



Universities' Third Mission is from teaching and doing research to dissemination of academic results and activities in society

Diana Spulber

DISFOR – Department of Education Sciences – University of Genoa, Italy
email: diana.spulber@unige.it

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Abstract

In recent decades the academic world of universities has been grappling with another challenge: the Third Mission, or social impact. It is precisely the term Third Mission or Social Impact that generates confusion since, on the one hand, everything the academic world does has both social and economic significance; on the other hand, the academic world is called upon to disseminate, to promote its teaching and research activities in society but excluding pure research and purely teaching activities. The manuscript aims to analyze the term Third Mission and the theories applied to it. Several SLRs have been analyzed, and the issues highlighted by the authors have been extrapolated and analyzed. Particular attention is given to academic engagement and the benefits of TM. The result could be helpful in a better understanding of the term itself and how it can be promoted among professors without creating further confusion and stress.

Key words: Third Mission, Academic Engagement, University-Industry Collaboration, Triple, Quadruple Quintuple Helix Theory, TM benefits

1. Introduction

In the current knowledge era, universities are called upon to play a crucial role beyond mere academic education: the so-called third mission. This represents an active engagement of academic institutions in contributing to their communities' social and economic development through research, dissemination of culture, and innovation. As a central institution for knowledge production, the university is recognized as the main engine for disseminating science and culture within society. As noted by Etzkowitz in 1998, the loci of scientific knowledge have shifted from the 'ivory tower' toward entrepreneurial science, representing a progressive interplay of

cognitive opportunities, institutional rearrangements, and normative change. The recognition of universities as integral players in addressing contemporary challenges, including technological advancement, socio-economic disparities, and environmental sustainability, reflects the evolving landscape of higher education. The significance of this mission has drawn considerable scholarly attention, spurring an increasing body of literature that seeks to define its parameters, explore its applications, and consider its implications for policy and practice (Romano et al., 2025; Coelho et al., 2021). As initially articulated within the Triple Helix model by Etzkowitz and Leydesdorff, the Third Mission emphasizes collaboration among academia, industry, and government to foster innovation and knowledge transfer (Carayannis et al., 2021). The debate regarding the university's entrepreneurial, cultural, and social role and the definitions that should be applied is not recent. In the academic literature, it is possible to find various definitions that describe the connection between the University and Society: Entrepreneurial University, University Technological Transfer, University's Social Impact, and University's Third Mission. A predominant theme emerging from this literature is the entrepreneurial university model, through which institutions adapt to become engines of innovation and economic growth, actively participating in technology transfer and societal problem-solving (Ranga et al., 2013).

The academic literature has extensively explored the factors driving the shift toward entrepreneurial models within higher education institutions. Many studies emphasize that the evolution of the entrepreneurial university has been significantly influenced by decreasing levels of governmental funding, which have led to substantial financial gaps that necessitate innovative responses (Chrisman et al., 1995; Slaughter & Leslie, 1997; Riviezzo & Napolitano, 2010; Muscio et al., 2017; Paoloni et al., 2019). Moreover, reductions in research funding systems have intensified competition among universities, compelling them to differentiate their offerings. Today, higher education institutions face constant pressure to enhance their performance, including their economic outcomes (Paoloni et al., 2019), and to respond effectively to the increasingly complex global developments impacting their stakeholders (Sam & van der Sijde, 2014). The concept of the entrepreneurial university has garnered growing scholarly and policy attention, though definitions vary widely—from institutions focused on technology transfer to those driven by innovation, commercialization, and economic self-sufficiency. Within this challenging context, the cultivation of an entrepreneurial culture is increasingly viewed by universities as a strategic means of securing essential resources — such as funding, partnerships, and access to infrastructure — from a diverse range of sources, thereby strengthening their sustainability and relevance in a rapidly evolving landscape (Mariani et al., 2018; Compagnucci et al., 2020; Gygli et al., 2019).

Scholars distinguish between academic entrepreneurship, typically led by individuals or teams based on their research pursuits, and university entrepreneurship, which is driven at the institutional level. Mechanisms such as Technology Transfer Offices, incubators, and science parks support these activities; however, debates continue regarding whether entrepreneurship should be understood through the lens of individual initiative or institutional transformation. Alternative models, including the innovative university, academic capitalism, enterprise university, and corporate university, reflect diverse manifestations of the entrepreneurial turn, often tied to reduced public funding and increased market orientation. Despite the fragmented terminology, these models share a common thread: the redefinition of the university's role in aligning teaching, research, and economic engagement with evolving societal and market expectations. Even today, the entrepreneurial university concept resonates more strongly in the United States than Europe, as American universities have historically relied significantly on it (Coelho et al., 2021). The expansion of the university's role aligns seamlessly with the heightened demand for responsibility and awareness regarding societal needs.

2. The Evolution of the Third Mission in Higher Education

Historically, a comprehensive understanding of the Third Mission in higher education institutions has evolved significantly since its inception in the late 20th century. Initially defined as a response to reduced public funding in the 1980s, the concept emphasized higher education's role in promoting economic development and technology transfer, alongside traditional teaching and research functions (Netshifhefhe et al., 2016). This early formulation was not merely a reactive measure; it reflected a growing recognition of the university's potential as an engine for societal advancement. Historically, the transition from research universities to entrepreneurial universities emerged in the United States in the late 19th century (Etzkowitz, 2004; Riviezzo & Napolitano, 2010). Institutions such as the Massachusetts Institute of Technology (MIT) and Stanford University serve as early archetypes of this transformation, having been among the first higher education institutions (HEIs) to broaden their traditional teaching and research missions by incorporating applied research with commercial relevance into their programs. These universities also pioneered knowledge transfer beyond academic boundaries and began directly supporting industry (Etzkowitz, 2000, 2003; Goethner & Wyrwich, 2019). In the Anglo-Saxon context, this new awareness matured in the late 1970s and early 1980s, when the first cuts in university funding imposed the necessity of seeking new funding sources; in this scenario, the university began to turn towards the business world. In the United States in 1980, the Bayh-Dole Act was enacted,

allowing universities to transfer exclusive ownership of many publicly funded inventions to facilitate commercialization. The Bayh-Dole Act is unanimously recognized as the catalyst for the evolution of the mission of public research institutions, which have gradually assumed an increasingly direct and incisive role in the dynamics of innovation and industrial development.

Private funding and corporate contracts have constituted a substantial portion of universities' financial resources, contributing significantly to their operational capabilities (Blenker & Dreisler, 2006). As a result, U.S. universities exhibit a more pronounced market orientation than their European counterparts, which rely predominantly on state funding (O'Reilly et al., 2019). Furthermore, while entrepreneurial initiatives in American universities have developed through a bottom-up process, European academic entrepreneurship has been introduced more recently and primarily through top-down mechanisms (Etzkowitz, 2004).

Over time, scholars like Etzkowitz and Leydesdorff (1997) introduced the Triple Helix model, which framed the university's role in facilitating collaboration among academia, industry, and government as essential for innovation. This model posits that such collaborative networks enhance knowledge transfer and stimulate economic growth and social development, thereby aligning educational institutions more closely with community and industry needs. Moreover, more recent explorations into higher education partnerships, such as those emerging from the Global North to the Global South, highlight the transformative impact of mutual collaboration in addressing local challenges and advancing global goals (Hanada, 2021). This evolution underscores the need for higher education institutions to adapt their missions to reflect broader societal dynamics and responsibilities while remaining committed to academic excellence and integrity. Thus, the Third Mission has gradually become a vital component of higher education identity, driving institutions to become more proactive in their engagement with diverse stakeholders and addressing pressing global issues

3. The Triple Quadruple and Quintuple Helix Model applied to the Third Mission.

The concept of the Triple Helix of university–industry–government relations, introduced in the 1990s by Etzkowitz (1993) and Etzkowitz and Leydesdorff (1995), builds upon earlier contributions by Lowe (1982) and Sábato and Mackenzi (1982). It reflects a shift from the dominant industry–government dyad characteristic in industrial society- towards an increasingly triadic interaction among universities, industries, and governments within the emerging knowledge society. The central thesis of the Triple Helix model posits that innovation and economic development in a Knowledge Society depend on an enhanced role of the university and the hybridization of

elements across the three spheres. This hybridization fosters new institutional and social configurations for the production, transfer, and application of knowledge, thus driving innovation forward (Ranga & Etzkowitz, 2013). This perspective not only embraces the process of creative destruction, traditionally seen as inherent to innovation dynamics (Schumpeter, 1942), but also highlights the importance of creative renewal occurring within each institutional sphere — university, industry, and government — as well as at their intersections. The configurations of the Triple Helix model, as described by Etzkowitz and Leydesdorff (2000), highlight the distinct roles each sphere plays in various countries, including moderation, collaborative leadership, substitution, and networking. Functions are crucial in the sense of competencies of the system components that determine the system's performance. The main function of a Triple Helix system is seen in a broader sense, encompassing the generation, diffusion, and utilization of knowledge and innovation. This function is realized with the techno-economic competencies described in innovation system theory and entrepreneurial, societal, cultural, and policy competencies embedded in what we call the 'Triple Helix spaces': the knowledge, innovation, and consensus spaces. The early 2000s saw an expansion of the Third Mission concept to incorporate social responsibilities, prompting in-depth discussions on how universities could engage with communities and address pressing societal challenges effectively.

In subsequent years, the focus shifted toward assessing the university's entrepreneurial qualities, emphasizing the entrepreneurial university model that equipped institutions to function more like businesses. This transition aligns with the growing recognition that universities must actively contribute to cultural and social progress as part of their Third Mission obligations (Tijmsma et al., 2023). By the mid-2010s, initiatives advocating for unifying the Third Mission with sustainable development goals emerged, illustrating the need to systematically integrate societal and environmental concerns into academia's missions (Romano et al., 2025; Kezar et al., 2001). This period also marked an increasing interest in how collaborative frameworks could enhance public sector engagement, with the Quadruple Helix model gaining traction in European contexts by emphasizing the inclusion of civil society alongside traditional actors (König et al., 2020). Today, the Third Mission continues to evolve, encompassing a broader spectrum of engagement strategies while necessitating an evaluation of the institutional mechanisms that support this multidimensional approach (Pacheco et al., 2024). This historical trajectory underscores the growing complexity and relevance of the Third Mission as an indispensable element of universities' operational frameworks, reflecting their transformative potential in contemporary society. The literature on the Third Mission of universities reflects a

significant evolution in educational objectives, extending beyond traditional teaching and research to encompass societal engagement and economic development (Compagnucci et al., 2020). Central themes emerge regarding the roles of universities as knowledge producers and societal innovators, positioning them as key players in regional and global innovation ecosystems. This shift is often framed within the context of the Triple Helix model, where the interplay among academia, industry, and government cultivates innovation and collaboration (Tijmsma et al., 2023). Ranga and Etzkowitz emphasize how hybrid relationships foster advantages in local development through collaborative strategies, highlighting the vital need for universities to bridge gaps in knowledge transfer and societal needs (Netshifhefhe et al., 2016; Tijmsma et al., 2023).

The *Quadruple Helix model* (Carayannis & Campbell, 2009) expands the traditional Triple Helix by incorporating a fourth dimension: the *media-based and culture-driven public*. This inclusion acknowledges the vital role of civil society, culture, values, and public communication in shaping innovation systems and knowledge co-creation. Building upon this, the *Quintuple Helix model* introduces a fifth dimension—the *natural environment*—positioning knowledge and innovation within the broader context of ecological sustainability. As such, the Quintuple Helix represents a forward-looking, integrative framework that aligns innovation and collaboration with *sustainable development*, *social ecology*, and *green transformation* principles. It reflects an urgent need for responsible innovation that serves economic and social progress and addresses environmental challenges in a holistic, systemic manner. Moreover, the literature suggests a growing recognition of the importance of citizen engagement in the innovation process. Recent discussions on the Quadruple Helix model further expand on this notion, asserting that including civil society enriches the innovation landscape and enhances democratic processes in knowledge production (König et al., 2020).

Miller et al., 2018s) examined technology transfer within a quadruple helix framework. In their research, they have adapted the Triple helix from Carayannis and Campbell (2009) by adding a new actor, Societal innovation user stakeholders. By adding a new actor in the ecology, it is possible to say that globally, academia fulfils its role of promoting comprehensive values. According to Carayannis and Campbell 2010 “*The Quintuple Helix Model is interdisciplinary and transdisciplinary at the same time: the complexity of the five-helix structure implies that a full analytical understanding of all helices requires the continuous involvement of the whole disciplinary spectrum, ranging from the natural sciences (because of the natural environment) to the social sciences and Quintuple Helix (context of [natural] environments for society) Quadruple Helix (context of society for Triple Helix) Triple Helix (basic model of the innovation core) knowledge economy knowledge society &*

knowledge democracy socio-ecological transition humanities (because of society, democracy and the economy)”(Carayannis and Campbell 2010, p. 62).

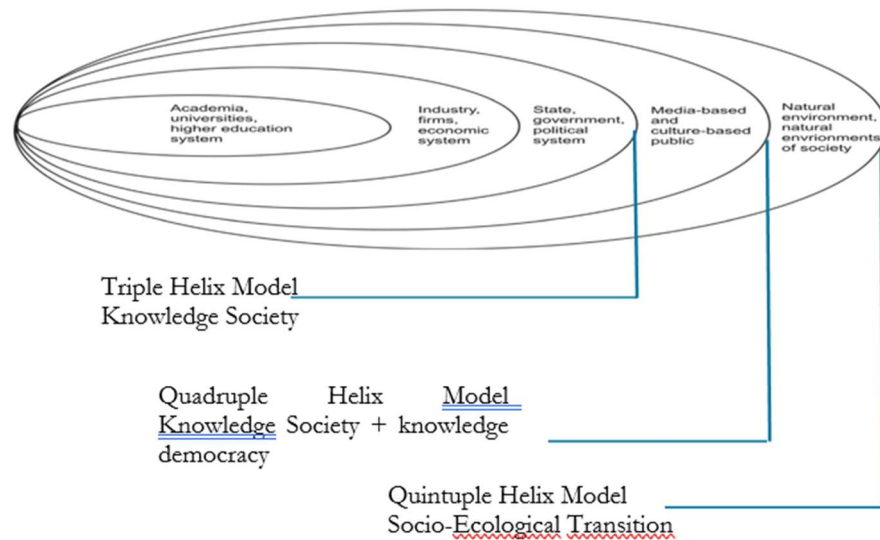


Fig. 1 UTM Knowledge production and innovation adapted from Carayannis et al 2012

Figure 1 explains the visual transition from Triple Helix Model to Quintuple Helix Model. *The Education System:* Representing the first helix, the education system encompasses universities, academic institutions, and schools. This subsystem is foundational in generating a nation’s *human capital*—including students, educators, researchers, and academic entrepreneurs—through the dissemination and advancement of knowledge.

The Economic System: The second helix focuses on the economy, comprising industries, firms, financial institutions, and services. It is responsible for producing and managing a nation’s *economic capital*, which includes entrepreneurship, technologies, infrastructure, products, and financial resources.

The Political System: The fifth helix represents the political and legal structures that shape national direction and policy. It governs the development and administration of *political and legal capital*—including laws, governance frameworks, public institutions, and strategic visions—that regulate and support the other subsystems within the state

The Media—and Culture-Based Public: This fourth helix merges two crucial forms of capital. The *culture-based public* contributes *social capital*—traditions, values, and collective identities—while the *media-based public* generates *information capital* through communication channels such as the Internet,

television, and social media, facilitating knowledge exchange and civic engagement.

The Natural Environment: As the third helix, the natural environment ensures sustainable development. It provides essential *natural capital* such as ecosystems, biodiversity, raw materials, and renewable resources necessary for both survival and innovation.

The Quintuple Helix model is both a theoretical and practical framework for exchanging and transforming knowledge as a resource. It is structured around five interconnected societal subsystems, each possessing its own form of capital, and is designed to foster sustainable development (Carayannis & Campbell, 2010). Within this cumulative model, knowledge flows dynamically from one subsystem to another, creating a continuous *circulation of knowledge* (Barth, 2011a). This circulation emphasizes that knowledge functions as both an *input* and an *output* across and within subsystems—be it within a single nation-state or between different states.

When one of the five subsystems receives a knowledge input, it can trigger a process of knowledge creation. This process integrates foundational knowledge and generates new insights, inventions, or technologies as knowledge outputs. These outputs then follow two possible trajectories:

1. They may lead directly to innovations that enhance sustainability within a nation.
2. Alternatively, they may re-enter the knowledge circulation process as refined know-how, becoming a new input for another subsystem within the helix.

In this way, the Quintuple Helix facilitates a recursive, evolving exchange of knowledge that continuously supports innovation, sustainability, and systemic interconnectivity (Carayannis & Campbell, 2010; Barth, 2011a). Carayannis and Campbell (2006, p4.) stated, "*On the one hand, knowledge serves as an input or resource for advanced societies and economies, which increasingly depend on knowledge. On the other hand, knowledge production (knowledge creation) also generates knowledge as an output, which then is being fed back (recycled) as a knowledge input.*" This thematic shift highlights the necessity for universities to adopt entrepreneurial and co-creative approaches that resonate with community expectations, addressing contemporary challenges such as climate change, public health, and economic disparities (Pacheco et al., 2024; Leydesdorff et al., 2016). The Third Mission is also discussed regarding its historical roots and contemporary implications. Initially emerging from the need for universities to justify public funding in the late 20th century, today's models emphasize the transition towards entrepreneurial universities capable of addressing pressing social issues (Mandrup et al., 2017). The complexities surrounding the integration of the Third Mission into university strategies underscore the evolving nature of the educational landscape that universities

must navigate alongside the Triple Helix model, ensuring they remain relevant contributors to both economic progress and societal well-being.

4. University-Industry Collaboration University-industry collaboration theories

Theories are essential for understanding how actors behave and interact within complex social systems.

Stakeholder Theory (ST), originally from management science, is applied to analyse knowledge exchange between universities and industry by prioritizing stakeholder interests. Stakeholders are defined as those who affect or are affected by institutional objectives, and their needs grow in complexity when engaged in co-creation. To manage this complexity, an operational framework organizes interactions across three stakeholder levels: micro, meso, and macro. At the micro-level, individual actors such as students and researchers engage through internships and research projects. The meso-level includes institutions like universities and businesses, linked through models such as the triple helix and entrepreneurial university. At the macro level, community stakeholders connect via regional innovation systems and open innovation. This multi-level approach allows a structured understanding of stakeholder dynamics in university-industry collaboration (UIC). The operational framework thus aligns diverse conceptual models to facilitate effective knowledge circulation. Ultimately, it supports decision-making and engagement across different actor levels in innovation ecosystems.

Institutional Theory (INT) refers to the study of the social processes, structures, and practices that shape the behaviour and interactions of individuals and organizations within a broader institutional environment. It emphasizes how actors operate within systems governed by formal rules, governance structures, social norms, and shared expectations that define legitimate conduct. These institutional arrangements influence how organizations structure themselves and interact with one another, creating a framework for understanding change, stability, and adaptation in social systems.

In the context of University-Industry Collaboration (UIC), INT offers a powerful lens through which to analyse how institutions such as universities, industries, and government bodies engage in and are shaped by collaborative activities. UICs do not emerge in a vacuum; they are embedded in institutional contexts that both enable and constrain innovation and knowledge transfer. Governance frameworks, regulatory policies, cultural values, and institutional missions all influence these partnerships' form, intensity, and outcomes.

This study contributes to the advancement of Institutional Theory by demonstrating how institutional dynamics impact the development and

performance of UICs. It reveals how shared norms, legitimacy-seeking behaviour, and institutional pressures shape the motivations and strategies of actors involved in knowledge exchange. By applying INT to the UIC landscape, this research highlights the pathways through which institutional alignment, policy support, and mutual adaptation can generate sustained collaboration, foster innovation ecosystems, and create long-term developmental benefits for all stakeholders involved.

Thus, INT not only helps explain the formation and evolution of UICs but also provides a framework to assess the institutional conditions under which these collaborations thrive or falter, offering valuable insights for scholars, practitioners, and policymakers aiming to enhance the effectiveness and impact of university-industry partnerships.

Complex and Adaptive Systems Theory (CAST) provides a framework for understanding how multiple entities interact within dynamic and often unpredictable environments to create synergies, adapt to change, and evolve (Dooley, 1997). This theory is particularly useful in analysing systems composed of diverse actors with differing objectives, structures, and behaviours—such as those found in University-Industry Collaborations (UICs). While universities are often characterized by hierarchical bureaucracies with multifaceted missions, industries tend to be driven by market dynamics and profit motives. CAST enables a systemic view of how these contrasting institutional logics can be reconciled through adaptive interactions.

In the context of UICs, CAST highlights the importance of non-linear feedback loops, continuous learning, and self-organization in fostering collaboration between academia and industry. Rather than being rigid and prescriptive, CAST views UICs as evolving ecosystems where actors respond to internal and external stimuli, adjust their strategies, and co-create new knowledge and value. This approach is especially relevant for addressing the complexity and unpredictability that often characterize real-world collaborations.

A significant contribution of this study lies in applying CAST to demystify the intricate interactions within UICs by proposing a simplified yet adaptive conceptual framework. By doing so, the research translates theoretical complexity into a practical model that can guide actors in navigating collaboration, reducing friction, and achieving mutual benefits. CAST thus offers a powerful lens for understanding how UICs can transform from static agreements into dynamic and responsive partnerships that continuously evolve in response to changes in knowledge, policy, and stakeholder needs.

Ultimately, CAST underscores the importance of flexibility, mutual learning, and adaptability in building resilient UICs capable of sustaining innovation and societal impact in a constantly shifting landscape.

The analysis of different UIC theories can be assumed in the table below:

Table 1: Analysis of different UIC theories

<i>Aspect</i>	<i>Stakeholder Theory (ST)</i>	<i>Institutional Theory (INT)</i>	<i>Complex and Adaptive Systems Theory (CAST)</i>
<i>Core Concept</i>	Balancing and prioritizing the interests of diverse stakeholders	Social behaviour is shaped by rules, norms, and governance structures	Interactions among diverse actors within evolving, dynamic systems
<i>UIC Focus</i>	Understanding who the stakeholders are and aligning interests	Analysing how institutional norms shape and constrain collaboration	Modelling UIC as a dynamic, evolving relationship driven by feedback
<i>Level of Analysis</i>	Micro (individuals), meso (institutions), macro (society)	Institutional/organizational structures and environments	System-level interactions and adaptiveness across actors
<i>Strength in UIC</i>	Helps define roles and expectations of partners (e.g., academics, firms, students, government)	Clarifies formal/informal constraints that influence UIC behaviour	Offers a model for understanding change, adaptation, and co-evolution
<i>Key Contribution to UIC</i>	Provides a framework to align goals, manage expectations, and optimize value for all actors	Highlights how existing norms and rules support or hinder UIC development	Explains how UICs evolve over time in response to internal and external stimuli
<i>Applicability</i>	Planning and evaluating stakeholder satisfaction and engagement	Designing and reforming policies and governance for collaboration	Managing complexity, innovation, and system adaptation within UICs
<i>UIC Challenges Addressed</i>	Conflict of interest, stakeholder misalignment	Institutional inertia, bureaucratic resistance	Unpredictability, change, and complexity in collaborations
<i>Criticism/Limitations</i>	May oversimplify power asymmetries between stakeholders	Can be too rigid or slow to adapt to new demands	It may be abstract or difficult to implement in policy and practice
<i>Examples in UIC</i>	Internship programs, joint research, government–industry–university partnerships	Triple helix model, entrepreneurial university	Regional innovation systems, Living Labs, smart specialization

5. Inputs from different Systematic Literature review

Academic Engagement

Perkmann et al., in 2013, explored the engagement of academics in university-industry knowledge transfer activities. Speaking about

engagement and commercialization, they subdivided the influence of academic engagement on antecedents and consequences of external engagement.

Individual characteristics represent one of the antecedents of academic engagement and significantly influence academic engagement with industry; specifically, factors such as male gender, seniority, prior collaboration experience, and high scientific productivity positively correlate with enhanced engagement, whereas age exhibits mixed effects on these relationships. The capacity of scientists to secure both public and private funding serves as a critical reinforcement for engagement, as it not only reflects their success but also signals potential value to industrial partners, aligning with findings that suggest financial backing is vital in fostering collaborative endeavours between academia and industry (Papa et al., 2018). While similar individual traits predict both academic engagement and the commercialization of research outputs, it is noteworthy that seniority and success in obtaining government grants are more strongly linked to academic engagement. In contrast, commercialization may be more associated with younger academics socializing in pro-commercial environments.

Moreover, organizational-level determinants affect academic engagement in ways that diverge from those influencing commercialization; for instance, academics affiliated with lower-ranked institutions tend to engage more frequently with industry, likely as a result of resource constraints, whereas higher-quality institutions may inadvertently discourage such engagement through prevailing cultural or peer pressure effects. In this context, group norms and association with interdisciplinary research centres positively influence engagement, underscoring how organizational culture and structural factors moderate individual behaviours. In contrast, commercialization is positively correlated with high institutional research quality and the establishment of formal technology transfer infrastructures, highlighting a divergence in the organizational conditions that bolster engagement versus those that facilitate commercialization.

Institutional context, particularly factors such as disciplinary affiliation and national policies, significantly shapes patterns of academic engagement; applied fields like engineering typically exhibit higher levels of engagement, while the preferred knowledge transfer channels display considerable variation across disciplines. Furthermore, while commercialization has been profoundly influenced by institutional reforms—illustrated by measures like the Bayh–Dole Act in the US—academic engagement, in comparison, has received significantly less policy focus and demonstrates fewer cross-national differences, although mechanisms like competitive funding systems may elevate engagement incentives (Abubakar et al., 2017). In summary, the nuances of academic engagement are driven more by cultural and disciplinary factors. In contrast, commercialization reveals greater sensitivity

to legal and policy frameworks designed to incentivize effective technology transfer.

What are the consequences of academic engagement? Academic engagement generally does not harm research productivity and may even enhance it by generating new ideas and innovative approaches, thus fostering academic growth and intellectual inquiry (Smith et al., 2020). However, some evidence suggests a potential long-term decline or an inverse U-shaped relationship, wherein initial engagement may lead to diminishing returns over time as researchers become increasingly focused on practical applications (Jones & Adams, 2021). Engagement may influence researchers' agendas toward applied topics, particularly in contexts where industry funding is involved, but findings on this shift are mixed, indicating a nuanced interplay between funding sources and academic priorities (Taylor et al., 2019). There is limited evidence that engagement or commercialization leads to greater secrecy or reduced communication among academics, although concerns about restricted knowledge sharing persist, especially in the life sciences, where competitive pressures can stifle open collaboration (Brown & Green, 2022). The impact of engagement on teaching is under-researched; however, one study suggests it may support increased student involvement and motivation, thereby enhancing the educational experience and outcomes (Wilson, 2020). Overall, while both engagement and commercialization can boost prestige and productivity, they raise unresolved concerns about openness and the balance between academic and commercial priorities, which remains a critical discussion point among scholars (Liu & Wong, 2018). Academic engagement, unlike commercialization, is practiced by a broader range of researchers and is largely complementary to core academic activities such as publishing and research, suggesting that fostering an engaged academic culture could lead to more holistic benefits for institutions and the communities they serve.

The acquisition of grants, particularly among senior, well-connected, and highly productive individuals, reflects a nuanced motivation that transcends mere financial incentives. It is often predominantly driven by scientific and educational objectives, positioning grant acquisition as a vital component of the broader ethos of open science within academic circles. This orientation aligns with the conceptual framework of academic engagement, which many scholars often perceive as a natural extension of their research pursuits. Organisationally, the dynamics of academic engagement exhibit a lesser dependence on institutional support and high research quality compared to commercialization strategies. This phenomenon frequently serves as a resource mobilization strategy for high-performing individuals who may be situated within lower-ranked institutions, thereby challenging traditional hierarchies of academic prestige (Peacock et al., 2023). At an institutional level, engagement tends to manifest most commonly within applied fields

such as engineering, where disciplinary norms exert a shaping influence that eclipses the potential impact of national policies. Overall, it can be posited that academic engagement is predominantly animated by individual initiative rather than by the structural confines of the institutions themselves, a characteristic that underscores the malleability and adaptability of the academic landscape. However, the long-term implications of such engagement on scientific productivity remain uncertain, particularly given the prevalence of cross-sectional studies that often fail to capture the longitudinal benefits of sustained academic engagement efforts.

Three key insights emerge from the synthesis of their findings regarding academic engagement. First, it tends to be positively associated with individual characteristics such as seniority and high scientific productivity, suggesting a strong alignment with the advancement of academic research, as noted in previous studies highlighting the relevance of personal attributes in fostering scholarly output (Pittman et al., 2022). Second, unlike commercialization, academic engagement is less embedded within institutional structures and is primarily driven by individual initiative, emphasizing the role of professors as crucial agents in enacting the third mission of higher education, which has gained increasing importance in contemporary academic discourse (Compagnucci et al., 2020). Third, it serves as a strategic resource mobilization, potentially compensating for limited institutional support, particularly in lower-ranked universities, where faculty often rely on personal networks and external collaborations to enhance their academic endeavours. However, caution is warranted when interpreting its effects on research productivity, as current evidence is largely based on cross-sectional studies, leaving the causal relationship—whether engagement enhances productivity or vice versa—yet to be established, raising fundamental questions about the underlying dynamics of academic activity in varying institutional contexts.

University-Industry Collaboration

In 2016, the systematic literature review (SLR) conducted by Ankrah and Al-Tabbaa primarily focused on the dynamics of university-industry collaboration (UIC). This systematic review of university-industry collaborations (UIC) from 1990 to 2014 analysed 109 studies, offering a descriptive and thematic synthesis that led to developing an integrated process framework. According to the authors, collaboration between universities and industry is widely recognized as a crucial driver of innovation through knowledge exchange; however, existing research remains fragmented and lacks a cohesive framework. The SLR culminated in identifying five key aspects that form the foundation of an integrated process framework, which provides a comprehensive analysis and outlines future

research directions. Forms of UIC are numerous; the literature identifies several common modalities such as joint ventures, consortia, and alliances. Nonetheless, little consensus exists regarding their precise definitions or nuanced distinctions, with additional forms having been recognized—underscoring the extensive variety of interaction possibilities. Various typologies have been proposed; among them, Bonaccorsi and Piccaluga's (1994) framework stands out as particularly comprehensive, categorizing UIC into six specific types that vary according to university resource involvement, duration, and degree of formalization. Notably, the review emphasizes that while formalized agreements can strengthen partnerships, an excess of formalization may engender conflict and distrust due to inherent tensions between interdependence and institutional autonomy. Motivations for UIC are multifaceted; to elucidate the underlying motivations, Oliver's (1990) six contingencies were employed as a framework, revealing that universities are primarily driven by factors such as necessity, reciprocity, efficiency, stability, and legitimacy—though not by asymmetry since power or control over industry does not typically serve as a motivator. Universities pursue UICs to respond effectively to government policy pressures, secure alternative funding, access specialized industry expertise, and enhance their strategic positioning within a competitive, knowledge-driven environment. In contrast, the industry's motivations are centred around gaining access to advanced research capabilities, reducing research and development costs, mitigating risks, and obtaining reputational gains through affiliation with prestigious academic institutions (Alarcón& Brunner, 2024; Reymert et al., 2022). Here is a visual summary of the six contingencies from Oliver's framework, illustrating the motivations of universities and industry in forming collaborations.

Table 2: Motivation for University-Industry Collaboration adapted from Oliver's framework

	University Motivations	Industry Motivations
Necessity	Response to government policies and strategic alignment	Need for innovation support and research access
Reciprocity	Access to industry expertise and infrastructure	Benefit from academic research and graduate employment
Efficiency	Alternative funding sources, IP licensing, reduced bureaucracy	Cost-effective R&D and access to public funding
Stability	Adaptation to a dynamic knowledge economy, resource sharing	Mitigating uncertainty, accessing external knowledge networks
Legitimacy	Enhancing institutional credibility and reputation	Reputational gains via association with top universities
Asymmetry	Not a motivator for universities	Exercise of control or influence (possible industry motive)

The formation and operationalization process—a modified version of Mitsuhashi's alliance formation model—describes the development of university-industry collaborations (UICs) through a five-stage process: partnership identification, making contact, partner assessment, negotiation, and agreement signing (Li J et al., 2024). Key enablers such as pre-existing relationships, trust, clearly defined roles, joint planning, and mutually agreed

measures of success are essential for the effective formation of UICs, where both legal and informal commitments play complementary roles that depend on the complexity of the partnership (Li J et al., 2024). Once operational, UICs naturally evolve through ongoing interactions; factors including communication, regular meetings, training initiatives, and personnel mobility significantly influence their success, with the intensity of these activities varying according to the degree of formalization established in the partnership. Enablers, inhibitors, and outcomes are influenced by various factors—classified into seven categories: resources, legal frameworks, and organizational issues. When effectively managed, these factors can enhance the success of knowledge and technology exchange; however, neglecting them can impede progress. Although UICs bring diverse economic, institutional, and social benefits for both parties involved, they do not have potential drawbacks. These can include mission drift, quality concerns, internal conflicts, and risks—particularly significant for universities, which often enter into these partnerships from a position of resource dependency, making them more susceptible to pressures from industry partners. This asymmetry increases the likelihood that academic values, timelines, or the open dissemination of knowledge may be compromised, demonstrating the complex dynamics of university-industry collaboration (Alarc M3n et al., 2024). The benefits and Drawbacks of University-Industry Collaboration (UIC) can be reassumed in the table below

Table 2: Benefits and Drawbacks of University-Industry Collaboration (UIC)

Category	Universities	Industry
<i>Economic Benefits</i>	Access to external funding, commercialization of research	Innovation gains, new products, competitive advantage
<i>Institutional Benefits</i>	Improved research capacity, enhanced reputation, staff, and student development	Access to academic expertise, recruitment of skilled graduates
<i>Social Benefits</i>	Strengthened community ties, contribution to societal challenges	Corporate Social Responsibility (CSR), positive public image

<i>Category</i>	<i>Universities</i>	<i>Industry</i>
<i>Mission Deviation</i>	Risk of drifting from educational or scientific goals	<i>Not typically applicable</i>
<i>Quality Issues</i>	Potential compromise of academic standards or research independence	Frustration with academic pace or methodology
<i>Conflicts</i>	Disputes over goals, authorship, or intellectual property	Tensions over IP rights or project direction
<i>Risks</i>	Dependence on industry funding, pressure for quick and marketable results	Legal and reputational risks, uncertainty of return on investment

Key findings underscore the urgent need for more objective measures of UIC outcomes that transcend current subjective evaluations, especially concerning the quantifiable value of spin-outs, patents, and commercialization activities. These principles align with the emphasis on knowledge transfer highlighted by (Garcia et al., 2025). The review also reveals a substantial lack of research addressing the effects of academic engagement on teaching and learning, raising critical questions about whether UICs can genuinely evolve from merely resource complementarity to a significant competitive advantage for firms. Furthermore, additional gaps are identified, including the unclear role of government in UICs, particularly pervasive in developing countries, echoing the observations made by (Hajrizi et al., 2024). The absence of comparative international studies that explore UIC success across various institutional, legal, and cultural contexts remains a significant oversight in the literature. Finally, the predominance of cross-sectional research severely limits the understanding of long-term effects, underscoring the pressing need for longitudinal studies to better assess the impact and sustainability of UICs over time.

In this vein, Miller et al. (2018) have examined technology transfer within a quadruple helix framework, adapting the Triple Helix model developed by Carayannis and Campbell (2009) by exploring:

- *Societal-Based Innovation in Quadruple Helix* -Adding a new actor, societal-based innovation users, expands the complexity of stakeholder dynamics,

as illustrated in the figure. The sample of Miller et al.'s systematic literature review (SLR) was composed of articles spanning the period from the introduction of the Bayh-Dole Act to 2016, covering more than three decades of research and practice. This SLR literature review identified four main themes that are critically important for understanding the impact that the emergence of quadruple helix structures has on innovation ecosystems. Developing stakeholder relationships is essential; the literature emphasizes a science-based, technology-push approach while also highlighting that in a quadruple helix context, soft infrastructures—such as stakeholder relationships, knowledge transfer, and human capital—are equally critical, albeit they introduce complexity, conflicts of interest, and risks stemming from diverse stakeholder agendas (Starkbaum et al., 2024). Effective university technology transfer (UTT) in this model heavily relies on the strategic management of regional and organizational stakeholder relationships and the pivotal role of academic entrepreneurs, who must navigate conflicting demands and bridge the substantial gap between academic and societal innovation needs (Lazarov et al., 2022). The individuated subthemes emerging in this discourse include People-based aspects of UTT, Balancing conflict, Academic engagement, and UTT performance measures and entities. Mode 2 UTT performance has traditionally focused on tangible outputs like patents and spin-offs. However, within the more intricate Quadruple Helix model, success is increasingly contingent upon adeptly managing diverse stakeholder relationships, addressing disciplinary constraints, and acknowledging the critical role of societal engagement in the innovation process.

- *UTT and Organisational Structures* The effectiveness of University Technology Transfer (UTT) within a Quadruple Helix model relies heavily on establishing integrative organizational structures that facilitate co-creation among diverse stakeholders. Nonetheless, many Technology Transfer Offices (TTOs) encounter significant resource, skill, and governance limitations that impede their capacity to manage complex stakeholder relationships effectively. As highlighted by recent research, the institutional nature of TTOs influences their operational behaviours and outcomes, reflecting the varying challenges they face ((Cartaxo et al., 2017)). Successful innovation in this context necessitates enhancing regional and institutional governance and requires the development of new enabling roles and infrastructures designed to promote stakeholder collaboration and knowledge exchange. Moreover, a thorough evaluation of knowledge and technology transfer mechanisms can provide insights into how these activities align with an institution's mission, thereby further informing strategic decision-making ((Tran et al., 2013)). TTOs can significantly improve their effectiveness and contribute to the

broader innovation ecosystem by addressing these limitations and fostering collaborative environments.

- *SLR and UTT Challenges* In their systematic literature review (SLR), the authors critically assess Mode 2 University Technology Transfer (UTT) through the lens of the quadruple helix model, accentuating the increasing involvement of societal innovation users alongside the heightened complexity of stakeholder relationships, which echoes findings in broader public policy contexts). Based on a comprehensive SLR, the authors delineate persistent challenges identified in previous UTT efforts while also acknowledging new challenges that have emerged from the more collaborative and networked environments characteristic of current innovation systems. This study underscores the pressing need to realign institutional culture, performance systems, and support structures within universities to effectively engage with the wider array of stakeholders, a sentiment also reflected in the analysis of cultural policy impacts (Yusof et al., 2012). Furthermore, it highlights that research into the quadruple helix framework is still in its nascent stages, particularly at the micro level, and advocates for longitudinal and case-based studies to attain a deeper understanding of its dynamics and implications. The proposed research agenda contributes to theoretical discussions and serves practical objectives by outlining critical themes and sub-themes that future inquiries should explore to foster the evolution of Mode 2 UTT within a quadruple helix context, thereby bridging the gap between theory and impactful practice.

Vick and Robertson (2018), in their systematic literature review (SLR), undertook an extensive analysis of knowledge transfer (KT) as it operates within the framework of technology management (TM) distinguishing itself specifically within the diverse national contexts of the UK. In their SLR, they diligently consolidated the prevailing body of knowledge. They robustly highlighted significant gaps concerning the dynamics of knowledge transfer (KT) between UK universities and industry, as evidenced in recent studies. This exploration centres on four key dimensions of university-industry (U-I) collaboration that have been identified through prior research: motivations, activities, barriers, and outcomes. Moreover, the importance of these dimensions cannot be overstated, as they encapsulate the multifaceted nature of interactions between higher education institutions and industrial stakeholders, which are crucial for fostering innovation and economic growth (Li et al., 2024)). These dimensions serve as a foundational framework for understanding the interrelations and processes of KT and underscore the ongoing challenges and opportunities present within the UK landscape regarding effective collaboration between universities and industry partners.

Through differing rationales, researchers interpret university-industry (U–I) knowledge transfer (KT) via two analytical lenses: one that emphasizes the political, social, and intangible influences impacting KT, and another that adopts a contextual perspective, delving into structural and operational factors including the types of collaboration, available resources, and sectoral dynamics. These perspectives are recognized as complementary, providing distinct yet interconnected insights into U–I knowledge transfer within the UK context. Research utilizing a sociopolitical lens has primarily focused on uncovering the motivations of academics to engage in U–I collaborations, while the contextual perspective has passed in on tangible KT activities and outcomes, albeit frequently without a sector-specific lens. Significant findings from existing literature have been synthesized, mainly through the analysis of 35 key studies, which reveal four central themes—motivations, activities, barriers, and outcomes—effectively highlighting the most recurrent patterns in U–I KT. Additionally, these findings present implications for policy development, particularly in directing future research funding and agenda-setting efforts, as underscored by recent analyses of university third missions and their integration into broader societal goals (Garcia et al., 2025)(Li et al., 2024). This integrated understanding ultimately enriches the discourse on effective KT and emphasizes the necessity of aligning academic and industrial interests to foster innovation and knowledge exchange.

- I. Activities - Studies adopting a sociopolitical perspective emphasize knowledge transfer (KT) as a socially embedded process, underscoring the critical role played by boundary spanners, knowledge brokers, and linked individuals who facilitate connections and spillovers between universities and industry, which can be essential for the realization of the third mission of higher education. In contrast, the contextual perspective focuses on the nuanced nature and intricate structure of KT activities, distinguishing between informal interactions such as advice-sharing and more formal mechanisms including patenting, licensing, and contract research, which are often categorized by their relational intensity and engagement with both academic and societal stakeholders. While UK research has extensively mapped KT activities, highlighting the significance of both informal and formal avenues, it remains uncertain which specific activities most effectively support the exploitation and adoption of transferred knowledge, particularly in light of evolving expectations from society and the academic community regarding impact and relevance.
- II. Motivation - Challenges in collaborative research arise not primarily from the structural model itself but from the individuals involved' divergent motivations and behaviours. Academics, for instance, are predominantly driven by intrinsic motivations such as self-motivation, the pursuit of

career recognition, and a commitment to research advancement, rather than external financial incentives; this aligns with findings that emphasize the role of non-monetary rewards in academic settings (de Souza et al., 2024). In contrast, industry partners, particularly those from smaller firms, tend to prioritize elements such as trust, customized relationships, and mutual understanding, highlighting the importance of relational dynamics in collaborative efforts (de Souza et al., 2024). Contextually, while geographical proximity can facilitate the development of informal ties and enhance collaboration, especially for smaller firms, it is insufficient on its own to guarantee sustained university-industry (U–I) interaction. A variety of other critical factors must also be considered, including academic expertise, absorptive capacity, and the cultivation of what is termed 'knowledge proximity'—this concept encompasses aspects such as shared language, aligned goals, and reciprocal benefits, all of which are essential for productive collaboration (Oliveira et al., 2024). To strengthen U–I partnerships effectively, it is necessary to pay ample attention to both the relational dynamics at play and the institutional structures that govern these relationships, going beyond merely addressing spatial closeness to foster deeper, enduring collaborations.

- III. Barriers - From a sociopolitical perspective, barriers to university-industry (U–I) collaboration are often deeply rooted in knowledge boundaries, institutional constraints, and individual limitations, such as a lack of time, incentives, or recognition for knowledge transfer (KT) activities. The perceived lower status of KT, often regarded as a 'third mission' alongside teaching and research, further undermines its institutional support and effectiveness. Contextually, these barriers are typically categorized as either orientation-related, which stems from differing goals and incentives between academic and industrial partners, or transaction-related, involving complex issues such as intellectual property conflicts and cumbersome bureaucratic procedures. Academics tend to experience orientation-related barriers more intensely, given their focus on scholarly output and research advancements, while firms, regardless of their size, report facing more significant challenges with transactional issues and internal capabilities required for effectively managing university interactions. Notably, existing research has yet to systematically compare barriers across various types of U–I activities, leaving a critical gap in understanding how these challenges differ by the forms of collaboration, such as commercialization versus joint research, thus highlighting the need for further investigation into these systemic obstacles.
- IV. Outcomes - A key finding emerging from the sociopolitical perspective highlights a significant gap in research regarding the intangible outcomes of university-industry (U–I) collaboration, which encompasses aspects such as new research ideas, novel opportunities, and potential negative

effects—dimensions often largely overlooked in favour of quantifiable outputs. Current performance indicators, such as those employed in the Higher Education Business and Community Interaction (HE-BCI) survey, tend to prioritize tangible 'knowledge products,' which can inadvertently lead to the underestimation of the wider value inherent in knowledge transfer (KT) processes (Smith, 2019). This emphasis on more concrete outputs may obscure U- I partnerships' nuanced, indirect benefits, including enhanced innovation capacity and increased societal contributions (Jones & Brown, 2020). From a contextual perspective, most existing studies predominantly focus on research-based outcomes or those directly related to U-I collaboration, ignoring the multifaceted implications that such collaborations can yield (Wilson, 2021). Notably, as articulated in recent literature, addressing this imbalance is imperative for a more holistic understanding of the dynamics at play within academic and industrial collaborations. Ultimately, a broader exploration of these intangible outcomes is essential to fully comprehend the impact and potential of U-I partnerships, framing them not solely within the confines of measurable outputs but as vital components of a knowledge-rich ecosystem (Thompson, 2022).

- V. University-Industry Collaboration Impacts - Applied outcomes, particularly publications, often underreport non-publishable but nonetheless valuable results that could illuminate the broader impacts of university-industry (U-I) collaboration. The review also reveals a significant imbalance in methodological approaches: Motivations for collaboration have predominantly been explored through qualitative research within a sociopolitical framework, whereas outcomes are generally examined quantitatively within the contextual stream, leading to a fragmented understanding of the collaborative landscape. Overall, sector-specific analyses remain noticeably limited, indicating an urgent need for more nuanced and inclusive evaluations of U-I collaboration impacts that reflect the complexity of these relationships (Marques et al., 2024). This systematic review offers a twofold contribution: it provides a descriptive analysis of methodologies and research emphasis in U-I knowledge transfer (KT) studies. It also presents a thematic analysis of key findings and rationales underpinning these efforts. The review identifies critical gaps, including the lack of sector-specific insights, underexplored bi-directional KT processes, and a concerning shortage of research focused on informal knowledge exchange and qualitative outcomes. It calls for future policy and research initiatives to prioritize nuanced, long-term, and sector-tailored approaches that can better support and sustain effective U-I collaboration, as evidenced by the growing body of literature emphasizing these themes (Li et al., 2024).

Compagnucci and Spigarelli conducted a systematic literature review (SLR) to analyse the academic literature concerning key constraints and recurring themes within the Triple Helix Model (TM) and potential measures to support policymaking and the effective implementation of this innovative model. Their comprehensive review explored several thematic areas, including the evolving conceptualization of the TM, the entrepreneurial transformation of higher education, the development of entrepreneurial universities, and knowledge transfer (KT) as a critical TM function—encompassing knowledge transfer offices (KTOs) alongside a spectrum of entrepreneurship education initiatives. Based on 134 peer-reviewed articles, Compagnucci and Spigarelli's review identifies key challenges in managing, evaluating, and enacting TM across diverse institutional and national contexts. Moreover, the review highlighted the important involvement of university staff and external stakeholders in TM activities, emphasizing collaborative engagement as a cornerstone of the model. It also addressed the evaluation and impact assessment of TM processes, the strategic orientation of universities toward sustainable practices, and the emerging role of co-creation for sustainability. The development of the entrepreneurial university has followed various pathways, such as Clark's five transformational elements and Etzkowitz's four evolutionary stages, each of which emphasizes strategies for internal reform, strategic engagement, and pathways to commercialization that resonate with the TM framework. Another influential model is Entrepreneurial Architecture (EA), proposed by Vorley and Nelles, which integrates institutional structures, leadership, strategies, systems, and culture to support entrepreneurship within educational and research endeavours. However, actualizing these models encounters several constraints, including entrenched resistance from academic staff, a lack of an entrepreneurial culture, and top-down governance practices that may stifle bottom-up innovation initiatives. Many academics remain sceptical, fearing that prevailing commercial imperatives may compromise academic integrity and distract from the primary educational missions of their institutions. Furthermore, studies indicate a potential conflict between entrepreneurial activity and teaching quality, though the relationship with research performance generally tends to be positive. Some empirical evidence reveals that entrepreneurial engagement can enhance flexibility, autonomy, and research output; however, it does not automatically transform a university unless it also enriches education and upholds core academic values, as emphasized in the TM context. Despite the push for transformation, many universities face substantial structural barriers, including hierarchical bureaucracy, a lack of coordination among departments, and insufficient entrepreneurial experience. Moreover, numerous institutions often fail to carve out a clear entrepreneurial identity or brand, which could significantly aid in attracting talent and strengthening

competitive positioning in an increasingly global educational landscape. A unified entrepreneurial culture remains underdeveloped, partly due to these barriers, calling for re-evaluating university strategies in the context of the TM and the entrepreneurial university paradigm (Madichie et al., 2022; Toan, 2021).

Because many academics lack familiarity with industry practices and are not integrated into entrepreneurial initiatives, a significant gap limits the effectiveness of entrepreneurial strategies within universities. Ultimately, the shift toward entrepreneurship in universities must be both structural and cultural, requiring coordinated internal efforts, robust support from leadership, and broader institutional alignment to avoid undermining traditional academic values, as highlighted in the Third Mission framework (Garcia et al., 2025). The table below outlines strategic measures to support the design and management of the entrepreneurial university, organized across four key domains: management, activities, promotion, and government support.

Table 3: Summary of measure needed for an entrepreneurial university

Management: Universities should avoid a "one size fits all" model and instead tailor their entrepreneurial strategies to their unique contexts, strengths, and institutional cultures. Leadership should adopt a multifaceted approach that integrates academic entrepreneurship with teaching, research, and societal impact, ensuring that educational initiatives are relevant and responsive to contemporary challenges (Mele et al., 2024). Understanding the role of internationalization and adopting a bottom-up, rather than purely top-down, approach can enhance entrepreneurship, fostering a more inclusive environment for innovation. Special attention should be paid to how trends manifest differently in developing countries, requiring more contextualized understanding and responses.
Activities: Entrepreneurial actions span a spectrum from hard (e.g., patenting, spin-offs) to soft (e.g., student training, academic publishing) initiatives. The scope of university engagement with industry should expand beyond licensing and spin-outs to include consultancy, joint research, and problem-solving collaborations that emphasize tangible outcomes. Informal connections and mobility between academia and industry are crucial in knowledge exchange and should be nurtured to bolster innovation ecosystems. Hosting external staff and engaging in collaborative prototyping and testing activities also enhance entrepreneurial outcomes, thereby contributing to the overall knowledge economy (Garcia et al., 2025).
Promotion: Universities can boost their reputation and market entry by aligning their brand with entrepreneurial success stories and societal contributions. Training academics in entrepreneurship, promoting visible role models, and fostering a culture of academic entrepreneurship strengthen institutional engagement and credibility. The more entrepreneurship is promoted institutionally, the more likely academics will be motivated to pursue related initiatives, creating a vibrant entrepreneurial landscape within the university.
Government Support: Following the Triple Helix Model, governments could create platforms for collaboration among universities, industries, and policymakers to foster innovation and entrepreneurship, thereby creating an ecosystem that supports sustainable economic growth (Mele et al., 2024).

Recognizing and rewarding staff units actively contributing to Third Mission (TM) initiatives is crucial for fostering a collaborative academic environment. Engagement strategies must be informed by an understanding of disciplinary and institutional diversity, thereby emphasizing the necessity of personalized approaches such as departmental meetings and focus groups to cultivate meaningful involvement. Rather than relying exclusively on generic leadership models that may fail to resonate with staff members, micro-practices tailored to the unique context of individual academics can significantly enhance engagement levels. Moreover, further investigation into incentive policies could provide valuable insights that help improve the participation of both academic and administrative personnel in TM activities, aligning with the increasing pressure on universities to fulfil their roles as engaged institutions in today's competitive environment. Such engagement supports the overarching objective of knowledge transfer to the community and enriches the university's contribution to regional development and social good.

Internal university bodies, such as Knowledge Transfer Offices (KTOs), should be empowered and trained to serve as critical bridges between academia and external parties, facilitating deeper stakeholder engagement. It is essential that stakeholders, particularly community members, are actively involved in identifying their specific learning needs to ensure that university services effectively meet the genuine demands and aspirations of their society. Furthermore, the role of autonomous organizations is significant in helping to alleviate cognitive and institutional barriers that often hinder collaboration between academia and business. Public outreach initiatives, including the use of various media and targeted communications, can significantly enhance awareness and participation in third mission activities (Ahoba-Sam et al., 2020). Additionally, exploring ICT tools and platforms should be prioritized to improve interaction and collaboration between universities and stakeholders, fostering a more robust engagement strategy relevant to contemporary needs.

Universities are increasingly expected to balance their traditional roles in teaching and research with a growing emphasis on the Third Mission (TM), which involves societal engagement and innovation. However, incorporating TM presents strategic challenges, including governance gaps, resource constraints, and ongoing debates regarding whether TM should be prioritized as a core objective within the university's mission. Scholars caution against a one-size-fits-all approach, emphasizing the need to tailor TM strategies to each university's specific institutional and regional context, as evidenced by the diverse challenges higher education institutions face globally. There is also concern about the risk of overburdening academic staff and the necessity to harmonize TM with teaching and research, recognizing that these three elements are interconnected and mutually

reinforcing in promoting broader societal impact. To support effective TM integration, universities must strategically align missions, actively engage with local stakeholders, and consider broader societal goals beyond mere commercial outputs, ensuring that societal needs are addressed through innovation and community collaboration.

The results concerning TM assessment elucidated the essential domains and metrics that are vital for enhancing the understanding and evaluation of the Third Mission (TM) of universities, drawing from various scholarly sources that highlight the significance of these dimensions in fostering educational impact and community engagement. This framework is systematically organized into three primary areas: Data Collection, Context, and TM Indicators, which underpin the rigorous analysis of the TM's effectiveness in advancing societal goals. Data Collection involves comprehensive methodologies that capture quantifiable outputs and outcomes, thereby enriching the evaluative processes necessary for assessing TM contributions. Context emphasizes the importance of situational factors and external influences that shape the TM's role within diverse institutional landscapes, echoing sentiments found in recent analyses of sustainable practices in circular economy business models (Awan et al., 2022). Finally, TM Indicators are critical benchmarks for measuring progress and success, providing clear metrics for universities to navigate their TM activities strategically and effectively. According to Compagnucci and Spigarelli, there are some steps to be done:

1. Data Collection

To better evaluate and support third mission (TM) activities, governments must establish a systematic approach to request comprehensive data from universities that facilitates evidence-based policymaking. The necessity for more detailed data collection and processing is underscored by the need to reflect the complexity and diversity inherent in university activities, especially as higher education institutions evolve to meet societal demands. This is particularly important as universities play a central role in addressing local and global challenges, emphasizing the relevance of capturing all facets of their contributions (Dyvnych 2023). Moreover, databases must be designed to include non-traditional academic activities, such as continuing education and societal engagement, which are essential for providing a holistic and accurate view of the third mission (TM). By doing so, governments can enhance the understanding of university impacts and align their policies more effectively with the educational and social needs of the communities they serve.

2. Context

Uniform evaluation models are inadequate because university missions vary significantly by country and institutional context, influencing the expectations and outcomes associated with their performance. This variation

underscores the necessity of being sensitive to different local, regional, and national dynamics that shape the operations of higher education institutions. For instance, the third mission (TM) performance and impact should be context-sensitive, considering the unique characteristics of each university, such as its operational environment, stakeholder needs, and socio-economic conditions within the region. In light of these factors, a nuanced understanding of context is essential for evaluating university missions holistically.

3. *TM Indicators*

Collaborative efforts between governments and universities are essential to develop robust and tailored indicators that effectively support sustainable development and foster social cohesion. When conducting assessments of the Third Mission (TM), these evaluations must reflect the diversity of university types, encompassing institutions focused on various fields such as medicine, technology, or social sciences and humanities (SSH) (Compagnucci et al., 2020). Indicators must capture tangible outcomes, like employment contributions, and intangible outcomes, such as knowledge diffusion, social impact, and cultural development. Furthermore, the evaluation metrics should consider diverse funding sources, the unique institutional missions, and the links between teaching, research, and the TM initiatives pursued by these institutions. Lastly, effective indicators should embrace collaborative and inclusive practices that underscore the importance of knowledge co-creation and societal engagement. In essence, the call for nuanced, multidimensional, and locally adapted approaches to evaluating and managing the university's contributions to the Third Mission emphasizes the need to transcend narrow economic metrics and incorporate broader social, cultural, and community-based impacts, thereby enriching the overall assessment framework of university contributions to society.

The results of the TM assessment individuated the key domains and measures necessary for enhancing the understanding and evaluation of the Third Mission (TM) of universities, drawing from scholarly sources. It is organized into three main areas: Data Collection, Context, and TM Indicators. The Compagnucci et al findings can be assumed in the table below.

Table 4: TM assessment according to Compagnucci et al findings

1. Data Collection

To better evaluate and support TM activities:

Governments should request comprehensive data from universities for evidence-based policymaking.

More detailed data collection and processing are needed to reflect the complexity and diversity of university activities.

Databases must include non-traditional academic activities, such as continuing education and societal engagement, to provide a holistic view of the TM.

Governments and institutions should invest in specialized personnel, self-assessment tools, and tailored inventories to prevent overburdening academic staff.

2. Context

Uniform evaluation models are inadequate because university missions vary significantly by country and institutional context.

TM performance and impact should be context-sensitive, considering the unique characteristics of each university and its regional environment.

3. TM Indicators

Governments and universities must collaborate to create robust and tailored indicators that support development and social cohesion.

TM assessment should reflect the diversity of university types (e.g., medical, technical, or SSH-focused institutions).

Indicators should capture both tangible and intangible outcomes, such as knowledge diffusion, social impact, employment contributions, and cultural development.

Evaluation metrics should consider sources of funding, institutional missions, and links between teaching, research, and TM.

Effective indicators must also reflect collaborative and inclusive practices emphasizing knowledge co-creation and societal engagement.

The Emerging Function of Co-Creation for Sustainability -Initial debates on universities' third mission (TM) primarily concentrated on market-driven activities. However, recent developments have significantly broadened its scope to encompass sustainability and social justice (Brown et al., 2025). As critical contributors to

sustainable development, universities are increasingly recognized for embedding a culture of sustainability within their management practices and operational frameworks (Brown et al., 2025). Universities collaborate with government, industry, and civil society through the Quadruple Helix Model to co-create innovative solutions that address complex regional and societal challenges (Alvial Palavicino et al., 2023). This process of co-creation not only complements traditional missions such as teaching and research but also enhances their effectiveness and relevance in a rapidly changing world. Although much of the existing research has focused predominantly on developed countries, there is a growing recognition that emerging nations provide equally valuable examples of how universities can serve as catalysts for inclusive and sustainable development through transformative partnerships that leverage local knowledge and resources (Alvial Palavicino et al., 2023).

This systematic literature review (SLR) offers a comprehensive overview of existing research on universities' third mission (TM), highlighting recurring themes and proposing an integrated framework to support scholars and policymakers in understanding this multifaceted concept. The TM remains a fragmented and evolving notion, encompassing entrepreneurial activities, knowledge transfer, and societal engagement alongside traditional functions such as teaching and research. The review calls for more tailored, context-sensitive approaches to TM implementation and assessment, particularly in fields such as spin-out creation, entrepreneurship education, and stakeholder engagement, thus ensuring that the unique characteristics of each institution are acknowledged and respected. It also emphasizes avoiding a "one-size-fits-all" model by appreciating institutional diversity and promoting bottom-up, regionally embedded strategies. Future research endeavours should investigate the strategic role of universities in smart specialization, explore how social sciences and humanities (SSHs) contribute to innovation processes, and assess the long-term sustainability of TM activities. As significant gaps remain in understanding how TM affects teaching and learning, it is essential to determine how ICT tools or Living Labs can effectively bridge the academic-societal divide. Moreover, government support is critical to collect robust data for TM evaluation and foster cross-sector collaboration among stakeholders. Ultimately, the TM should be conceptualized as a collaborative, adaptive process that necessitates new models, policies, and empirical research to maximize the university's contributions to sustainable development and social well-being.

6. Discussion and Conclusion

Universities are currently at a crossroads, facing growing societal expectations while balancing their traditional teaching and research missions with the emerging Third Mission (TM). This shift reflects changes in how knowledge is produced and the evolving role of universities in contributing to human capital and regional development, particularly through engagement with local communities and institutions (Rusciano, 2024). However, adopting the TM poses strategic challenges, especially due to institutional and governance gaps, and the inappropriate application of one-size-fits-all models that fail to account for the unique needs of diverse academic environments. Scholars emphasize the importance of tailoring TM strategies to local contexts and institutional capacities, supporting the notion that fostering diversity and inclusivity in these approaches is crucial rather than imposing standard solutions (Giacconi et al., 2024). The interdependency between teaching, research, and the TM is increasingly recognized, with many scholars arguing that these missions are complementary rather than competing, thereby enhancing the overall educational landscape. Local embeddedness also plays a crucial role, as universities must engage meaningfully with their regional ecosystems to ensure knowledge transfer and social impact, supporting the assertion that universities can act as catalysts for local and national development (Rusciano, 2024). Integrating social sciences and humanities into innovation ecosystems remains an underexplored territory, yet it holds significant promise for advancing inclusive, socially embedded university models that can address complex societal issues (Perkmann et al., 2012). In parallel, the rise of entrepreneurial universities necessitates a careful balancing act between commercial interests and academic integrity, thereby seeking to avoid tensions that may arise from prioritizing market-driven objectives over fundamental research and teaching missions. The literature consistently identifies a vital role for government in enabling university collaboration through strategic funding, regulatory frameworks, and coordinated data collection efforts, though this role is often ambiguous, particularly in emerging economies where institutional capacities are still developing. Policymakers are encouraged to foster tailored incentive systems, recognize disciplinary differences, and strengthen mechanisms that facilitate deeper university-society interaction, thereby enhancing the efficacy of UICs (Perkmann et al., 2012). Furthermore, stakeholder engagement—including community groups and non-academic actors—should be actively incorporated into TM and KT strategies, with information and communication technology (ICT) and Living Labs serving as potential enablers of collaborative innovation. Universities must also focus on addressing internal challenges, such as weak entrepreneurial cultures and administrative silos, which can significantly hinder the effectiveness of UICs

and TM. As knowledge production evolves to become more collaborative, applied, and socially accountable, higher education institutions are increasingly called upon to adapt both structurally and culturally. The strategic alignment of teaching, research, and third mission activities is crucial to creating meaningful synergies and ensuring that universities remain relevant to societal needs in an ever-changing landscape. Importantly, future frameworks should promote innovation and entrepreneurship, uphold academic values, foster inclusivity, and contribute to sustainable regional development. Building an entrepreneurial culture must go hand-in-hand with institutional learning, academic freedom, and diverse models of success, thereby crafting an ecosystem where all stakeholders thrive. Overall, the reviews conclusively underscore that the path forward necessitates more nuanced, evidence-based, and inclusive models of university transformation—models that are adaptive to context, responsive to societal challenges, and rooted in long-term impact rather than merely short-term outputs.

As it is possible to see from the diverse array of research that has been thoroughly analysed, the synthesis of multiple systematic literature reviews on university-industry collaboration (UIC), academic engagement, knowledge transfer (KT), and the third mission (TM) of universities reveals both the complexity and potential inherent in these evolving academic functions. The comprehensive review by Ankrah highlights that although UIC has expanded considerably across various contexts, significant gaps persist in measuring its success, particularly with regard to spin-outs, patents, and commercialization processes, thereby calling for more objective and standardized metrics to evaluate effectiveness. Furthermore, academic engagement, as highlighted by Perkmann, appears to be substantially driven by individual initiative and scholarly excellence rather than by institutional embedding, thereby suggesting a disconnect that could inhibit broader systemic change in the role of academia in fostering innovation ((Schot et al., 2018)). This juxtaposition raises critical questions about how universities can more effectively fulfil their third mission while ensuring that their initiatives in UIC and KT are robustly supported through comprehensive evaluation frameworks and institutional strategies.

However, despite the substantial advancements in conceptualizations, critical gaps persist in understanding the nuances of the third mission. For instance, while the literature highlights the importance of fostering partnerships across sectors, a lack of clarity exists concerning the specific roles and impacts of different stakeholders, particularly regarding civil society's involvement (Zawdie, 2010). Moreover, theoretical discussions frequently overshadow the empirical evaluation of third mission activities, necessitating more robust research that examines practical outcomes and the societal implications of universities' outreach efforts (Freel et al., 2019).

Furthermore, emerging frameworks, such as the Quadruple Helix model, which incorporates civil society into the innovation mix, open new avenues for inquiry but remain underexplored in relation to the third mission (Fidanoski et al., 2022). In addition, recent studies suggest that the operationalization of the third mission varies considerably across disciplines and geographic contexts, indicating a pressing need for a more nuanced approach that considers factors such as institutional culture, faculty attitudes, and the surrounding socio-economic landscape of the community (König et al., 2020). In particular, the engagement levels of academics in third-mission activities can be influenced by individual motivations, the institutional environment, and external pressures, thus warranting a deeper exploration of these dynamics (Smith HL et al., 2025). Furthermore, while substantial emphasis is placed on the importance of entrepreneurial initiatives within universities, challenges such as resource allocation, faculty resistance, and balancing academic integrity with commercial interests remain under-examined (Garcia et al., 2025). The heterogeneity of TM activities—from academic knowledge transfer to social engagement—makes it difficult to clearly define or measure, further complicating strategic orientation and implementation efforts. Importantly, the role of the Social Sciences and Humanities (SSHs) in TM has often been overlooked despite their potential to contribute significantly to socio-economic development and innovation, emphasizing the need for an integrated approach that leverages diverse academic strengths (Giacconi et al., 2024). Recent studies suggest that integrating SSHs into TM efforts can help universities address broader societal challenges and enhance public value, thus reinforcing their relevance in contemporary contexts. Moving forward, universities must adopt inclusive and context-sensitive TM strategies that align their missions with societal needs while maximizing the potential of all academic disciplines in concert with the traditional missions they uphold. A comprehensive understanding of the third mission holds the potential to highlight pathways for enhancing university engagement with society in sustainable and transformative ways.

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