







University Spin-offs in the Business Transformation of the University of the Century

Spin-offs Universitarias en la Transformación Empresarial del Siglo XXI

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Fecha de recepción: 18.05.2024

Fecha de aprobación: 06.06.2024

Fecha de publicación: 30.06.2024

Cómo citar: Urdaneta Montiel, A., Jaramillo Escobar, B., Moyano Morán, G. (2024). University Spin-offs in the Business Transformation of the University of the Century. *Eduser* 11 (1), 7-16. <https://doi.org/10.18050/eduser.v11n1a1>

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Abstract

University spin-offs play a crucial role in the business vision of the postmodern university by generating technological products and intellectual property, allowing the articulation among the academia, the public sector and the society. The research aimed to determine the validity of university spin-offs and the role they play in the generation of innovation, development of science and technology transfer. The study is qualitative, based on documentary sources of specialized articles in indexed databases, of which 26 were selected based on criteria related to the topic, successful experiences in the creation and operation of these companies. The content analysis technique was used with emphasis on argumentation, narration and enunciation. Among the main results, it can be mentioned that university spin-offs play an important role as means for technology transfer, however, they require improving and innovating management, organizational structure and institutional culture. Furthermore, a regulatory framework is needed in order to promote the operation of these entities and to strengthen the relationship and cooperation among the university, the State and the business sector. The adoption of an entrepreneurial mindset in universities, both public and private, is essential to improve competitiveness and support teaching, research.

Keywords: Spin-off; knowledge management; technology transfer; university business vision.

Resumen

Las spin-offs universitarias desempeñan un papel crucial en la visión empresarial de la universidad posmoderna al generar productos tecnológicos y propiedad intelectual, permiten la articulación, entre la academia, sector público y la sociedad. La investigación tuvo como objetivo determinar su vigencia y el papel que desempeña en la generación de la innovación, desarrollo de la ciencia y la transferencia tecnológica. El estudio es de carácter cualitativo, basado en fuentes documentales de artículos especializados en bases de datos indexadas, de los cuales se seleccionaron 26 en función de criterios relacionados con el tema, experiencias exitosas en la creación y operación de estas empresas. Se utilizó la técnica de análisis de contenido con énfasis en la argumentación, narración y enunciación. Entre los principales resultados se puede mencionar que las spin-offs universitarias juegan un importante papel como medios para la transferencia de tecnología, sin embargo, requieren mejorar e innovar la gestión, la estructura organizativa y la cultura institucional. Además, es necesario un marco regulatorio que promueva el funcionamiento de estas entidades, en beneficio de fortalecer la relación y cooperación entre la universidad, el Estado y el sector empresarial. La adopción de una mentalidad empresarial en las universidades, tanto públicas como privadas, es esencial para mejorar la competitividad y apoyar la docencia, y la investigación.

Palabras clave: Spin-off; gestión del conocimiento; transferencia tecnológica; visión empresarial universitaria.

INTRODUCTION

A spin-off is a new, independent company created from a parent organization to commercialize specific products, services, or technologies. These companies allow the parent entity to focus on a particular market or customer base and arise for reasons such as the need for specialization, external funding, or a streamlined corporate structure. University spin-offs (USOs), formed by academic staff, aim to “promote innovation and technological development” through the commercialization of research (Clarysse *et al.*, 2005). They play a crucial role in the postmodern university’s business vision by generating technological products and intellectual property (Djokovic, 2008), and their growth is driven by scientific advancements and their integration into society as development tools (Shane, 2004). USOs act as a bridge between public research and societal development, using models like the triple helix, where universities, companies, and the State collaborate (Czaron *et al.*, 2022). However, universities face challenges in knowledge management and technology transfer, especially in emerging economies. Effective technology transfer requires profitable mechanisms and an understanding of legal and commercial aspects, with universities central to developing a competitive, innovation-driven environment (Corsi & Prencipe, 2016).

Literature review

Today’s universities face significant challenges, including aligning resources for effective knowledge management and responding to societal and market demands. A key aspect of this is the strategic importance of technological business, where technology transfer plays a central role in the educational mission and offers potential for self-financing. This has sparked a debate in academia about reconciling the differing goals of the business and university sectors, leading to a redefinition of universities to adopt a postmodern academic business model essential for survival, productivity, and competitiveness. “In the field of integration, the academia becomes the framework for the development of the society and the entrepreneurship” (Czaron *et al.*, 2022).

Berbegal-Mirabent *et al.* (2015) examine factors influencing the creation of university spin-offs (USOs), particularly the roles of technology

transfer offices (TTOs). They analyze three types of spin-offs—those supported by TTOs, those with licensing agreements, and those with university stakes—finding that no single strategy is superior, and multiple paths can lead to successful academic entrepreneurship. Seed capital and support are critical, though the management of seed capital is less significant (Berbegal-Mirabent *et al.*, 2015).

USOs serve as a strategic link between academia and society, contributing to employment, wealth generation, and collaboration in production processes (Rodeiro *et al.*, 2021; Canals, 2003). This role is reinforced by the triple helix model, where the university generates knowledge, companies produce and consume technological products, and the State funds research, ensuring stable and reliable interactions.

Bueno *et al.* (2003) observe that a simplistic, mechanistic model often dominates reality, yet countries like Chile, Singapore, and Brazil demonstrate the significant role academic institutions can play in knowledge management. However, not all universities have successfully implemented this, hindered by divergent decision-making, uncollaborative environments, or weak societal integration. The adoption of an entrepreneurial mindset in universities, both public and private, is essential for enhancing competitiveness and supporting teaching, research, and social promotion through strategies that emphasize scientific and technological output.

Innovative knowledge management in universities is challenged by conflicting objectives among businesses, the State, and society, alongside growing social demands and the need for efficiency (Bernate and Guativa, 2020). Universities must align their resources towards knowledge management that bridges the conceptual gap and contributes to the information society. In a postmodern context marked by globalization, competition, and changing consumer preferences, organizations must improve processes and leverage technology transfer to gain competitive advantages. This requires not only technological updates but also skill development and an understanding of legal frameworks.

León (2003) highlights that technical knowledge exchange, involving the acquisition of external technological knowledge, necessitates a

technological contract to support each stage, which is crucial for managing university spin-offs (USOs). Such contracts may include the sale or rental of technological assets, ensuring benefits according to international practices. Technology transfer, as defined by Díaz (2017), involves knowledge exchange to modernize production processes. Aguila (2005) emphasizes that technology transfer encompasses both soft (systems, procedures, information) and hard (machinery, equipment, tools) aspects.

In technology transfer, the exchange or sharing of technological products aims to enhance and innovate organizational processes by integrating externally developed soft and hard technologies, supported by legal contracts and operational assistance (Nicolaou, 2003). The complex environment of the knowledge society underscores the need to institutionalize technological business and support entrepreneurship. Universities, as knowledge generators, must view technology transfer as crucial for both public and private financing (Gras, 2007). University spin-offs signify a shift towards the commercialization of intellectual property and technological products (Aceytuno & Paz, 2008; Seguí-Mas, 2013; Blanco, 2016; Czakon *et al.*, 2022).

Iglesias *et al.* (2012) describe spin-offs, based on empirical research involving 70 spin-offs from 37 universities, as companies focused on the commercialization of scientific technological products, reflecting the new business vision of postmodern universities that integrate economic growth, development, and sustainability (Fuster, 2021). Collaboration between universities and industries is essential for technology and knowledge transfer, which are fundamental for creating new companies. These collaborations enable universities to acquire critical competencies and are crucial for current university management and innovation (Martínez *et al.*, 2023).

Romero *et al.* (2024) emphasize that university-industry collaboration can generate spin-offs and highlight the practical application of university knowledge in today's society. They identify key factors for successful collaboration, emphasizing the role of innovation and technology in shaping business-university policies. The diversity within spin-off founding teams can influence their performance non-linearly, showing that plurality drives innovation (Tagliacruz *et al.*, 2021). The

involvement of external investors, such as venture capital funds, and the relationship between team composition and spin-off performance stress the importance of collaborating with external actors to foster innovation, growth, and knowledge coordination, which aligns with the promotion of interdisciplinarity in modern universities.

Highlighting the critical role of spin-offs in transferring technology from academia to the business sector, they promote the practical application of academic research (Pachciarek, 2023). The 21st-century university spin-offs (USOs) emphasize collaboration with companies and administrative environments to facilitate effective commercialization processes, fostering entrepreneurship and driving universities towards a business- and market-oriented approach.

Prencipe *et al.* (2020) explore the impact of the regional environment and knowledge diffusion on USO growth in Spain and Italy. Using multilevel analysis models, they find that the regional context significantly influences growth in Spain, while its effect is less pronounced in Italy, underscoring the importance of regional policies in supporting university entrepreneurship.

In their study of Spanish USOs from 2005 to 2013, Rodeiro *et al.* (2021) discover that company size, particularly the number of employees, positively correlates with survival, noting that reaching a minimum size reduces the risk of failure. They also find that factors influencing survival vary across micro, small, medium, and large USOs. Resource-intensive activities like patenting or debt payment decrease the survival probability of micro USOs, while exporting activities increase it. Tacit knowledge from academic founders is crucial for the survival of smaller USOs.

Ortín and Vendrell (2014) contribute to understanding the total factor productivity (TFP) of USOs by comparing them with other new technology companies in their early years. They adopt a longitudinal approach, finding that while USOs have the potential to develop long-term wealth-generating business models, they often disappear after 2-3 years of operation.

Korpysa (2019) takes a diagnostic approach to the entrepreneurial process of university spin-offs in Poland, combining theoretical and empirical elements to examine the sequences of events and decision-making logic in these companies. His research, based on 141 USOs

in 2017, emphasizes the diverse definitions of university spin-offs, particularly focusing on the commercialization of university knowledge. Internal and external factors, including economic, legislative, and external financing, significantly influence the creation and operation of these companies.

Szopa *et al.* (2015) emphasize the importance of universities in driving economic growth through new, innovative companies, which impacts product development, industry creation, and job and wealth generation. Their study proposes a framework to analyze the results of university spin-off activities, highlighting previously underestimated social and cultural factors. It examines how these organizations can foster an innovative culture and contribute to economic and social growth. The study also underscores the growing internationalization of these companies and their role in cross-sector collaboration and strategic alliances, stressing the need to integrate universities' innovative capacities into policies and strategies for promoting innovation and entrepreneurship.

Thomas *et al.* (2020) underscore the importance of innovation and value creation through scientific research and university-business collaboration. Their longitudinal analysis of 30 USOs provides insights into the entrepreneurial capabilities necessary for success, including the role of scientist-entrepreneurs and their operating ecosystems. They highlight the commercialization of disruptive technologies as crucial in the postmodern business vision of universities as active agents in knowledge and technology transfer.

Guercini and Milanese (2019) investigate the relationship between novelty and heritage in the context of USOs, using cases from an Italian university. They find that novelty can be either an asset or a liability, with its effects moderated by heritage. Their IMP-based approach reveals how heritage, incorporating "network memory" and "culture and language," interacts with novelty, potentially mitigating its impact or enhancing its positive dimensions under certain conditions, such as organizational enthusiasm and innovation capacity.

Fini *et al.* (2023) assess the effectiveness of public subsidies, particularly Small Business Innovation Research (SBIR) awards, on USOs.

They find that the impact of these awards varies by product type: for digital technologies, they negatively affect venture capital raising and have no impact on IPOs, exits, or first sales. Conversely, for non-digital companies, such as those in biotechnology and energy, these awards positively influence venture capital raising and performance.

The study suggests that digital technologies face faster cycle times and a greater market uncertainty, making them less receptive to subsidies designed to support the technological development. The results underscore the importance of considering the industrial domain when evaluating the effectiveness of SBIR-type subsidies for USOs, also highlighting the nuanced relationship between public subsidies and their success, and emphasizing the need for policy interventions targeted at specific industrial domains. They suggest that public support can be more effective when directed at projects with high technical risk and longer product cycles (Fini *et al.*, 2023).

Figueiredo *et al.*, (2024) emphasize that USOs typically arise from the transfer of university knowledge and technology, with management teams often composed of students, professors, or researchers. Universities typically provide necessary resources and infrastructures to foster these entrepreneurial efforts, with technology companies being the most common type of USO. Entrepreneurial education has gained traction due to the challenges students face in the job market, making USOs a significant research focus.

MATERIALS AND METHODS

An analytical investigation, as described by Hurtado (2012), was conducted to examine the key components of university spin-offs, focusing on their significance and contributions. The study employed a retrospective documentary design, reviewing specialized literature on the historical development of spin-offs within the university context. Sources included specialized articles from indexed databases, with 26 articles selected based on criteria related to the topic and successful experiences in the creation and operation of these companies.

The content or discourse analysis technique, as defined by Hurtado (2012), was used to analyze the articles, focusing on argumentation, narration, and enunciation. The methodology followed the Grounded Theory approach (Strauss, 2002), beginning with open coding to identify initial codes representing main ideas. This progressed to axial coding, where connections between codes were established to form broader themes. In the final phase, relational coding, categories were conceptualized based on the reviewed documents, and a conditional matrix was created to visually represent the connections between categories, facilitating a theoretical analysis of the phenomenon.

RESULTS PRESENTATION AND DISCUSSION

The article discusses how universities, in response to the complexities of the postmodern environment, have transformed their strategies, structures, and cultures, adopting a more business-oriented approach. This shift includes active participation in the business market, generating self-financing through initiatives like university spin-offs (USOs). These spin-offs are seen as business options that satisfy social, labor, and commercial needs, forming the foundation of university entrepreneurship.

Abootorabi *et al.* (2024) examine how the combination of economic and social objectives in USOs impacts their performance and

governance. Their study finds that spin-offs with hybrid goals outperform those with purely economic or social objectives, emphasizing the importance of aligning investment objectives with these hybrid goals to enhance performance. The study also highlights the value of public-private collaboration and academic entrepreneurship in promoting regional development and technological innovation.

In another study, Park *et al.* (2023) explore the role of intangible assets—such as intellectual property, human capital, and relational capital—in the success of USOs, especially in their early stages. While traditional research has focused on tangible assets, this study provides a conceptual framework showing that intangible assets are crucial for scientific advances, economic performance, and knowledge translation. It offers recommendations for leveraging these assets to improve science-based innovation and achieve better economic and social outcomes.

The analysis of these studies led to the identification of categories and subcategories that help understand the creation and management of USOs and their significance in the university's postmodern entrepreneurial vision. The qualitative analysis also resulted in a conditional analysis matrix that systematizes these insights, providing a basis for examining the broader impact of USOs on the knowledge society (Figure 1). The studies underscore the importance of knowledge administration in universities as a system that integrates internal and external factors to support teaching, research, and business initiatives, ultimately promoting productivity and competitiveness.

Figure 1
Conditional analysis matrix

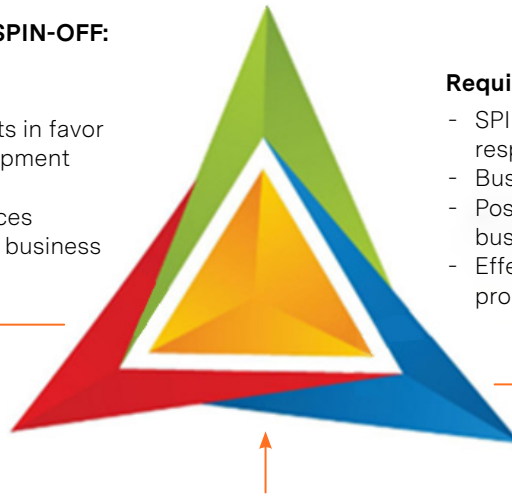
TECHNOLOGY TRANSFER MECHANISM

Fundamentals for creation and management of the university SPIN-OFF:

- Complexity of the process
- Profile of the actors
- Marketing of scientific products in favor of economic and social development
- Technological transformation
- Generation of financial resources
- University transformation with business vision

Requirements and importance:

- SPIN-OFF as a tool of social responsibility
- Business experience and cooperative
- Postmodern vision of technological business
- Effective knowledge management promotes technological development



Adaptation to the postmodern environment:

Need for organizations and universities to adapt to a postmodern environment, characterized by complexity, uncertainty and rapid technological evolution.

Source: Qualitative processing of articles. Urdaneta, *et al.* (2023)

The investigation explores knowledge management within universities as an open system that should align with the needs and expectations of external actors, incorporating an environmentally conscious approach. Hahn *et al.* (2024) examine how university research activities influence spin-offs' access to early-stage capital financing, highlighting the tension between universities' research and commercialization missions. They provide insights into promoting industry collaboration and balancing these missions, and suggest future research on imprinting mechanisms and the role of local business ecosystems in spin-off development.

Nevalainen *et al.* (2020) investigate the financing process of university spin-offs (USOs) through the experiences of managers who act as substitute entrepreneurs. Using a meta-micro-narrative approach, their study reveals how these managers' local understandings of investors' values and roles challenge the 'ideal' financing process described in research literature. Their findings underscore the need for further research into USO financing dynamics from the entrepreneurs' perspective.

From a qualitative epistemological perspective, the articles were analyzed using a transdisciplinary interpretive approach, leading to the identification of technology transfer mechanisms as a key category. Iglesias (2012) and Taheri (2019) discuss the emergence of technological entities within universities as a means of transferring technology to the productive sector, reflecting a modern university business vision. This trend emphasizes the importance of innovation, technological development, and the generation of qualified employment, which are crucial for socioeconomic development.

The interaction between the business sector and universities is recognized as beneficial, reinforcing a strategy that prioritizes universities' business potential and their contributions to self-financing and economic benefits. This strategy requires an appropriate structural, strategic, operational, and legal framework, as noted by Rodeiro-Pazos (2021).

The study discusses the role of spin-offs in transforming universities into active participants in the technological market, requiring a shift from

traditional structures to a matrix approach that redefines functions and management models. This change turns scientific research into a source of business, self-financing, growth, and competitiveness, challenging the traditional university paradigm and promoting a postmodern business vision. Aceytuno and Paz (2008) note that this shift has significantly altered university responsibilities, positioning technology transfer as a crucial function in the postmodern era.

Access to venture capital is critical for spin-offs, particularly for strategies like joint ventures. Fernández-López *et al.* (2020) emphasize that venture capital availability decreases with geographic distance, making local capital vital for the creation of university spin-offs (USOs). The legal framework surrounding universities and intellectual property is also crucial, as it supports the competitive commercialization of products and services, aligning with the integration of the university, State, and business sectors.

Wicaksono *et al.* (2024) contribute to the understanding of USOs within the postmodern business vision of universities by providing a systematic literature review and scientometric analysis. They highlight the role of USOs in regional economic development, the commercialization of research, innovation dissemination, productivity improvement, and job creation. The study also identifies common challenges for USOs, such as early-stage failure and limited growth, and proposes a new definition and framework for USO development. Additionally, they suggest four potential research topics, including the relationship between scientists' job satisfaction and the sustainability of USOs, offering valuable insights for advancing the practice and understanding of USOs in the contemporary business context.

Adriana *et al.* (2024) explore factors influencing insurance companies' decisions regarding Sharia business units, providing insights applicable to university spin-offs (USOs) and the modern business vision of 21st-century universities. They emphasize the role of corporate entrepreneurship, legislation, human resource development, industry perspectives, and innovation in fostering business innovation and spin-offs, while adapting to current regulatory demands.

Odei y Novak (2022) analyze the entrepreneurial university's role in transferring academic knowledge to businesses and its impact on

socioeconomic development, using data from the UK. They find that funding, patents, and rewards significantly influence the creation of USOs, with patents acting as a key mediator. They advocate for integrating entrepreneurship into university curricula and providing financial support to stimulate USOs, especially in transitioning democracies. They also call for further research to address external factors and university-specific characteristics.

Yashiro *et al.* (2024) focus on the role of interorganizational collaboration and financing in sustaining and expanding R&D activities in USOs. Their regional analysis highlights differences in strategies between the US and UK, suggesting the need to adapt approaches to specific environments. The study underscores the importance of strong local and international networks, particularly in pharmaceutical innovation, and offers both theoretical and practical insights into managing USOs, emphasizing the evaluation of scientific quality and collaboration strategies.

FINAL THOUGHTS

For university spin-offs to thrive in a changing and demanding environment, it is essential to consider structural, strategic and legal aspects that ensure their competitiveness and excellence.

Organizational objectives impact the behavior and performance of USOs, and they provide important insights for business practice and policy formulation, both for academics, scientific entrepreneurs and policy makers, about how to best leverage intangible assets in order to improve the science-based innovation.

Areas for future research need to be identified, such as a deeper understanding of imprinting mechanisms and the role of local business ecosystems in the development of USOs, which provides a comprehensive and valuable theoretical-practical vision of these and the business university from the perspective of entrepreneurs. Research would include the relationship between the job satisfaction of scientists or academics and the training and sustainability of USOs. These aspects provide a solid foundation for understanding how universities can foster

business innovation and spin-off creation, while adapting to the current business environment and the regulatory demands. Moreover, society would benefit from public policies that stimulate knowledge transfer and the creation of emerging companies based on academic research.

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