001-2023)

Title	Year	Authors	Journal
Entrepreneurialism in Japanese and UK universities: Governance, management, leadership, and funding	2006	Yokoyama K.	Higher Education
Does competitive research funding encourage diversity in higher education?	2008	Horta H.; Huisman J.; Heitor M.	Science and Public Policy
Funding systems for higher education and their impacts on institutional strategies and academia: A comparative perspective	2010	Frølich N.; Kalpazidou Schmidt E.; Rosa M.J.	International Journal of Educational Management
University funding and student funding: International comparisons	2016	Jongbloed B.; Vossensteyn H.	Oxford Review of Economic Policy
Revenue diversification in public higher education: Comparing the university and polytechnic sectors	2014	Teixeira P.N.; Rocha V.; Biscaia R.; Cardoso M.F.	Public Administration Review
Developing entrepreneurial universities in Taiwan: The effects of research funding sources	2009	Hu M.-C.	Science, Technology and Society
Training the scientific workforce: Does funding mechanism matter?	2016	Blume-Kohout M.E.; Adhikari D.	Research Policy
Higher education financing in Japan: Trends and challenges	2018	Huang F.	International Journal of Educational Development
A new funding model for nursing education through business development initiatives	2018	Broome M.E.; Bowersox D.; Relf M.	Journal of Professional Nursing
Financial regulations and the diversification of funding sources in higher education institutions: selected European experiences	2017	Stachowiak-Kudła M.; Kudła J.	Studies in Higher Education
Recent changes in financing higher education in Germany and their intended and unintended consequences	2018	Teichler U.	International Journal of Educational Development
Developing a Model for a 'Ladder of Incubation' Linked to Higher and Further Education Institutions in Wales	2005	Voisey P.; Gornall L.; Jones P.; Thomas B.	Industry and Higher Education

3.2. Financing Mechanisms for Entrepreneurial Universities

An entrepreneurial-oriented university is categorized as one that has been becoming more entrepreneurial and market oriented. Despite this shift, the entrepreneurial culture at such universities is fragmented and partial (Yokoyama, 2006). Entrepreneurial universities emphasize the importance of engaging in entrepreneurial activities, including the establishment of university

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business corporations. However, it is not necessarily the case that the university should identify itself as an entrepreneurial university or that the university relies solely on income generated from entrepreneurial activities (Yokoyama, 2006).

Entrepreneurial universities adopt diverse strategies to secure funding for their entrepreneurial activities. These strategies encompass various internal and external income sources, such as income from entrepreneurial activities, government grants, tuition and fees, industry partnerships, private investors, endowments, and donations from philanthropists or donors (Liu et al., 2020; Yokoyama, 2006). The key funding sources and mechanisms discussed in the literature are as follows:

3.2.1. Public Funding and Grants

Public funding refers to financial support governments and government entities provide to back higher education institutions (Sharma and Thandi, 2002; Yokoyama, 2006). Government funding has historically played a dominant role in higher education financing across different countries (Broome et al., 2018; Mokaya and Ochieng, 2020; Liu et al., 2020; Wiener et al., 2020). While entrepreneurial universities attract funding through various strategies, public funding remains a vital financing mechanism for supporting these institutions (Wang, 2001; Cheung, 2004; Liu et al., 2020; Garzón-Correa et al., 2022; Lin et al., 2023, Ahmad et al., 2020, Mahamood and Ab Rahman, 2015).

Public funds are available in various forms, including government grants (Frolich et al., 2010; Ziderman, 2017), competitive grants (Tabatadze, 2023; Elena et al., 2017), research funds (Futao, 2018), innovation funds, and subsidies (Cheung,2003). In some countries, government funds are directly given from central government to universities. Alternatively, intermediary funding agencies are utilized in other countries to safeguard the independence of higher education institutions from direct political influence (Cheung,2003). The intermediate funding agencies serve to offer financial advice to the government concerning financial issues of higher education (Hu, 2009).

Pursuing government grants and contracts related to entrepreneurial activities, innovation, or workforce development can provide additional funding to bolster the university's initiatives (Broome et al., 2018; Ait et al., 2021). Entrepreneurial universities acquire government grants to support their research and development activities, particularly in areas of national priority (Sharma and Thandi, 2002; El Gibari et al., 2021; Liu et al., 2020; Hugo et al., 2008; Yokoyama, 2006; Monika and Kudla, 2017; Liu and Gao, 2021). In various countries, such support is often facilitated through the provision of "state-funded" places, which are determined by admission quotas and represent a complex mechanism (Sudakova and Dahel, 2023; Kempkes and Pohl, 2008).

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Table 3. Summary of funding sources for universities

Financing Mechanisms (Models)	Countries Applied	Reasons	Key Fundings Units	Forms of funding	Impact	Key References
Public Funding and Grants (Government funding)	Almost all countries	Government is responsible to ensure the availability of education for all citizens; Stability funds	Federal and Regional Governments, Government Agencies, Third-Party	State Appropriation and Grants	Competition for public funding increases the quality and potential of universities	Liu et al., 2020; Mokaya and Ochieng, 2020; Yokoyama, 2006; Broome et al., 2018; Wiener et al., 2020
Private Investment and Venture Capital	Russia, Japan	Income Diversification & attract additional funding for entrepreneurial activities	Individuals, Corporations, or Foundations	Investment	Promote innovations, startups, and commercialization of research and development activities	Hugo et al., 2008; Liu and Gao, 2021; Hu, 2009; Sudakova and Dahel, 2023; Panigrahi, 2018; Nagy, et al., 2014;
Industry Partnerships and Collaborations	Many countries including	Funding technology transfer, research projects, and entrepreneurial activities	Local Industries, MNCs	Research fund, buying technologies and patents	Provide opportunities for funding research, innovations, and entrepreneurial activities. Bridging the gap between academia and industry	Yokoyama, 2006; Monika and Kudla, 2017; Wiener et al., 2020; Hu, 2009; Yokoyama, 2006; Hayter, 2018
Technology transfer	Japan, Taiwan, UK	Support innovation & university-based entrepreneurship, particularly for technology start-ups and spin-offs	Private organization, public companies, government entities	Income from Commercializing research outcomes and licensing intellectual property	Established university business corporations to generate income and attract funding for entrepreneurial activities	Ziderman, 2017; Bramwell & Wolfe, 2008; Klofsten et al., 2019; Fernández Nogueira et al., 2018; Broome et al., 2018; Pedro and Tatyana, 2013; Tabatadze, 2023
Philanthropic Donations and Endowments	Many Countries	To carry social responsibilities. Finance research, innovation, and other activities	Individuals, foundations, and corporations	Receive gifts, endowments, and donations from individuals or institutions	Fulfilling social responsibilities; Raising additional funds	Yulia et al., 2021; ROHAYATI, et. al., 2022; Khusainova et al., 2021
Tuition	Many countries, including England and Hong Kong	To balance the rising demand for higher education with limited public resources.	Students, Parents, Organizations, Foundations, Government	Receive full tuition fee or part of their costs (cost-sharing)	Balance demand for higher education with limited public resources. Ensure the sustainability of higher education	Sirbu, 2015; Jongbloed and Vossensteyn, 2016; Corbet and Larkin, 2017; Blume-Kohout & Adhikari, 2016; Sengupta and Rossi, 2023
Non-Traditional Sources	In Different Countries	To reduce dependency on traditional funding sources such as government grants, tuition, and state appropriation.	Buyers and users of their service	Income from royalties, rental and sale of real estate properties; alumni contributions; sales of educational services	Revenue diversification; increase revenue sources; create job opportunities; enhance services	Voisey et al., 2005; Chiwandire & Vincent, 2019; Wiener et al., 2020; Yokoyama, 2006

3.2.2. Private Investment and Venture Capital

Private investment and venture capital play significant roles in financing higher education institutions (Garzón-Correa et al., 2022; Liu et al., 2020; Hugo et al., 2008; Liu and Gao, 2021; Nikšić and Paleka, 2020). Entrepreneurial universities often seek private investment and venture capital to support their entrepreneurial initiatives. In some countries like Russia and Japan, entrepreneurial universities rely on private funding from individuals, corporations, or foundations to support their research and development activities as well as some areas of training (Broome et al., 2018; Zhang et al., 2016; Hu, 2009, Yokoyama, 2006; Sharma and Thandi, 2002; Chiwandire & Vincent, 2019; Sudakova and Dahel, 2023; Akinkugbe, 2000; Cheung,2003; Ciumas, 2009; Panigrahi, 2018, Nagy, et al., 2014, Mahamood and Ab Rahman, 2015).

Similarly, Venture capital investment has emerged as an important funding source for entrepreneurial universities, attracting funding from venture capital firms interested in investing in innovative startups and technologies developed by the universities. This source of funding particularly supports university-based entrepreneurship, particularly for technology start-ups and spin-offs (Voisey et al., 2005; Sharma and Thandi, 2002; Panigrahi, 2018, Sengupta and Rossi, 2023; Rasmussen and Jarl, 2010; Soares and Torkomian, 2021, Adams and Mohadeb, 2005).

3.2.3. Industry Partnerships and Collaborations

Industry partnerships and collaborations are essential for the development of entrepreneurial universities, as they provide funding research, innovations, and entrepreneurial activities (El Gibari et al., 2021; Garzón-Correa et al., 2022; Voisey et al., 2005; Yokoyama, 2006; Sharma and Thandi, 2002; Monika and Kudla, 2017; Yulia et al., 2021; ROHAYATI, et. al., 2022; Wiener et al., 2020; Elena et al., 2017). Like public funding sources, private funding sources and industry partnerships with local industry are crucial for the growth of entrepreneurial universities (Hu, 2009). Apart from its funding mechanism, partnership with industry stakeholders plays a crucial role in bridging the gap between academia and industry in many countries. In some cases, public funding used as a prerequisite and catalyst in attracting private research funding to bridge the gaps between university and industry research (Yokoyama, 2006, Hu, 2009).

Many studies indicated that establishing partnerships with industry stakeholders, including business, commerce, and government sectors, is another alternative key method to secure funding for technology transfer, research projects, and entrepreneurial activities (Hugo et al., 2008; Yokoyama, 2006). The nature of collaboration between industry and universities varies significantly across industry sector, allowing universities to shift funding responsibilities for industry related higher education research to multinational enterprises (Hugo et al., 2008; Cohen et al., 2002; Yokoyama, 2006; Sharma and Thandi, 2002).

Entrepreneurial universities forge strategic partnerships with industry players to enrich their activities (El Gibari et al., 2021; Garzón-Correa et al., 2022; Voisey et al., 2005; Sharma and Thandi, 2002; Monika and Kudla, 2017; Akinkugbe, 2000; Yulia et al., 2021; ROHAYATI, et. al., 2022; Wiener et al., 2020; Elena et al., 2017). The impact of these partnerships on the entrepreneurial activities of universities is very important, providing valuable funding mechanisms, reinforcing the importance of industry collaboration (Garzón-Correa et al., 2022; Voisey et al., 2005; Sharma and Thandi, 2002; Monika and Kudla, 2017; Khusainova et al., 2021; Civera et al., 2017).

Entrepreneurial universities generate funds from industries affiliated with their institutions and social services, like logistics services, continuing education, research activities, and technology transfers and patent sales (Liu et al., 2020). By collaborating with external organizations such as

industry partners, health systems, or community stakeholders, entrepreneurial universities access funding through sponsored research programs and corporate training programs (Broome et al., 2018). To attract funding and establish partnerships with supportive companies, entrepreneurial universities compete with other institutions and strive to build a strong reputation within the research community and private sectors (Hayter, 2018. They strive to establish a track record and foster collaborations with companies willing to support projects (Hugo et al., 2008; Khusainova et al., 2021; Frolich et al., 2010; Frolich and Strom, 2008; Wiener et al., 2020).

The literature also discusses that commercial research and consultancy activities serve as additional income sources for entrepreneurial universities (Frolich et al., 2010; Frølich & Strøm, 2008; Wiener et al., 2020; Panigrahi, 2018, Yokoyama, 2006). Although undertaking research projects and consultancy activities are less widely explored methods of funding by the traditional universities, entrepreneurial universities provide consultancy services and technological research to government and enterprises (Wang, 2001; Frolich et al., 2010; Frolich and Strom, 2008; Wiener et al., 2020, Panigrahi, 2018). These activities have long been part of entrepreneurial universities' efforts to monetize expertise and knowledge through consultancy projects (Wang, 2001; Al-Hamadeen and Alsharairi, 2014).

3.2.4. Technology transfer

Technology transfer has emerged as a significant revenue source for entrepreneurial universities, mainly for those emphasizing science and technology over human science (Yokoyama, 2006). Entrepreneurial universities often stimulate their students and research staff by allocating funds to encourage the creation of new ideas and inventions. They have been able to monetize new technologies through commercializing in the relevant market (Yulia et al., 2021; Klofsten et al., 2019; Ziderman, 2017; Pedro and Tatyana, 2013).

Moreover, research and technology organizations dedicated to technology transfer have been established across different countries to facilitate the commercialization of research outcomes and the licensing of intellectual property (Teichler, 2018). Collaborative programs bridging the gap between industry and academia have been vital in fostering technology transfers, generating royalty revenues, delivering professional services, and operating incubation centers in universities (Sengupta and Rossi, 2023; Hu, 2009). Entrepreneurial universities transfer technologies through commercializing research outcomes and licensing intellectual property (Yokoyama, 2006, Yulia et al., 2021). Furthermore, they actively support entrepreneurial endeavors through knowledge transfer, incubation facilities, mentorship, and consultancy services, creating a conducive environment for innovation within and outside the academic realm (Bolli and Somogyi, 2011, Ziderman, 2017, Bercovitz and Feldman 2006).

Overall, the literature underscores the vital role of technology transfer in generating revenue for entrepreneurial universities, allowing them to support their entrepreneurial activities and achieve financial sustainability which contribute significantly to economic growth and innovative practices (Sharma and Thandi, 2002).

3.2.5. Philanthropic Donations and Endowments

Philanthropic donations and endowments have long been crucial sources of revenue for higher education institutions globally (Liu et al., 2020; Teixeira et al., 2014). In various countries, government funding for universities has decreased, making philanthropy an increasingly important source of financial support (Broome et al., 2018; Wang, 2001; Zhang et al., 2016; Liu et al., 2020; Akinkugbe, 2000; Teichler, 2018; Hu, 2009). In the context of entrepreneurial universities, philanthropy plays a

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crucial role in financing innovative ventures, offering financial support through. gifts, endowments, and donations from individuals, foundations and corporations (Broome et al., 2018; Liu et al., 2020).

Philanthropic contributions enable entrepreneurial universities to finance their research, innovation, and other activities (Broome et al., 2018). While philanthropic donations traditionally make up a small portion of total university revenues, their significance is growing as philanthropists and donors contribute significantly to reducing higher education costs through private funding (Goksu and Goksu, 2015; Liu et al., 2020). They use donation funds to establish research centers, pay scholarships, and support specific research projects, and to enhance the university's entrepreneurial activities and impact (Sharma and Thandi, 2002).

Endowments, another common form of fundraising for universities, in which a fund is created from charitable donations with a specified purpose. Unlike general donations, endowments come with specific conditions set by donors to ensure the fund's sustainability and impact on the university (Khusainova et al., 2021; Sharma and Thandi, 2002). Both philanthropic donations and endowments provide valuable financial support to entrepreneurial universities, enabling them to pursue their commitment to innovation and excellence in higher education (Yulia et al., 2021).

3.2.6. Tuition and Fees

In the realm of higher education, tuition and fees paid by students represent a crucial and reliable income stream for universities, particularly in countries where central government and local authorities funding diminishes (Ouma & Cloete, 2009; Sengupta and Rossi, 2023, Broome et al., 2018). In light of this, tuition fees have become an increasingly important revenue source for universities globally, allowing them to reduce their reliance on government support (Liu et al., 2020; Futao, 2018). In many cases, tuition fees represent the second largest source of income for universities next to government funds, making them a semi-stable source of revenue (Liu et al., 2020; Yang and Zhao 2012, Ait et al., 2021). Universities often use cost-sharing models where they share the cost of education with students, parents, and other sectors (Sirbu, 2015; Sudakova and Dahel, 2023; Wang 2001).

Universities have implemented various tuition funding models depending on their management policy. Some universities are adopting hybrid models, like cost-sharing, where students, parents, and other stakeholders contribute to the education cost. The rationale behind cost-sharing is that those who benefit from education should at least share in the costs (Johnstone, 2006). The introduction of cost-sharing has become common in many countries due to the strain on public budgets for higher education. Japan, for instance, has a high number of private institutions heavily reliant on tuition (Frolich and Strom, 2008; Jongbloed and Vossensteyn, 2016).

In countries like England and Hong Kong, universities receive funding through a combination of tuition fees and block grants (Cheung, 2003), while in countries like Germany, tuition fees at public universities are either minimal or nonexistent (Teichler, 2018). Developing countries have been shifting the cost burden from taxpayers to students and parents, with the government subsidies often available for students unable to afford tuition fees (Jongbloed and Vossensteyn, 2016). In particular, countries like Australia and Russia have explored innovative approaches like fee-paying programs, loans to students, and targeted funding to enhance financial sustainability and widen access to education (Blume-Kohout & Adhikari, 2016; Platonova et al., 2015; Broome et al., 2018; Zavdetovna et al., 2016; Sudakova and Dahel, 2023).

In general, existing literature highlights tuition and fees as significant income sources for higher education institutions globally. In many countries, the shift towards cost-sharing and increased

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private expenditures is driven by the need to balance the rising demand for higher education with limited public resources (Broome et al., 2018). Entrepreneurial universities implement various funding models exist, including loans to students to cover tuition and fees, provided by state, educational institutions, banks, or private entities (Futao, 2018, Corbet and Larkin, 2017; Adams and Mohadeb, 2005, Liu et al., 2020). This diverse landscape of funding strategies across countries emphasizes the diverse strategies taken to ensure the sustainability of higher education (Adams and Mohadeb, 2005, Futao, 2018).

3.2.7. Other or Non-Traditional Sources

Entrepreneurial universities worldwide are exploring additional sources of funding to reduce their dependency on traditional sources like government grants, state appropriation and tuition fees (Sanyal, 2006). Non-traditional funding sources for these universities include income from royalties, alumni contributions, sales of educational services, grants from foundations, and income from rental and sale of real estate properties. By diversifying their revenue streams, these sources enable entrepreneur universities to reduce their reliance on traditional funding sources and increase their financial stability (Adams and Mohadeb, 2005).

Revenue diversification for entrepreneurial universities extend to activities including technology transfer, consulting, and customized educational programs. Monetizing their research and expertise through commercialization and consultancy projects enable universities to attract external funding and enhance their financial stability (Pedro and Tatyana, 2013).

Furthermore, entrepreneur universities generate income from other non-traditional sources through fees for incubation services, royalties, training activities, consultancy, and equity stakes in client companies. They also engage in activities such as leasing university facilities for events, conferences, and commercialization of research, as well as altering financial decision-making process. Attracting or recruiting foreign students, organizing conferences, and engaging in commercial research and consultancy activities are also among non-traditional sources of revenues for entrepreneurial universities (Voisey et al., 2005; Chiwandire & Vincent, 2019; Sharma and Thandi, 2002; Sengupta and Rossi, 2023).

Commercial research and consultancy activities involve providing consulting services and technological research for government and enterprises, with universities establishing research. research advisory centers to secure funding for projects (Wang, 2001; Wiener et al., 2020). Entrepreneurial universities also engage in research and consultancy projects for industry partners to monetize their expertise (Yokoyama, 2006, Sharma and Thandi, 2002). Additionally, client-related executive development packages and customized executive education programs for corporate clients and organizations contribute to revenue generation of entrepreneurial universities (Broome et al., 2018, Teixeira et al., 2014, Pedro and Tatyana, 2013).

Entrepreneurial universities may also generate revenue through licensing intellectual property and receiving royalties from research and development activities. In some countries, entrepreneurial activities focus on research partnership with the private sector, collaboration, and technological licensing (Yokoyama, 2006). Technology Licensing Centers are to license technology and promote intellectual property recognition, enabling universities to fund their entrepreneurial activities and contributing to the knowledge-based economy (Khusainova et al., 2021; Sudakova and Dahel, 2023; Hu, 2009).

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4. Discussion, Implications, and Future Directions

This section discusses the implications of the findings, highlighting emerging trends in financing mechanisms for entrepreneurial universities. It also explores future directions and provides recommendations for policymakers and university leaders.

4.1. Discussion and Implications

The concept of revenue diversification for universities, defined as generating income beyond government funding through various innovative initiatives, is crucial for their sustainability and impact (Pedro and Tatyana, 2013). Studies indicate that various revenue streams contribute to the financial landscape of higher education, particularly in entrepreneurial universities. These sources encompass government grants, tuition fees or cost-sharing, donations, and entrepreneurial activities such as research commercialization, technology transfer, consulting, customized courses, underscoring the importance of multifaceted approach to financial sustainability (Liu et al., 2020; Pedro and Tatyana, 2013, Jongbloed and Vossensteyn, 2016).

Effective funding mechanisms are essential for entrepreneurial universities to thrive, driving innovation, creating economic value, and fostering societal impact. A diverse funding portfolio is crucial for sustainability amidst economic changes in higher education (Teixeira et al., 2014).

Entrepreneurial universities employ diverse funding mechanisms such as grants, industry partnerships, and philanthropic donations, supported by institutional policies that promote commercialization and intellectual property rights. They attract funds through dedicated research centers, incubators, and partnerships with investors and alumni. Institutional policies fostering innovation, interdisciplinary collaboration, and entrepreneurship play a pivotal role in creating an environment conductive to the prosperity of universities.

Each financing mechanism presents unique advantages and challenges, influencing the type and pace of entrepreneurial activities pursued (Maria et al., 2012; Amaral & Magalhães, 2001, Hugo et al., 2008). For instance, government grants may support long-term research endeavors with societal impact, while venture capital investments focus on high-growth potential.

Financial resources for publicly funded universities come from governments, students, and other entities through grants, tuition fees, and donations (Jongbloed and Vossensteyn, 2016). In response to the need for increased efficiency and effectiveness and to supplement government funding, universities are exploring revenue diversification strategies including commercializing research and technology transfer.

The systematic review conducted shed light on the varying funding mechanisms employed by entrepreneurial universities and other higher educational institutions across different countries. It emphasized the vital role of effective funding mechanism for entrepreneurial universities to thrive and achieve their missions of fostering innovation, creating economic value, and driving societal impact. A balanced and diversified funding portfolio that incorporates multiple sources and models is essential to ensure sustainability and resilience in the face of changing economic landscapes and emerging trends with higher education.

Institutional policies play a critical role in supporting entrepreneurship and guiding funding decisions within universities. Policies that promote a culture of innovation, foster interdisciplinary collaboration and incentivize entrepreneurial endeavors play a pivotal role in creating an enabling environment for entrepreneurial universities to thrive (Teixeira et al., 2014). Additionally, policies that facilitate the commercialization of research outcomes, safeguard intellectual property rights, and streamline administrative processes can further support the funding and success of entrepreneurial initiatives.

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Revenue diversification, beyond government grants, typically involves activities such as commercialization of research, transferring technology, consulting, offering lifelong learning and customized courses, generating funds from owned assets, and engaging in other related activities (Pedro and Tatyana, 2013). In order achieve diversified revenue generation, it is essential for universities to collaborate with external stakeholders, particular industry partners, as this aligns with broader trends in higher education policy (Teixeira et al., 2014). The literature emphasizes the importance of universities engaging with external stakeholders to enhance revenue generation, aligning with current trends in higher education policy. Despite these benefits, universities often encounter challenges and financing constraints, such as fluctuating government subsidies, fluctuations in student enrollment, and limited control over tuition fees (Maria et al., 2015; Knoeppel and Sala, 2015; Kanaan et al., 2011).

One of the key reasons why diversified funding is important for entrepreneurial universities is the unpredictability and variability of funding sources. Relying solely on traditional sources such as government grants or tuition fees may not be sufficient to support the dynamic and often high-risk activities associated with entrepreneurial endeavors. Diversified funding mitigates the unpredictability of funding sources, allowing universities to support dynamic entrepreneurial initiatives (Kanaan et al., 2011).

Entrepreneurial universities always explore a variety of funding mechanisms tailored to their specific goals and priorities. Each of these mechanisms offers unique opportunities and challenges, and universities need to carefully assess and tailor their funding strategies to align with their specific goals and priorities. The benefits of different financing mechanisms include access to diverse funding sources, increased resources for research and innovation, opportunities for networking and collaboration, and potential for financial returns (Kanaan et al., 2011). However, challenges may include competition for funding, loss of control over intellectual property, conflicts of interest, and pressure to meet commercialization goals. By diversifying their funding sources, universities can mitigate financial risks and ensure stable funding streams to support their entrepreneurial initiatives.

Along with the various benefits and challenges associated with each funding mechanism, the outcomes and impacts of different financing mechanisms on entrepreneurial universities can vary. For example, government grants may support long-term research projects with societal impact, while venture capital investments may focus on quick returns and high-growth potential. The choice of financing mechanism can influence the type of entrepreneurial activities pursued, the speed of technology commercialization, and the overall success of the university's innovation ecosystem.

In general, effective funding mechanisms, diversified funding sources, and alignment with institutional policies are essential for entrepreneurial universities to realize their full potential and to drive innovation, foster entrepreneurship, and contribute to economic growth. By leveraging diverse funding models, and aligning institutional policies with entrepreneurial objectives, universities can enhance their capacity to drive innovation, foster entrepreneurship, and contribute to economic growth and development.

4.2. Emerging Trends and Future Directions in Financing Entrepreneurial Universities

University reform is being propelled by a multitude of factors, including a crisis in public funding, the heightened competitive environment in higher education, and the growing imperative for universities to be more accountable to society at large. Over the past few decades, public funding sources for universities have become increasingly unstable, prompting a quest for exploration of alternative revenue streams (Yokoyama, 2006). Transformations in funding policies, models, and trends have highlighted the need for continuous innovation and sustainable financing mechanisms for educational institutions.

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Entrepreneurial universities across diverse countries are turning to entrepreneurial activities to counter the decline in public funds and adapt to rapidly evolving markets. The universities are characterized by their efforts to reduce reliance on public funds, foster entrepreneurial identities, and contribute to regional economies by increasing external funding through entrepreneurial initiatives, reforming their organizational structures, and promoting strong community ties (Yokoyama, 2006).

In the landscape of higher education financing, several emerging trends and future directions point towards the evolution of financing mechanisms for entrepreneurial universities:

Diversification of Funding Sources: Universities are increasingly diversifying revenue streams to reduce reliance on government funding, leveraging activities like commercializing research, technology transfer, and consulting services to augment financial resources (Pedro and Tatyana, 2013).

Ramped-up External Funding: One of the emerging trends across many entrepreneurial universities is the increased search for external funding sources to reduce dependence on government funding. They are seeking to boost external funding through avenues like technology transfer, applied research, patents, and partnerships with industry. This external funding is crucial for supporting entrepreneurial initiatives and reducing dependence on public funds (Pedro and Tatyana, 2013; Sharma and Thandi, 2002; Maria and Bleotu, 2014).

Commercialization of Academic Programs: There is a growing trend towards commercializing academic offerings and research, with universities selling degree programs and seeking alternative revenue streams. Universities are increasingly exploring opportunities to commercialize academic programs and research and forming industry alliance for research and innovation to generate additional revenue (Sharma and Thandi, 2002).

Self-Reliance and Entrepreneurial Activities: Universities are adopting entrepreneurialism by which they become engaged in more entrepreneurial activities than they were before (Yokoyama, 2006). Entrepreneurial universities are increasingly focusing on becoming more self-reliant by engaging in entrepreneurial endeavors to address funding challenges and bolster accountability to society as a whole.

Organizational Transformation: Universities are undergoing organizational transformations to adapt to the changing environment and foster an entrepreneurial culture within their institutions. This includes reshaping their leadership, management, internal funding mechanism, and governance structures to support entrepreneurial endeavors (Yokoyama, 2006).

Industry Collaborations: Closer ties with private industries for research and funding opportunities are becoming a growing trend for universities, leading to diversified funding sources and research partnerships (Futao, 2018). Universities in various countries have already well positioned in recognizing commercial opportunities and formation of industry alliances in research and innovation (Sharma and Thandi, 2002).

Digitalization and Innovation: The increasing digitalization of the economy presents new openings for entrepreneurial universities to attract funding for pioneering research projects. This trend highlights the growing emphasis on technology and innovation in entrepreneurial activities.

Globalization: The globalization of the economy is opening-up fresh funding opportunities from international sources. Globalization is also facilitating global collaborations with partners, aligning with the increasing interconnectedness of research and innovation on a global scale.

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5. Conclusions and Research Directions

In conclusion, this systematic literature review has examined the critical role of financing mechanisms in the success and sustainability of entrepreneurial universities worldwide. By analyzing existing literature, the review has provided insights into the various financing strategies utilized by these institutions and their impact on entrepreneurial activities. The review has explored the diverse strategies employed by universities to support their entrepreneurial endeavors and adapt to the changing higher education landscape. Through analyzing a diverse range of funding sources and models, this study has underscored the importance of financial innovation and strategic partnerships in driving entrepreneurial activities within higher education institutions.

These emerging trends in financing entrepreneurial universities underscore the evolving landscape of higher education and the evolving strategies being adopted to ensure sustainability and growth in a competitive environment. The findings emphasize the importance of entrepreneurial universities to adapt to changing economic landscapes, embrace revenue diversification strategies, and prioritize research and development investments to foster innovation and societal impact. Furthermore, the review has highlighted the significance of effective funding mechanisms in promoting collaboration, technology commercialization, and knowledge transfer between academia and industry.

The insights collected from this study contribute to enriching the existing body of knowledge on financing mechanisms for higher education institutions, offering valuable guidance for university leaders, policymakers, and researchers seeking to enhance the entrepreneurial ecosystem and developing effective financing mechanisms to support entrepreneurship and innovation in higher education.

Further research and analysis of recent developments in the field are vital for a comprehensive understanding of funding trends in higher education. This review serves as a foundation for future research endeavors aimed at exploring emerging trends in funding schemes for entrepreneurial universities, assessing the long-term impacts of financing strategies on entrepreneurial activities, and identifying best practices for sustainable financial management in higher education. To further advance the understanding of financing mechanisms for entrepreneurial universities, future research endeavors can focus on key areas, such as:

- Conducting in-depth impact assessments to assess the long-term effect of various funding strategies on the entrepreneurial endeavors within universities.

- Comparing funding models across various geographical locations and different types of universities (to identify best practices and lessons learned.

- Exploring the role of emerging technologies, including Artificial Intelligence (AI), in revolutionizing fundraising and financial management in higher education.

- Investigating the policy implications of the various funding mechanisms on academic autonomy, institutional governance, and student outcomes to inform decision-making.

By addressing these recommendations and exploring future research directions, stakeholders in the higher education institutions can enhance their strategic approaches to financing and contribute to the sustainable growth and innovation of entrepreneurial universities.

Declarations

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