International Journal of Innovative Research and Scientific Studies, 8(3) 2025, pages: 4874-4887

ISSN: 2617-6548

URL: www.ijirss.com

A comparative study of the research and innovation ecosystems of state and private universities in the Philippines using the quintuple helix framework

Kenneth Armas

Nueva Ecija University of Science and Technology, Philippines.

(*Email: kennetharmas@neust.edu.ph*)

Abstract

This study presents a comparative analysis of State Universities and Colleges (SUCs) and private universities in the Philippines in their application of the Quintuple Helix Model to enhance research, innovation, and extension (RIE) functions. Recognizing the distinct mandates and operational contexts of public and private higher education institutions, the research examines how each type engages with government, industry, academia, civil society, and environmental sectors to foster sustainable innovation. Using a comparative qualitative research design, supported by document analysis and case study development, the study identifies the strategic approaches, key challenges, performance indicators, and sectoral collaborations of both SUCs and private universities. Findings reveal that while SUCs face systemic challenges related to funding, bureaucratic rigidity, and limited industry linkages, they play a critical role in community engagement and public-sector collaboration. Private universities, on the other hand, exhibit strengths in market-oriented research and industry partnerships but encounter constraints in financial sustainability, public sector engagement, and broader societal impact. The study highlights best practices, identifies structural and policy gaps, and offers recommendations to optimize multi-sectoral collaborations across both public and private HEIs. By situating the analysis within the Quintuple Helix framework, the study contributes to understanding how Philippine higher education institutions can more effectively drive sustainable development and innovation.

Keywords: Higher education policy, Multi-sectoral collaboration, Philippine higher education institutions, Private universities, Quintuple helix model, Research innovation and extension (RIE), State universities and colleges (SUCs), Sustainable innovation.

DOI: 10.53894/ijirss.v8i3.7635
Funding: This study received no specific financial support.
History: Received: 17 April 2025 / **Revised:** 21 May 2025 / **Accepted:** 23 May 2025 / **Published:** 5 June 2025

Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.
Transparency: The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

The Philippine higher education sector is characterized by its diversity, encompassing over 2,000 institutions, including a large number of private universities and a robust network of State Universities and Colleges (SUCs) [1]. While both institutional types contribute to national development, they operate under distinct mandates and structural conditions. SUCs are legally mandated to fulfill a trilogy of functions: instruction, research, and extension, positioning them as strategic agents for regional and national progress [2, 3]. Private universities, though historically more autonomous and market-driven, have increasingly emphasized research, innovation, and extension (RIE) activities to enhance academic prestige, global rankings, and societal impact [4, 5].

However, both SUCs and private HEIs face persistent challenges in RIE development, including inadequate infrastructure, limited funding, fragmented industry linkages, and insufficient integration with community needs [6, 7]. In this complex landscape, the Quintuple Helix Model, introduced by Armas and Villegas [8] offers a strategic framework for strengthening RIE functions through dynamic collaboration among government, industry, academia, civil society, and the environment. By promoting multi-sectoral partnerships, the model fosters sustainable innovation ecosystems essential for achieving national development goals and global sustainability targets.

This study provides a comprehensive comparative analysis of how State Universities and Colleges (SUCs) and private universities in the Philippines operationalize the Quintuple Helix Model to enhance their Research and Innovation Ecosystem (RIE) activities. It systematically examines institutional strategies and structures, modes of engagement with each helix sector, key performance indicators, policy environments, and the comparative strengths and challenges faced by public and private Higher Education Institutions (HEIs). Specific case studies are presented to illustrate real-world applications of multi-helix collaborations, including best practices and notable gaps. Ultimately, this analysis aims to inform policy reforms and institutional strategies that can enable Philippine HEIs to more effectively collaborate with government, industry, communities, and environmental stakeholders to drive inclusive innovation and sustainable development.

1.1. Theoretical Framework

This study is anchored on the Quintuple Helix Model introduced by Armas and Villegas [8] which conceptualizes sustainable innovation ecosystems through the dynamic interaction of five key sectors: government, industry, academia, civil society, and the environment. The model positions State Universities and Colleges (SUCs) as central actors, serving as hubs that connect and integrate these sectors to foster research, innovation, and extension (RIE) activities aligned with sustainable development goals.

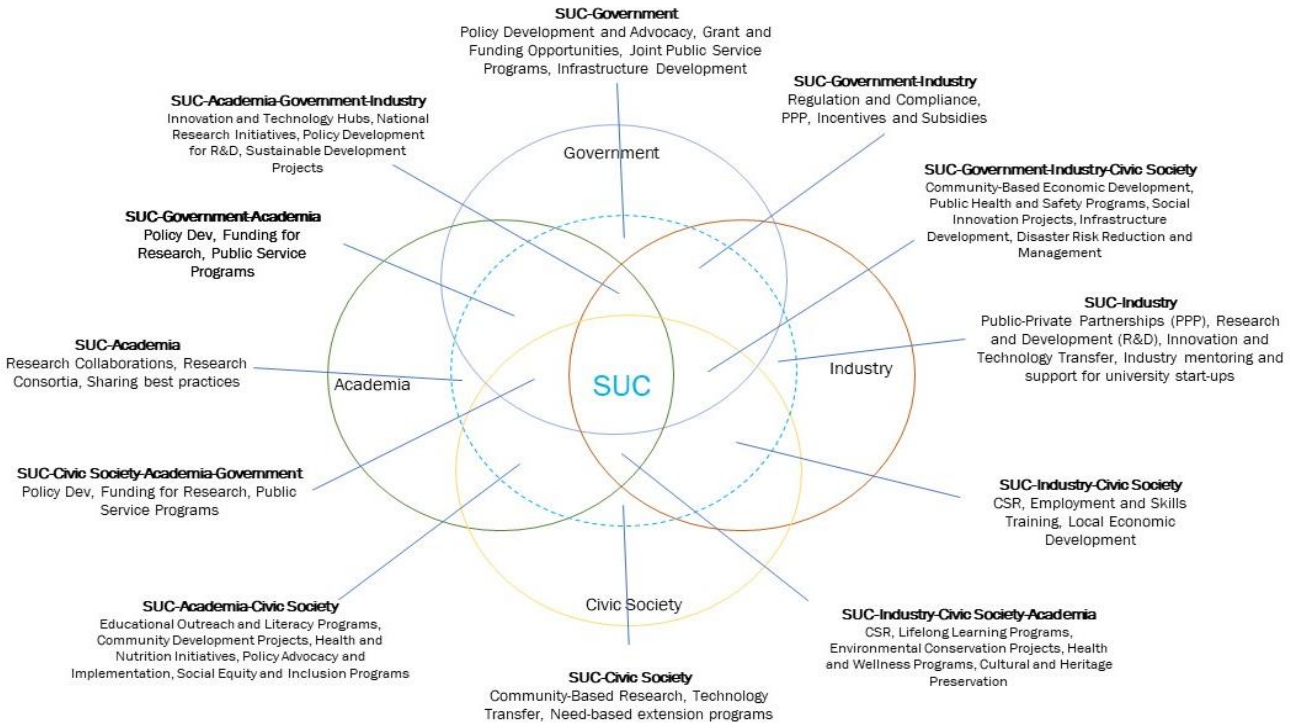

Figure 1.
Quintuple Helix Model of Research, Innovation, and Extension.

According to Armas and Villegas [8], the Quintuple Helix Model reflects the evolving role of higher education institutions beyond traditional academic functions, emphasizing their contribution to societal transformation, technological advancement, and environmental stewardship. In this framework, government agencies provide the regulatory environment, policy direction, and funding support; industry partners drive commercialization and applied research initiatives; academic

institutions generate knowledge and develop human capital; civil society ensures that innovation efforts are socially relevant and inclusive; and environmental considerations guide the sustainability of all innovation activities.

The model further recognizes the necessity of multi-sectoral collaborations, wherein SUCs engage in partnerships that are bilateral (e.g., SUC–Industry), trilateral (e.g., SUC–Academia–Government), or comprehensive (e.g., SUC–Government–Industry–Academia–Civil Society), depending on the objectives and contexts of specific RIE initiatives. This interconnectedness is vital for achieving higher levels of innovation efficiency, community impact, and contribution to national development.

In the context of this comparative analysis between SUCs and private universities in the Philippines, the Quintuple Helix Model provides a robust analytical lens to assess the extent, nature, and effectiveness of multi-sectoral engagements of higher education institutions. It enables the identification of strategic strengths, gaps, and opportunities for enhancing RIE functions, ultimately supporting the pursuit of inclusive and sustainable development.

1.2. Research Objectives

This study aims to conduct a comparative analysis between State Universities and Colleges (SUCs) and private universities in the Philippines regarding their application of the Quintuple Helix Model in enhancing research, innovation, and extension (RIE) functions. Specifically, the study seeks to:

1. Compare the institutional strategies and governance structures for RIE implementation in SUCs and private universities.
2. Evaluate the engagement levels and partnership models of both State Universities and Colleges (SUCs) and private universities with the five helix sectors: government, industry, academia, civil society, and the environment.
3. Assess key performance indicators (KPIs) such as research output, technology transfer, community impact, and innovation commercialization across State Universities and Colleges (SUCs) and private universities.
4. Analyze the policy, funding, and governance environments that facilitate or hinder the implementation of RIE functions in public and private higher education institutions.
5. Identify comparative strengths, weaknesses, and best practices that can inform a more effective and inclusive application of the Quintuple Helix Model in Philippine higher education.

1.3. Research Methodology

This study employed a comparative qualitative research design supported by document analysis and case study development to examine the differences and similarities between State Universities and Colleges (SUCs) and private universities in their application of the Quintuple Helix Model.

In terms of data collection methods, the study first relied on document analysis. Institutional reports, publications from the Commission on Higher Education (CHED), the Department of Science and Technology (DOST), and relevant policy briefs were systematically reviewed. Peer-reviewed articles and government reports published between 2020 and 2025 were included to comprehensively assess Research, Innovation, and Extension (RIE) activities and their outcomes. Furthermore, published case studies from both SUCs and private higher education institutions were utilized to validate examples of multi-helix collaboration observed in actual institutional practices.

The study also developed two detailed case studies, one representing a SUC and another a private university. These case studies were constructed to illustrate the practical applications of the Quintuple Helix Model, focusing particularly on real-world projects that successfully integrated government, industry, academia, civil society, and environmental concerns.

Secondary data sources were used to complement the qualitative analysis. Research metrics, including publication counts, technology transfer activities, and the extent of community extension programs, were obtained from existing datasets, institutional reports, and performance evaluation documents.

For data analysis techniques, thematic analysis was employed to identify recurring themes, strategies, and challenges associated with the application of the Quintuple Helix Model in the two types of institutions. Comparative analysis was conducted to highlight the distinctions between SUCs and private universities across various dimensions, such as institutional structures, funding models, stakeholder engagement practices, and innovation outcomes. Additionally, a tabular presentation of key performance indicators, strengths, and weaknesses was utilized to enhance the clarity and visual comparability of findings.

With respect to ethical considerations, the study exclusively utilized publicly available documents and institutional reports. No personal data or direct interaction with human subjects were involved. All data sources were properly cited and acknowledged in accordance with established academic and ethical standards.

2. Results and Discussion

2.1. Institutional Strategies and Structures for RIE

2.1.1. SUCs: Strategies and Structures

Public universities in the Philippines operate under government mandates that formally integrate Research, Innovation, and Extension (RIE) into their core functions. State Universities and Colleges (SUCs) typically have established offices such as a Research and Development Office and an Extension Services unit, often led by vice-presidents or directors for RIE. These structures ensure that research and community service are planned alongside teaching. For instance, many SUCs undergo SUC Levelling and accreditation processes where research and extension performance are key indicators [9]. The Commission on Higher Education (CHED) requires that State Universities and Colleges (SUCs) contribute to innovation and

knowledge production for economic growth and policy support [9]. As a result, SUCs craft institutional RIE agendas aligned with national development plans and often specialize in fields relevant to their region (e.g., agriculture, fisheries, industrial technology). However, resources remain a constraint – a 2021 Asian Development Bank survey found that 60% of Philippine universities lack advanced laboratories and research facilities, hampering high-quality research efforts. To address this, some SUCs have pursued inter-university consortia and partnerships to share resources, and they tap into government grants to build capacity. In recent years, SUCs have begun establishing Technology Transfer Offices (TTOs) and innovation centers on campus; over 30 universities (mostly SUCs) have created TTOs since 2015 to facilitate patenting and commercialization. Still, institutional support varies, and many SUCs face fragmented RIE efforts due to limited funding and bureaucratic hurdles. Overall, the public sector framework gives SUCs a clear mandate and public funding base for RIE, but they must strategically organize and seek partnerships to overcome resource gaps and fragmentation.

2.2. Private Universities: Strategies and Structures

Private HEIs are not legally mandated to conduct research or extension, but leading private universities have made RIE central to their vision to remain competitive and relevant. These institutions often develop internal policies and incentives to promote research, such as dedicated research offices, faculty research grants, and reduced teaching loads for active researchers. A prominent example is De La Salle University (DLSU), which deliberately transitioned into a "research university" and built an extensive RIE infrastructure: it created an Office of the Vice Chancellor for Research and Innovation overseeing 11 research centers and five support offices for research management, intellectual property, incubation, publications, and ethics [10]. This comprehensive structure, coupled with strong leadership and faculty qualifications, enabled DLSU to become one of the nation's top research producers [4, 10]. Other major private universities, such as Ateneo de Manila University and the University of Santo Tomas, have similarly established university research councils, innovation hubs, and community engagement centers. Many private universities, especially those that are religiously affiliated, embed extension and outreach offices in their organizational charts to coordinate community service and service-learning programs [11]. The majority of smaller private colleges, however, remain teaching-focused with minimal research structure – as of 2017, only *55 out of nearly 2,000 Philippine HEIs had any Scopus-indexed publications*, indicating that RIE activity is concentrated in a small subset of mainly top-tier institutions [8]. Those private universities that excel in RIE often leverage their autonomy to specialize in niches; for example, some have founded centers of excellence in fields like information technology or medicine through endowments and industry sponsorship. Flexibility is a hallmark of private HEIs – they can swiftly introduce new programs (e.g., a course in social innovation or a data science research unit) in response to emerging opportunities, whereas public institutions may be constrained by more rigid approval processes [11]. In summary, private universities' strategies for RIE are driven by institutional vision and market positioning: the most successful cases demonstrate strong internal frameworks and investment in RIE capacity, whereas many others have yet to develop a research culture and rely primarily on instruction as their mission [4].

2.3. Engagement with Quintuple Helix Sectors

A critical part of applying the Quintuple Helix Model is how universities engage and partner with the five sectors: government, industry, other academic institutions, civil society, and the environment. Both SUCs and private universities in the Philippines pursue collaborations in these areas, but their levels of engagement and partnership models can differ based on their nature (public vs. private), resources, and strategic priorities.

2.4. Government Partnerships

State Universities and Colleges (SUCs) have inherently close ties to government, being state-funded and governed. They routinely collaborate with national government agencies and local government units (LGUs) as part of their mandate. Many SUCs implement government-funded research projects or serve as regional outposts for national programs. For example, the Department of Science and Technology (DOST) channels research and development (R&D) grants to SUCs through initiatives like the Niche Centers in the Regions (NICER) program, which establishes research centers in SUCs to address regional needs [12]. SUCs also contribute to policy through think-tank work or pilot programs (e.g., a state university might partner with the Department of Agriculture on crop trials or with the Department of Health on public health interventions). Government funding and policy support are thus key enablers for SUC engagement – the government acts as both sponsor and stakeholder in SUC projects. However, this can be a double-edged sword: heavy reliance on government funds means that changes in public budget priorities directly impact SUCs, and bureaucratic requirements can slow down projects. Still, under the Quintuple Helix model, the government's role is to enable and guide innovation. There have been positive developments, such as CHED's Research, Innovation, and Extension Grants and the Philippine Innovation Act [13] aiming to provide policy incentives and funding for university partnerships, private universities, by contrast, engage with the government more selectively. They do not receive annual government subsidies, but they often collaborate with the government on specific projects or in policy advisory roles. Top private universities frequently win competitive research grants from DOST, CHED, or even foreign-assisted government projects, effectively partnering in R&D. For instance, Ateneo de Manila and De La Salle have received DOST grants to lead research on climate change, education technology, etc., contributing expertise in return for funding. Private HEIs also work with LGUs and national agencies in extension initiatives (e.g., a private university's public health school running a community clinic in coordination with the city government). The partnership model for private institutions tends to be project-based and driven by mutual interest: the government gains additional research capability or community reach, while the university gains funding or a real-world testbed for innovation. In summary, SUCs maintain a broad and institutionalized engagement with the government (as part

of their governance structure), whereas private universities engage through ad hoc collaborations and grant-driven partnerships. Both face the challenge of aligning academic work with government priorities, but when alignment happens, it significantly enhances the relevance and uptake of university innovations.

2.5. Industry Partnerships

Bridging academe and industry is a central pillar of innovation. State universities and colleges (SUCs) historically lag in industry collaboration, though efforts are increasing. A recent Commission on Higher Education (CHED) survey in 2021 indicated that fewer than 40% of state universities have active partnerships with industry. Those that do often limit engagement to specific projects like joint technology development or student internship programs, rather than broad institutional ties. Challenges inhibiting SUC0 industry linkages include difficulties in aligning academic research topics with the immediate practical needs of companies, concerns over intellectual property ownership, and cultural gaps between academics and business practitioners. Moreover, many SUCs are located in provinces where large private R&D-intensive companies are few; their industry partners may mostly be small enterprises or agriculture-based cooperatives. To improve this, government programs such as the Department of Science and Technology's (DOST) Collaborative R&D to Leverage Philippine Industries (CRADLE) provide a platform where a company identifies a problem and a university (often a SUC) is funded to research a solution, fostering direct cooperation. Some SUCs have begun to set up industry liaison offices or adopt incentive policies (e.g., revenue-sharing on commercialized research) to attract industry partners. On the other hand, private universities generally have more agility in forming industry partnerships and, in some cases, a stronger orientation to do so. Leading private universities leverage their alumni networks and urban locations to connect with industry. De La Salle University (DLSU), for example, has formed research collaborations with over 159 educational institutions and numerous industry partners worldwide; many of its projects are done in cooperation with corporations and result in co-authored publications or technology prototypes [10]. Private universities often invite industry leaders to sit on advisory boards for curricula and research, ensuring alignment with market trends. They may also engage in consultancy work for businesses, which keeps faculty attuned to industry needs. A notable model is the establishment of university-based incubators and accelerators with industry support: DLSU's Animo Labs (a DOST-backed incubator) helps spin off startups from campus research in partnership with mentors and investors. Ateneo de Manila's Ateneo Intellectual Property Office similarly collaborates with companies on patent licensing and has launched startup ventures in fields like biotechnology. These partnerships allow private higher education institutions (HEIs) to directly contribute to innovation commercialization, from prototype development to startup formation. It must be noted that outside the top tier, many private institutions have limited industry linkages, focusing on job placements for graduates rather than joint R&D. Overall, private universities show a somewhat higher engagement level with industry in terms of formal collaborations and technology commercialization, supported by their internal IP offices and incubators. SUCs are catching up through government-facilitated programs, but sustained collaboration is still emergent and needs strengthening via clear policies and trust-building between academia and industry.

2.6. Academic Collaboration (Inter-University and International)

Within the academia helix, partnerships among universities and research institutes are crucial for knowledge exchange and capacity building. State Universities and Colleges (SUCs) often collaborate with each other through regional research consortia or alliances. For instance, in many regions, SUCs form a consortium (sometimes supported by the Department of Science and Technology (DOST) or the Commission on Higher Education (CHED)) to share laboratory facilities, co-host conferences, or undertake multi-institution research projects. This is partly driven by resource limitations a cluster of SUCs can pool expertise and equipment to tackle larger Research and Innovation Ecosystem (RIE) initiatives than any single rural campus could alone. SUCs also collaborate with government research agencies (like DOST's research institutes or the Department of Agriculture's (DA) experiment stations) in what effectively extends the academia helix beyond universities. Internationally, a few leading SUCs (notably the University of the Philippines system) have forged partnerships with foreign universities on joint research and faculty/student exchanges, although many smaller SUCs have limited international linkages. Participation in international academic networks has been growing as the government and CHED encourage publication in indexed journals and research mobility; some SUCs send faculty for advanced training abroad and engage in projects like the World Bank-funded research capacity programs. Private universities in the Philippines, especially the well-resourced ones, tend to have broader academic networks both domestically and globally. They are active in associations like the ASEAN University Network and often have longstanding exchange programs (for example, Ateneo and De La Salle each have dozens of partner universities across Asia, Europe, and North America for collaborative research and study abroad). These connections enhance their research output – De La Salle University's (DLSU) high publication count has been attributed in part to international collaborations, with 1,260 internationally co-authored articles versus 268 purely local collaborations in one analysis [10]. Domestically, private universities sometimes collaborate with SUCs as well; for instance, consortium projects on climate change or education reform have seen private and public higher education institutions (HEIs) working together with support from funding agencies or NGOs. Knowledge-sharing consortia such as the Philippine Higher Education Research Network (PHERNet) include both public and private universities designated by CHED to lead research programs. In terms of engagement models, academic collaboration often takes the form of co-publishing research, co-hosting events, or sharing best practices (e.g., a top private university might mentor emerging research offices of SUCs). The Quintuple Helix emphasis on academia means creating an innovation ecosystem where HEIs collectively raise the national research profile. Both SUCs and private universities recognize this and are increasingly involved in multi-university projects. However, one disparity is that private universities, with generally better-funded research and international appeal, initiate collaborations

that boost their global ranking, whereas SUCs focus on collaborations that address regional problems and capacity gaps. Both approaches are valuable: combining them leads to a more integrated academic helix, bridging global knowledge with local application.

2.7. Civil Society and Community Engagement

Engagement with civil society, which in this context includes non-governmental organizations (NGOs), community groups, and the general public as stakeholders is a strong suit of Philippine universities, particularly through their extension and outreach programs. State universities and colleges (SUCs) are explicitly mandated to serve communities, and they typically maintain robust extension portfolios. Many SUCs operate community training programs, livelihood workshops, agricultural demonstration projects, public health clinics, and the like in their surrounding localities. These programs often involve partnerships with NGOs, farmers' associations, cooperatives, and other civil society actors. According to a recent assessment, SUC extension services in agriculture, health, and disaster preparedness collectively reach over 150,000 rural households annually, showcasing the scale of community impact driven by public universities. The model of civil society engagement at SUCs is usually long-term and grassroots: faculty and students work directly with marginalized groups (such as subsistence farmers, indigent families, and out-of-school youth) to apply research-based solutions or provide technical assistance. For example, a state university may help a fishing community improve their catch via marine science research, or an education college at a SUC may train local teachers on new pedagogies. Monitoring and evaluation of these initiatives, however, is an area for improvement only about 35% of state universities have formal mechanisms to assess the long-term outcomes of their extension projects. Still, the cultural expectation is that SUCs stand as pillars of community development in their regions. Private universities also engage civil society, though their approach can differ. Many private institutions (especially those run by religious orders or with a social advocacy orientation) incorporate community service as part of their mission. They establish social action centers or community extension offices to coordinate volunteer activities, service-learning for students, and outreach projects [11]. For instance, Catholic universities often have programs for urban poor communities focusing on education, youth development, or housing, partnering with NGOs and parishes. A number of private universities have become incubators for social innovation – they create hubs where students and faculty collaborate with NGOs to develop solutions to social problems. The British Council noted centers like the Hub of Innovation for Inclusion at De La Salle-College of St. Benilde and the Centre for Social Entrepreneurship at the University of San Carlos (a private university in Cebu) as examples where academia and civil society co-create initiatives [11]. Private higher education institutions (HEIs) may not match the geographic breadth of SUC outreach, but they often bring in additional resources from donors or international NGOs for community projects. A case in point is Central Mindanao University (a public institution) partnering with a faith-based organization, Coffee for Peace, to support local coffee growers, a collaboration that blurs the line between public and private sectors and involves civil society for peace-building and livelihood [11]. In summary, engagement levels are high in both sectors but with different flavors: SUCs deliver large-scale, government-backed extension programs deeply embedded in local communities, while private universities frequently pursue innovative or advocacy-oriented projects in collaboration with civil society groups. Both contribute to the social impact mission of higher education, which is central to the Quintuple Helix's inclusion of civil society as a key player in research and innovation ecosystems.

2.8. Environmental Integration

The inclusion of the environment as the fifth helix reflects the imperative for sustainable and ecological orientation in RIE activities. Philippine universities integrate environmental considerations in multiple ways. SUCs often address environmental challenges through their research focus and extension programs. Many SUCs, especially those in agricultural and coastal areas, engage in research on climate-resilient farming, biodiversity conservation, renewable energy, and disaster risk reduction. For example, several DOST-NICER centers hosted by SUCs explicitly tackle environmental sustainability: the Biodiversity R&D Center and the Bamboo R&D Center established in Mindanao SUCs are geared towards conserving natural resources while creating green products [12]. SUC extension programs frequently include environmental education and community-based resource management. It is common for a state university to work with local communities and environmental agencies on reforestation, marine protected areas, or sustainable agriculture as part of their outreach mandate. Environmental stewardship is thus woven into SUCs' activities, aligning with national sustainable development goals. Private universities incorporate the environment helix largely through institutional advocacy and specialized research. Top private universities have dedicated environmental research institutes or sustainability offices. Ateneo de Manila University, for instance, has an Institute of Sustainability that collaborates with companies and communities on climate action projects and disaster resilience initiatives. De La Salle University hosts centers for water resources management and alternative energy research. These universities engage the environment helix by forging partnerships with environmental NGOs (like the World Wide Fund for Nature, etc.), participating in policy dialogues on climate change, and integrating sustainability into campus operations and curriculum. A number of private HEIs also champion "green" campus initiatives and are recognized in UI Green Metric or THE Impact Rankings for their environmental efforts. Collaboration with government and civil society on environmental issues is another area where privates contribute – for example, Silliman University (a private university in Negros Oriental) operates an internationally renowned marine laboratory and works with the DENR and local fisherfolk communities on marine conservation and coastal resource management. Its Angelo King Center for Environmental Management was established with private foundation support to conduct research and extension on protecting marine and terrestrial ecosystems . This illustrates a multi-helix model: a private university unit funded by a private donor, partnering with communities and government to address environmental problems. In essence, both SUCs and private universities

recognize the environment as both a stakeholder and beneficiary of RIE. They differ mainly in scale and origin of initiatives – SUCs might execute government-funded environmental projects (like climate adaptation training for farmers through the Agricultural Training Institute), whereas private universities might initiate projects out of institutional ethos or external grants. Under the Quintuple Helix, the trend is toward transdisciplinary approaches where ecologists, social scientists, local communities, and policymakers are all involved in research and innovation projects for sustainability. This is increasingly visible in Philippine HEIs of both types, as they align academic work with pressing environmental priorities such as climate resilience, clean energy, and biodiversity preservation.

2.9. Key Performance Indicators: RIE Outputs and Outcomes

To gauge the effectiveness of RIE functions under the Quintuple Helix approach, several key performance indicators (KPIs) can be examined. These include research output (e.g., publications), technology transfer and innovation metrics (patents, startups), community impact measures, and success in the commercialization of research. A comparative look at SUCs and private universities on these indicators is provided in Table 1.

Table 1.
Key RIE Performance Indicators – Comparison of SUCs and Private Universities in the Philippines.

Performance Indicator	State Universities and Colleges (SUCs)	Private Universities
Research Output (publications, citations)	Concentrated in a few leading SUCs (especially the University of the Philippines system). UP Diliman alone historically leads in total publications [8]. However, overall output is limited across the sector – *only 55 out of ~2,000 Philippine HEIs had any Scopus-indexed publications as of 2017* [8], indicating that many SUCs produce little to no international research. Factors include heavy teaching loads and resource gaps. Recent efforts (e.g., faculty development, research consortia) are gradually improving output.	Dominated by a small number of top-tier privates. DLSU, for example, was the most productive Philippine university in 2014–2015 with 1,780 publications and over 12,000 citations (as of early 2016) [10]. Its output alone comprised an estimated 15% of the national research publications by 2019 . Ateneo de Manila, UST, and a few others also contribute significantly. Outside these, most private colleges have negligible research output [4]. The high-performing privates achieve their output by investing in research infrastructure and incentives (e.g., DLSU's internal research grants and professorial chairs).
Technology Transfer & Innovation (patents, TTOs, startups)	Many SUCs are building capacity but still lag in measurable outcomes. Over 30 universities (mostly SUCs) have established Technology Transfer Offices since 2015 file-dtg38menhbu1pbf7ze52xw , spurred by the Philippine Technology Transfer Act. Some patenting activity exists, yet few SUCs have successfully transformed research outputs into intellectual property licenses or startups to date [14]. Well-funded SUCs with dedicated innovation support (often those with Level IV status or special funding) show higher commercialization rates, but overall, the number of patents filed by SUCs remains modest. Government initiatives like NICER centers and CRADLE projects aim to increase innovation outputs by providing R&D funding targeted at local industry needs. Incubators are also emerging – about 25% of SUCs host a DOST-assisted incubator facility. Still, the innovation ecosystem is underdeveloped in many SUCs, reflecting the early stage of tech transfer culture.	Leading private universities tend to outperform in tech transfer relative to their number. They have set up TTOs and innovation hubs often ahead of their public counterparts. DLSU's Innovation and Technology Office and Animo Labs incubator, for example, have been active in filing patents and nurturing tech startups in partnership with DOST . Universities like Ateneo and Mapúa also boast startup incubators and industry-funded labs. Well-resourced privates achieve more patents and spin-offs, as noted by Padolina [6] – universities with better-funded TTOs see higher commercialization success. Nevertheless, on a national scale, the patent output of private HEIs is still low in absolute numbers. The culture of innovation is stronger in the top privates (often driven by their desire for global recognition and alumni support), but most private HEIs have yet to engage in technology transfer at all.
Community Impact (scope of extension/community programs)	High coverage and mandated: SUCs deliver extensive extension services often reaching tens of thousands of beneficiaries. Their programs have *wide geographic spread*, addressing rural development, agriculture, literacy, health, and more. For instance, SUC-led agricultural	Targeted and values-driven: Private universities' community impact is often shaped by their institutional values or specialization. They may not have the numeric reach of SUCs countrywide, but many private institutions implement

	extension has been reported to benefit over 150,000 rural households annually. Each SUC typically runs multiple community projects, and CHED and other bodies assess their performance (SUCs are evaluated on extension outcomes in accreditation and annual reports) [9]. The depth of impact varies many projects show anecdotal success (e.g. increased farmers' income, improved local governance), but only 35% of SUCs systematically monitor and evaluate long-term outcomes. Still, SUCs are considered the backbone of community education and technology dissemination in the countryside. During crises (e.g. the COVID-19 pandemic), SUCs leveraged their networks to provide community aid and were recognized for innovative extension responses	high-impact projects in their niches. For example, a private urban university might focus on an adopt-a-community program improving the livelihoods of the urban poor, while a private sectarian university might run nationwide scholarship and training programs via its church network. The scale of private HEI extension is generally smaller often a few partner communities or schools rather than whole provinces – but can be deep in those locales. Notable private HEIs (Ateneo, La Salle, etc.) have long-standing partnerships with NGOs and community groups, resulting in recognized initiatives in poverty alleviation, education, and disaster relief. CHED now even acknowledges top private university extension programs alongside public ones . A challenge for private HEIs is sustaining funding for outreach (which may rely on donations or student involvement), yet their strength lies in innovative approaches (e.g., integrating service-learning into curricula or incubating social enterprises) that engage civil society and yield qualitative impact.
Innovation Commercialization (startup formation, product commercialization, industry uptake)	Emerging, with government push: Commercializing research is a newer endeavor for most SUCs. A lack of strong academe-industry linkages means few research innovations have made it to market from SUCs so far [14] . There are success stories e.g., a state university developing a biofertilizer adopted by local farmers, or a university-developed food product now sold commercially but these are exceptions rather than the rule. The barriers include limited venture financing in provincial areas, and SUC policies historically not prioritizing profit from research. However, national policies and funds are encouraging change: the NICER program's regional centers aim to revitalize industries (e.g. garlic, cacao) by providing R&D that directly improves products and incomes [12]. Such centers, if successful, effectively commercialize innovation by raising productivity of local commodities (the Cacao NICER projects a 30–40% income increase for farmers via improved crop technology [12]). Furthermore, some SUCs engage in spin-off formation through DOST's startup grants; e.g., university researchers have launched startups in fields like biotech and electronics with government incubation. In summary, SUCs are building the foundations (TTOs, incubators) for commercialization but are still in a nascent stage of generating widespread market-driven innovations.	Moderate, leveraging networks: Private universities, when they produce significant research, tend to be proactive in seeking commercialization avenues. They often pursue patent licensing deals with industry and encourage faculty to start companies. For instance, Ateneo de Manila researchers commercialized a diagnostic kit for dengue fever in partnership with a private firm, and DLSU faculty startups have emerged in AI and engineering sectors (some supported by its Animo Labs). The flexibility of private institutions allows them to enter joint ventures or investor agreements relatively quickly compared to public counterparts. Nonetheless, only a handful of private universities have a volume of research that yields commercial opportunities. Those that do (mostly in Manila) benefit from proximity to investors and multinational companies. Private HEIs also capitalize on alumni entrepreneurs; their incubators often receive mentorship and seed funding from successful alumni. The result is a growing number of university-linked startups and licensed technologies in the past five years. Challenges remain, such as balancing academic goals with profit motives and navigating intellectual property

		ownership (especially if research had public funding). But arguably, the private sector universities show a template of how an academic discovery can be incubated and spun off efficiently. Looking at outcomes, privates have led in some commercialization metrics: e.g., by 2020 DLSU had dozens of patents and several technologies in the commercialization pipeline (ranging from environmental sensors to educational software), outpacing many larger SUCs in this regard. Still, in aggregate, the innovation commercialization ecosystem is still developing across all Philippine HEIs – both sectors have considerable room to grow in translating research into marketable products and enterprises.

Overall, Table 1 highlights that both SUCs and private universities have distinct strengths in certain KPIs and share common challenges in others. SUCs excel in broad community reach and aligning with public goals, while struggling to translate research into IP and high publication counts outside the top tier. Private universities excel in research output per institution among the top players and show agility in forming startups or industry deals, but they reach fewer beneficiaries in extension, and the research activity is concentrated in only a few institutions. Notably, both sectors are hindered by underdeveloped innovation financing and infrastructure in the country [14]. These KPIs suggest that a more synergistic approach where public and private HEIs complement each other could bolster the national RIE performance. For instance, improving collaborations (as the helix model encourages) can help leverage the strengths of each: a private HEI's advanced lab can work with a SUC's community network to field-test an innovation, etc. Metrics are gradually improving, and continued monitoring of publications, patents, community outcomes, and startup successes will indicate how effectively the Quintuple Helix approach is being implemented in both types of institutions.

2.10. Policy Environment, Funding, and Governance Frameworks

The context in which universities operate including government policies, funding structures, and governance models significantly affects their ability to implement the Quintuple Helix Model. Here, we compare how these factors enable or hinder State Universities and Colleges (SUCs) and private universities.

2.11. Funding Structures

State Universities and Colleges (SUCs) are financed primarily through the national government budget (General Appropriations Act), which covers salaries and basic operations, and through incremental funding from programs and grants. Since the passage of the Universal Access to Quality Tertiary Education Act of 2017, tuition in SUCs is free, which has increased enrollment but also intensified the competition between public and private Higher Education Institutions (HEIs) for students and resources [14]. Government funding for SUC research has historically been limited only about 2% of the higher education development budget was allocated for Centers of Excellence/Development as of the early 2010s, and this support has even declined over time [14]. SUCs were encouraged to generate their own revenue, but few have tapped into high-value sources like industry ventures [14]. On the positive side, recent years have seen targeted funding schemes such as the DOST Science for Change Program (including NICER, CRADLE, and other sub-programs) which invested ₱1.7 billion to establish 35 NICER R&D centers across 17 regions by 2021 [15] mostly in SUCs. CHED has also offered Grants-in-Aid for research and extension that both SUCs and private HEIs can compete for financial assistance. Private universities, conversely, rely on tuition, donations, endowments, and any entrepreneurial income (e.g., from campus services or IP licenses). They are excluded from the government's regular subsidy, which means top private universities often have high tuition fees to fund their programs. Some private institutions with strong alumni or corporate backing benefit from substantial donations (e.g., foundations supporting research chairs or building facilities, as seen with Silliman's Angelo King Center). However, many smaller private institutions operate on tight budgets and cannot easily invest in research or extension beyond core instructional needs. They can apply for government research grants (and indeed have won DOST/CHED projects), but this is competitive and usually the realm of those already having some capacity. A noteworthy policy development is the push for public–private complementarity in higher education financing: experts have argued that the government should not crowd out private HEIs but rather support them in areas like research to harness the strengths of both [14]. At present, funding

structures arguably favor SUCs for large-scale endeavors (due to state funding and facilities) while privates must be more entrepreneurial or selective in their RIE investments.

2.12. Policy and Regulatory Environment

SUCs operate under laws like RA 8292 (governing SUC boards and institutional autonomy) and are subject to oversight by CHED and the Department of Budget and Management (DBM). They benefit from policies such as the Technology Transfer Act of 2009 (RA 10055), which allows universities (including SUCs) to own intellectual property and revenue from government-funded research, thereby incentivizing tech transfer activities. This law, along with innovation grants, has created a more favorable policy environment for university RIE by clarifying IP rights and providing some funding. Additionally, CHED Memorandum Orders (CMOs) set standards for research e.g., CMO 46 s.2012 emphasizes that universities must support research for innovation and national development [9]. For private universities, the policy environment includes CHED's autonomous and deregulated status grants, which are often tied to performance (including research output and accreditation). Achieving autonomous status can ease some regulatory burdens and allow a private HEI more flexibility in opening new programs, which indirectly supports innovation. However, certain policies have unintentionally hurt private HEIs: the free tuition in public HEIs, as mentioned, caused an exodus of students to SUCs, impacting private enrollment and finances [14]. While this policy improved access, it underlined the need for a more complementary approach where private HEIs are supported to continue quality offerings. On research and innovation-specific policies, private universities can equally benefit from RA 10055 for IP and RA 11337 (Innovative Startup Act), which provides support for startups (some of which emerge from universities). Implementation of these acts is ongoing; for example, both public and private HEIs are establishing startups eligible for DOST's Startup Research Grant under the Startup Act. The governance framework also differs: SUCs are governed by a Board of Regents that includes government officials (e.g., CHED Chair, regional development council representatives, etc.), which can be a strength in aligning with public goals but at times a hindrance if political interests override academic decisions [14]. Leadership turnover in SUCs can follow political cycles (especially for Local Universities and Colleges, whose heads may change with local elections), potentially causing discontinuity in RIE programs [14]. Private universities are typically governed by an independent Board of Trustees or Directors, which may include industry and civic leaders. This can foster a stable long-term strategy, but governance quality varies by institution; some boards invest in elevating research, while others remain focused on enrollment and teaching. A positive trend is that many private HEIs with strong governance have set clear research agendas and mobilized internal funds to support them [4].

2.13. Enabling vs Hindering Factors

Enabling factors for SUCs include direct government appropriations for infrastructure (some SUCs received capital outlay for research buildings and equipment), policy mandates that give RIE weight in evaluating SUC presidents, and national R&D agendas that involve SUCs in pressing issues (such as food security and renewable energy). Hindrances for SUCs include bureaucratic procurement rules that make acquiring research equipment slow, line-item budgeting that may limit the flexible use of funds for multidisciplinary projects, and a civil service compensation structure that often cannot compete with private sector salaries for researchers (leading to challenges in retaining high-level talent). For private universities, enabling factors include their autonomy to craft unique programs, the ability to offer merit-based pay or rewards to prolific researchers, and generally less administrative red tape in partnering with industry or foreign entities. A private HEI can, for example, create a spinoff company relatively quickly or adjust policies to encourage innovation without needing national approvals. On the hindrance side, financing instruments for research are markedly absent at a systemic level [14] There is no recurring government subsidy for private HEI research, and Philippine private philanthropy for university research is not as developed as in some countries. Thus, private universities depend on a mix of tuition cross-subsidy and chasing grants, which may not be sustainable for many. Both sectors share some policy hurdles: research funding in the Philippines remains just around 0.2–0.3% of GDP (grossly below UNESCO's 1% recommendation), affecting all universities' ability to conduct cutting-edge RIE [14]. Moreover, the lack of a unified national innovation system linking universities, industries, and government (though improving) means that policies sometimes do not sync; for example, universities produce graduates without strong research skills because curricula are focused on licensure exams rather than inquiry [14] reflecting a policy gap in fostering research culture in undergraduate education.

In conclusion of this section, the policy environment is evolving with recognition of research and innovation as critical. The governance frameworks in SUCs and private universities differ, but each has room to adopt best practices (such as depoliticizing SUC leadership and encouraging private boards to invest in long-term RIE capacity). Funding reforms are arguably needed to ensure both types of institutions can implement Quintuple Helix collaborations: suggestions from policymakers include developing financing to fund HEI innovations and infrastructure in the long term, and promoting public private complementarity by harnessing the strengths of each sector [14]. Only with sufficient support and an enabling policy climate can the lofty goals of the Quintuple Helix sustainable, collaborative innovation be fully realized in Philippine higher education.

2.14. Comparative Challenges and Strengths

Both SUCs and private universities face unique challenges in applying the Quintuple Helix Model, as well as distinct strengths they bring to RIE efforts. Table 2 summarizes the comparative challenges and strengths of the two types of institutions:

Table 2.
Comparative Challenges and Strengths of SUCs vs. Private Universities in RIE Functions.

Dimension	State Universities and Colleges (Public HEIs)	Private Universities (Private HEIs)
Key Challenges	- Resource Limitations: Funding per student and per faculty for research is often low. SUCs rely on government budgets that prioritize access (enrollment) over research, and dedicated R&D funds are limited [14]. Equipment and labs are lacking in many SUCs (60% without advanced facilities). - Bureaucracy and Administrative Rigidities: Government procurement and hiring rules can slow down projects. Decision-making may be centralized and slow, and SUC administrators must navigate political oversight. In some cases, politicized leadership or frequent leadership changes (especially in local public colleges) disrupt continuity of RIE programs [14]. - Human Capital Constraints: A significant portion of SUC faculty do not hold doctoral degrees and have minimal research experience, partly due to emphasis on teaching and licensure exam prep historically [14] . Heavy teaching loads and large class sizes in popular SUCs leave little time for research work. Cultivating a research culture is still an ongoing process in many SUCs (research is often seen as secondary to teaching). - Industry Linkage and IP Issues: SUCs generally have weak connections to industry few formal partnerships and low trust from the private sector in some cases. There are challenges in navigating IP ownership and profit-sharing with industry, which deters collaboration. Additionally, SUCs have been slow to produce patents or spin-offs, resulting in less proof-of-concept to attract industry interest [14]	- Financial Sustainability Pressures: Private universities depend heavily on tuition and enrollment income. Many institutions lack dedicated R&D endowments or research grants, making it difficult to sustain high-cost R&D activities unless externally funded [1, 5]. Economic downturns or declining enrollments directly impact the ability to invest in research and extension programs. - Market-Oriented RIE Focus: Private HEIs often prioritize commercially viable research, consultancy, and quick-return projects that align with client needs rather than long-term fundamental research [6]. This market orientation may limit the broader societal or environmental innovation impacts envisioned in the Quintuple Helix framework. - Limited Collaboration with Public Sector and Civil Society: Some private universities focus more on business and industry partnerships but have weaker collaboration networks with government agencies and civil society organizations [8]. This creates gaps in societal relevance and limits engagement with policy-driven or grassroots innovation initiatives. - Research Culture and Faculty Incentives: While elite private universities (e.g., Ateneo, DLSU) have strong research cultures, many mid-tier and smaller private higher education institutions struggle to motivate faculty towards research due to low incentives, heavy teaching loads, and high administrative expectations [16]. Research outputs are often concentrated in a small pool of faculty rather than institutionalized across departments.
Key Strengths	- Public Service Mandate and Mission: SUCs have a clear mandate to serve national and local development. This instills a strong ethos of community service and alignment with public needs. They are driven to address pressing societal problems (poverty, food security, etc.) as part of their core mission, which naturally aligns with the Quintuple Helix goal of societal benefit. - Government Support and Programs: Being public, SUCs are eligible for various government supports from annual funding to special R&D grants (e.g., DOST and CHED programs). Policy frameworks are increasingly supportive (e.g., incentives for publishing and innovation in SUC leveling, laws enabling tech transfer). When tapped effectively, these enable SUCs to build facilities and research programs that might be out of reach for private institutions. For example, SUCs have led the establishment of region-specific research centers funded by DOST to tackle local industry challenges [12]. - Broad Regional Presence: With at least one SUC in each province (and multiple campuses nationwide), SUCs collectively have unmatched geographic reach. This allows them to implement	- Agility and Flexibility: Private HEIs can often make decisions and implement changes faster than public ones. Curricular and program innovations can be introduced with more agility (less layers of approval) [11]. This flexibility extends to forming partnerships a private university president or dean can green-light a collaboration or new research initiative quickly if it aligns with institutional strategy, without needing extensive government approval. - Access to Alternate Funding and Resources: Top private universities frequently have support from alumni, industry, and philanthropic sources. They can launch capital campaigns or receive endowments specifically for research or facility upgrades (e.g., corporate-sponsored research labs or foundations endowing a research center). Some private universities also charge higher tuition that subsidizes research activities. This can mean better laboratories, libraries, and higher faculty salaries in the elite private institutions, attracting talent and enabling more ambitious RIE projects. - International and Industry Linkages: Private universities often cultivate global networks and partnerships. They have the branding and autonomy to join international consortia, host visiting foreign

	RIE activities in diverse contexts and mobilize knowledge to remote communities. They can tailor innovations to local cultures and environments, leveraging local knowledge. This capillarity is a strength for the diffusion of innovation and community engagement at scale. - Institutional Stability and Accountability: SUCs, being state institutions, are less likely to shut down or drastically change course due to financial issues (unlike some smaller private colleges). They have stable enrollment due to free tuition and, as such, can plan long-term projects. Their use of public funds is subject to audits, which, despite being bureaucratic, ensures a level of accountability and documentation that can be helpful in the continuous improvement of programs.	professors, and collaborate abroad, which can elevate their research quality and output. They also tend to include industry leaders on their boards or as adjunct faculty, creating a bridge for knowledge transfer. The presence of practitioners in the classroom and in governance helps privates stay attuned to market trends and innovation opportunities, enhancing the academia-industry-civil interface. - Niche Expertise and Innovation Culture: Many private HEIs carve out niches where they excel – for example, a certain private university might be known for its IT and engineering prowess, another for business incubation, and another for social entrepreneurship. This focus allows for depth and excellence in specific RIE areas. Furthermore, private institutions often encourage a culture of innovation institution-wide: some integrate research into undergraduate education, encourage student startups, or emphasize interdisciplinary work across departments. A good example is how religious-affiliated universities integrate social innovation into their teaching and research, turning community service into laboratories for experimentation (as seen in their dedicated centers for social innovation) [11]. Such cultures can produce model projects that can be scaled or replicated by others.

As shown in Table 2, the challenges faced by SUCs tend to be structural (funding, bureaucracy, scale of mandate), whereas those faced by private universities are largely resource-driven (financial constraints for smaller players) and alignment issues (ensuring their educational focus includes research and extension). The strengths are complementary: SUCs have a strong foundation in public mission and reach, and private institutions bring dynamism, external connections, and often higher per-capita resources in the leading institutions. These differences suggest that collaboration between the two sectors could allow one's strengths to mitigate the other's weaknesses. For instance, a partnership where a private university provides advanced lab analysis for a research project while an SUC partner organizes field implementation and community validation can yield a result neither could achieve as effectively alone.

Understanding these comparative strengths and challenges is crucial for policymakers and educational leaders. Efforts such as promoting public–private research consortia or joint extension ventures can harness the public sector's network and the private sector's agility. Additionally, addressing challenges within each such as depoliticizing SUC leadership appointments or establishing a national research fund accessible to private HEIs will be important. The next section will highlight case studies that exemplify how some institutions are overcoming challenges and leveraging strengths through Quintuple Helix collaboration.

2.15. Case Studies

To illustrate how the Quintuple Helix Model is being operationalized in practice, this section presents two case studies: one from a state university and one from a private university. These examples demonstrate multi-helix engagement in RIE and highlight specific outcomes and lessons.

2.16. Case Study 1: NICER Agri-innovation Centers at Mariano Marcos State University (Public)

Mariano Marcos State University (MMSU), a State University and College (SUC) in Ilocos Norte, has taken a leading role in regional innovation through the DOST's Niche Centers in the Regions (NICER) program. Under NICER, MMSU was awarded a project to establish a Garlic and Other Agri-Food Condiments R&D Center aimed at revitalizing the local garlic industry [12]. This initiative embodies the Quintuple Helix Model: the *government* (DOST) provides funding and strategic direction; the *university* (MMSU) houses the research and coordinates academic expertise; *industry* is represented by local garlic farmers and traders who collaborate and stand to benefit economically; *civil society* and local communities are engaged as stakeholders whose livelihoods and cultural traditions (garlic farming being a local heritage) are addressed; and the *environment* is considered through sustainable farming practices and the preservation of local garlic varieties. In implementation, MMSU's researchers work closely with farmer cooperatives and the provincial government transferring technology on improved garlic cultivation, better storage and processing, and organizing community-based seed production. Early results have shown promise in increasing yields and quality of garlic, directly impacting farmers' income and sustaining an industry that was previously in decline [12]. Similarly, in Mindanao, other SUCs like the University of Southern Mindanao launched a Cacao R&D Center via NICER, which aims to upgrade cacao bean quality and optimize post-harvest processes to raise farmers' incomes by an estimated *30–40%* [12]. These centers illustrate how a structured partnership model can work: government funding and policy support empower the university; the university generates research solutions;

industry/community partners co-create and adopt innovations; and environmental sustainability (such as conserving the biodiversity of garlic or cacao) is a core objective. A key lesson from MMSU's case is the importance of aligning RIE activities with local economic drivers by doing so, the project has garnered support from all helix actors (e.g., local businesses co-sponsor training events, NGOs assist in organizing farmers, LGUs integrate the project into their agriculture programs). The NICER centers are still ongoing, but they represent a successful convergence of quintuple helix elements in a public university setting, and if outcomes continue to be positive (higher crop productivity, new garlic products, etc.), it could serve as a model for other SUCs. The case also highlights how policy and funding (government helix) can activate the other helices: without DOST's program, the collaboration might not have come together on its own, but with it, a platform was created for sustained university-industry-community interaction resulting in innovation for sustainable development.

2.17. Case Study 2: Silliman University's Environmental Extension and Research (Private)

Silliman University, a private university in the Visayas, offers an example of how private HEIs can integrate research, innovation, and extension with multi-sector partnerships, particularly in the realm of environmental management. Silliman houses the Angelo King Center for Research and Environmental Management (SUAKREM) a non-profit research and extension unit established in 1999 through a private foundation endowment (Angelo King Foundation). This center was created to conduct research on marine and terrestrial ecosystems and to apply findings to conservation and sustainable livelihoods in coastal communities. In practice, SUAKREM operates at the intersection of academia, civil society, government, and the environment: it performs scientific studies (academia) on biodiversity and marine protected areas, works directly with *community groups* of fishermen and local NGOs to implement marine conservation (civil society), provides training to those communities on sustainable practices (extension), and advises local *government units* and national agencies like DENR on environmental policy and the establishment of marine sanctuaries (government). The *industry* helix is also present indirectly – for example, the center promotes environmentally friendly technologies that can increase fishery yields for coastal enterprises , and eco-tourism operators in the area benefit from healthier marine ecosystems. Over the years, Silliman's initiatives have led to the creation of multiple community-managed marine protected areas along the Dumaguete coastline and beyond, with documented increases in fish biomass and improved livelihoods from associated eco-tourism. A notable innovation was Silliman's pioneering of community-based coastal resource management in the Philippines, which has since been replicated nationally. The success factors in this case include: dedicated funding from a private donor which gave the center financial stability; Silliman's longstanding educational philosophy of "Via, Veritas, Vita" which emphasizes service, ensuring institutional support for extension; and effective partnership with government Silliman's scientists work closely with Philippine agencies and even international bodies (one example, its marine lab was involved in a UNDP project for coral reef restoration). This demonstrates that private universities, when mission-oriented, can be *hubs of social innovation and sustainability*, rallying various sectors. SUAKREM's work aligns with the environment helix by actively protecting natural ecosystems, and with civil society by empowering communities as co-managers of resources. The case also underlines how private sector funding (a foundation) can kick-start a helix collaboration that persists for decades. In Quintuple Helix terms, Silliman's experience shows that a private HEI can take leadership in a local innovation ecosystem by building trust with communities (social helix) and credibility with government agencies (political helix), all grounded in solid scientific research (academic helix) and aimed at environmental sustainability (environment helix). The outcomes healthier reefs, educated citizens, sustained fisheries speak to the power of such cross-sector synergy.

These case studies, one from a public institution and one from a private institution, both illustrate that success in RIE often comes from strategic partnerships across the helices. MMSU leveraged a national government initiative to unite stakeholders around agricultural innovation, while Silliman leveraged private philanthropy and its own vision to spearhead community-centric environmental innovation. Both overcame certain limitations (MMSU being in a region far from Manila's resources, Silliman being a smaller private school outside the state system) by engaging the quintuple helix. They reinforce the notion that context-specific strategies are key: each institution focused on areas of comparative advantage (MMSU's agri-tech strength in Ilocos garlic, Silliman's marine science legacy in Dumaguete) and then brought together the relevant sectors to collaborate.

3. Conclusion

The comparative analysis of Philippine State Universities and Colleges versus private universities through the lens of the Quintuple Helix Model reveals a landscape where divergent pathways converge toward a common goal: enhancing research, innovation, and extension for societal benefit. SUCs, buoyed by public mandates and funding, anchor widespread community development efforts and are gradually building research and innovation capacity, though they grapple with resource and structural constraints. Private universities, driven by autonomy and niche strengths, demonstrate how agility and targeted investment can yield high research output and pioneering initiatives, yet their contributions are uneven across the sector. In terms of the five helices of innovation, SUCs excel at government and community engagement (thanks to their public service orientation and extensive reach), while leading private HEIs often excel at industry collaboration and global academic linkages (a product of their flexibility and pursuit of excellence). Both types are integrating the environmental helix into their RIE endeavors, aligning with sustainable development imperatives.

Crucially, this study finds that complementarity is more prominent than competition in the quest for innovation. The strengths of SUCs public accountability, regional presence, and alignment with national goals complement those of private universities – dynamism, concentrated expertise, and external networks [14]. Challenges such as an underdeveloped research culture, limited funding, and policy gaps affect both, calling for systemic solutions. Recent policies and programs indicate a recognition that enabling all HEIs to partake in RIE is vital: government grants are increasingly open to private HEIs, and

collaboration platforms are emerging. Moving forward, fostering public-private partnerships in research and extension could amplify the impact of each helix. For instance, joint research centers, co-hosted innovation hubs, and shared extension projects can allow knowledge to flow across institutional boundaries. The Quintuple Helix Model provides a useful framework for such collaboration it reminds stakeholders that innovation thrives when universities (whether public or private) act as part of an ecosystem with government as enabler, industry as collaborator, civil society as co-creator, and environmental sustainability as a guiding principle.

In conclusion, the engagement of Philippine higher education with the Quintuple Helix is a work in progress marked by promising practices and persistent gaps. By learning from successful case studies and comparative insights, both SUCs and private universities can refine their strategies and structures: SUCs can strive for more entrepreneurial approaches and internationalization, while private universities can deepen their social and developmental commitments. Policymakers should continue to craft an environment that rewards collaboration, funds innovation, and links education to inclusive development, cutting across the public-private divide [14]. If these conditions are met, the synergy of the five helices government, industry, academia, civil society, and environment will substantially enhance the RIE functions of all Philippine universities, ultimately driving the knowledge-based, sustainable development that the nation aspires to.

References

[1] Commission on Higher Education (CHED), *CHED mandate and functions* Quezon City, Philippines: Commission on Higher Education, 2023.

[2] R. M. Salazar-Clemeña and S. A. Almonte-Acosta, "Developing research culture in Philippine higher education institutions: Perspectives of university faculty," *Asian Journal of University Education*, vol. 3, no. 2, pp. 21–33, 2007.

[3] Philippine Institute for Development Studies, "Enhancing the contribution of higher education institutions to innovation in the Philippines," PIDS Discussion Paper Series No. 2019-10. Quezon City, Philippines: Philippine Institute for Development Studies, 2019.

[4] A. Lunag, M. Cruz, and J. Reyes, "Enhancing university competitiveness through research, innovation, and extension: A market-driven approach," *Journal of Higher Education Development*, vol. 12, no. 1, pp. 45–62, 2024.

[5] R. Garcia, M. Ting, and J. Hoorebeek, "The impact of RIE activities on academic prestige and global rankings: Case studies from the Philippines," *Asian Journal of University Innovation*, vol. 7, no. 2, pp. 101–118, 2024.

[6] W. G. Padolina, "Technology transfer and commercialization in Philippine universities," *Asian Journal of Innovation and Policy*, vol. 4, no. 1, pp. 1–14, 2015.

[7] Asian Development Bank, "Higher education infrastructure needs assessment for research and development in the Philippines," ADB Report Series, 2021.

[8] K. L. Armas and M. N. Villegas, "Partnerships for sustainable development: A Quintuple Helix framework for research, innovation, and extension in Philippine state universities," *Journal of Lifestyle and SDGs Review*, vol. 5, no. 2, pp. e03158-e03158, 2025. https://doi.org/10.47172/2965-730X.SDGsReview.v5.n02.pe03158

[9] E. Sermona, P. Dela Cruz, and M. Santos, "Research and extension performance in State universities and colleges (SUCs): Implications for levelling and accreditation," *Philippine Journal of Higher Education*, vol. 9, no. 1, pp. 34–49, 2020.

[10] R. Chua and L. Mia, "Building an extensive research and innovation infrastructure: The creation of the office of the Vice chancellor for research and innovation in a Philippine university," *Journal of Philippine Higher Education*, vol. 10, no. 2, pp. 45–62, 2016.

[11] British Council, *Social innovation and higher education in the Philippines: Case studies*. Mandaluyong City, Philippines: British Council, 2020.

[12] K. L. Armas, *The role of state universities and colleges in policy development and innovation in the Philippines*. Manila, Philippines: Commission on Higher Education, 2020.

[13] Philippine Innovation Act, *Republic act No. 11293: Philippine innovation act*. Manila, Philippines: Official Gazette, 2019.

[14] L. R. Dacuycuy, V. B. Paqueo, and A. C. Orbeta, *From research to impact: Assessing technology transfer and commercialization in Philippine State Universities and Colleges*. Quezon City, Philippines: Philippine Institute for Development Studies (PIDS), 2023.

[15] M. E. L. Atienza, *Public higher education in the Philippines: State universities and colleges in national development and globalization*. Quezon City, Philippines: University of the Philippines Center for Integrative and Development Studies (UP CIDS), 2021.

[16] R. M. Salazar-Clemeña and S. A. Almonte-Acosta, "Assessing research output and quality in Philippine higher education institutions," *Asian Journal of Higher Education Research* vol. 5, no. 3, pp. 65–83, 2021.