UNIVERSITY OF THE PHILIPPINES
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MASTER IN RESEARCH AND DEVELOPMENT MANAGEMENT

OLIVE JOY G. ABING

SYSTEMS ANALYSIS OF ACTOR PERCEPTIONS ON COLLABORATIONS WITHIN A PHILIPPINE REGIONAL INNOVATION SYSTEM

Thesis Adviser:

LEO MENDEL D. ROSARIO, PHD
Faculty of Management and Development Studies

06 July 2026

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Acceptance Page

This thesis of **OLIVE JOY G. ABING** titled: "**SYSTEMS ANALYSIS OF ACTOR PERCEPTIONS ON COLLABORATIONS WITHIN A PHILIPPINE REGIONAL INNOVATION SYSTEM"** is hereby accepted by the Faculty of Management and Development Studies, U.P. Open University, in partial fulfillment of the requirements for the degree **Master of Research and Development Management (MR&DM).**

LEO MENDEL D. ROSARIO, PHD _____
Chair, Advisory Committee Date

PRIMO G. GARCIA, PHD _____
Member, Advisory Committee Date

MAGDALENO R. VASQUEZ, JR., PHD _____
Member, Advisory Committee Date

FINAFLOR F. TAYLAN, DPROFST
Dean
Faculty of Management and Development Studies

_____
(Date)

Biographical Sketch

Dr. Olive Joy G. Abing is a research enthusiast engaging in multidisciplinary studies involving language, literature, communication, governance, innovation systems, and technology transfer. She is a firm believer that language transcends all disciplines and must be incorporated as one integral aspect of research, particularly in technology development and commercialization.

She has worked in a private college and a state university for 24 years, teaching language and communication. Presently, she is affiliated with Iloilo Science and Technology University as an English Language Professor. She has also been designated as Cluster Chair in Language Studies for 10 years, Research Ethics Chair for 3 years, Editor for the University Research Journal for 10 years, and Head of Creatives under the Public Information and Communication Office for 4 years.

Her research interest is in multidisciplinary approaches. She has engaged in externally funded projects for DILG in developing and piloting BNEO Modules; the Decentralization and Local Governance Reform Advocacy Program (DLGRAP); and the DOST-PCAARRD Regional Agri-Aqua Innovation System Enhancement (RAISE) program. These engagements testify to her advocacy for integrating language into research across disciplines. Her work bridges linguistic inquiry with governance, agriculture, and innovation studies, demonstrating that effective communication is not merely a support function but a critical component of research design and policy implementation. This sustained engagement reflects her broader conviction that meaningful societal impact emerges when language, communication, and discipline-specific expertise are treated as interconnected, rather than separate, domains of scholarly practice.

Acknowledgement

Deep gratitude and admiration are intended first and foremost for my thesis adviser and MR&DM chair, Dr. Leo Mendel Rosario. His support, motivation, and encouragement for us to always do everything with excellence as befits an MR&DM student are unparalleled. I appreciate the lessons and professional advice both in the classroom and during our research meetings. He helped us become better students and researchers by always guiding and encouraging us to go beyond our comfort zone and explore novel research initiatives.

To my esteemed panel members, Dr. Primo Garcia and Dr. Jhong Vasquez, whose unparalleled expertise in research and innovation systems elevated this study far beyond its original vision. Your rigorous guidance and critical insights transformed my work into a much more meaningful contribution to the field. I am deeply grateful for the privilege of your mentorship, and I earnestly hope our paths cross again so I may continue to learn from your exemplary scholarship.

My peers in the MR&DM and ARISE research group, who became dear close friends; Sir Paris, Doc Cryz, Doc Beth, and Doc Raly, thank you for standing by me even in my most stressful moments. You are always there to coach, send references, cheer, and give time and lectures to overcome some research bottlenecks. My MR&DM studies would never be as colorful and eventful if not for your presence and guidance. Your rare blend of intellectual guidance and genuine friendship not only rescued my research from its tough spot but transformed my academic journey into an unforgettable milestone.

ISAT U Community for giving me a place to grow, to test my mettle, and to explore horizons of great possibility in my profession. Our university provided me with

growth opportunities, and I am grateful for this chance. Our nurturing environment inspired me to do my best and channel my future research to uplift our community and honor the university.

UPOU MR&DM faculty and staff for the new learnings and a chance to grow professionally. It saddens me that my education has to end, but I bring with me the knowledge and the passion to commit more and continuously do more in research. I am grateful for your inspiring mentorship, and I will ensure that the knowledge you have instilled in me continues to uplift the community.

UPOU MR&DM classmates and peers whose intellectual camaraderie and vibrant discussions enriched our virtual class. Navigating this four-year complex degree would have been a solitary path if not for your shared insights. I am happy to have walked this academic journey alongside you, who are already dedicated professionals but still give some time to learn more in research and development, knowing it is one way for us to do more for our country. I look forward to all of your achievements.

To my research participants, my profound gratitude goes to each of you for so generously sharing your time, invaluable expertise, and lived experiences, which formed the very foundation of this study. You have my lifelong gratitude.

Most importantly, to God Almighty, whose grace and mercy know no bounds. His unfailing love sustains me, and His redemption covers me in the many times I failed Him, yet He never turned His back on me. His goodness and mercy are overflowing. I am forever in awe of His presence in my life.

Dedication

The culmination of this study and my graduate degree is dedicated to Jack and Nicole, who always keep me anchored no matter how far I stray or soar, and who made our house a home. We may not be perfect. We fight, we disagree, we bicker, we raise our voices… but we will always be family. Nothing is missing. Nothing is lost. We will keep each other close at heart. We will have each other's back…

Always…

To my cousins whose ever-present support keeps me grounded, especially to Mye, Tit, Inday, Ne Ging, Ne Jelyn, Sosoy, Kuya Bong, Doy, and the rest. Your love and care through all these years make me feel loved and cherished. Through all my strife, you are my constant, and this small success is also dedicated to all of you.

To Nomie, for always being a shoulder to lean on, always compassionate, and with a big heart to carry me through thick and thin. The thought of more travels with you is an antidote to all burnout and stress. True friends are as rare as diamonds, and I am one of the blessed few who found it in you. Ng Yem, for always taking care of me; the Animal Kingdom, for the laughter; and RSD friends, whose warm presence at work always lightens the load. Your friendship means so much to me, and I know I will have you all through life for keeps.

To my family, Guillergan, Abing, and Asis, for being supportive and understanding despite my hectic schedules and workload. Your help and support are truly valued, especially in taking care of the kids in the days when I am quite busy with my studies and work.

ABSTRACT

This study aimed to analyze the inherently unique, multifaceted, and complex dynamics of the regional innovation system (RIS) in Western Visayas based on the actual perceptions of the actors involved in the ecosystem. Much is still left unknown about the RIS in the country, particularly the roles and functions, relationships and interconnection, and collaboration among its central stakeholders. This prompted the need to conduct an empirical analysis with the main goal of analyzing the actor perceptions on the collaboration within the WV RIS to better understand this ecosystem. Guided by a systems approach, central stakeholders involving purposively selected 20 participants from universities, government, industry, and community sectors, were identified to corroborate their perceptions, insights, and engagements regarding the innovation process of the RIS in Western Visayas. Utilizing qualitative multiple case study research design, multi-level system approach data analysis tool was employed for an empirical data collection method and analysis including Social Network Analysis to infer actor perceptions on their roles, functions, and interaction within the RIS, Iceberg Model to delve deeper down to the institutional and cultural factors for prevailing factors identified by actors as barriers or drivers of innovation performance, and Causal Loop Diagramming to analyze the causal linkages, and the reinforcing or balancing behaviors perceived by actors to influence the progress or decline of the innovation process.

Findings revealed a government-academe-dominant structure, with DOST holding the highest eigenvector centrality and LGUs serving as critical brokers connecting otherwise disconnected actors, while industry and startups remain structurally peripheral. Trust, ecosystem collaboration, shared vision, visible success stories, strengthened value chain orientation, market readiness, and visionary

leadership emerged as key drivers of collaboration, whereas weak commercialization, stakeholder's receptiveness, and discontinuity of technology adoption initiatives constituted persistent barriers rooted in deeply ingrained cultural assumptions and mental models on risk aversion business culture, researcher mindset, dole-out dependency mindset, and siloed mentality of government agencies. Reinforcing loops around commercialization success and leadership coexisted with vicious cycles of dependency and silo mentality. The RIS reflects an early-to-intermediate Quadruple Helix system—formally quadrilateral but structurally imbalanced. These findings imply that strengthening industry integration, reforming promotion incentives, and institutionalizing local government support are essential for sustainable innovation diffusion. It is recommended that policymakers prioritize demand-driven, multi-stakeholder collaboration mechanisms to transform localized successes into systemic, self-sustaining regional innovation momentum.

Keywords: Regional Innovation System; Systems Approach; Social Network Analysis; Iceberg Model; Causal Loop Diagramming

TABLE OF CONTENTS

Title Page i

University Permission Page ii

Acceptance Page iii

Biographical Sketch iv

Acknowledgement v

Dedication vii

Abstract vii

Table of Contents ix

Chapter I: THE RESEARCH PROBLEM 1
- Introduction 1
- Background of the Study 6
- Regional Innovation System in the Philippines 6
- Overview of the Regional Innovation System in Western Visayas 7
- Systems Approach and the Innovation Models in RIS 11
- Statement of the Problem 15
- Research Questions 16
- Objectives of the Study 17
- Scope and Limitation of the Study 18
- Limitations of the Study 19
- Significance of the Study 21

Chapter II: REVIEW OF RELATED LITERATURE **Error! Bookmark not defined.**
- National and Regional Innovation System 23
- Theoretical Underpinnings of the Systems Approach 28
- System Approach in Regional Innovation System 30
- Innovation Systems Framework 31
- Social Network Analysis 36
- Iceberg Model Analysis 40
- Causal Loop Diagramming 45
- Theoretical Framework 49
- Analytical Framework Process 52
- Research Gaps 54

Chapter III: METHODOLOGY 58
- Introduction 58
- Research Method 58

Study Setting 60
Participants of the Study 60
Sampling Procedure 63
Data Collection Method and Procedures 64
Data Analysis Procedure 66
Risk Mitigating Strategies 72
Research Instrument 73
Ensuring Trustworthiness of the Data 74
Research Ethics 76

CHAPTER IV: RESULTS AND DISCUSSION 79
Sampling results 80
Data Collection Results 84
Themes Emerging from the Research Questions 85
SRQ1. How do the actors perceive the structures, roles, functions, and manner of interaction and collaboration among the key stakeholders within the regional innovation system? 86
SRQ 2. What do the actors identify as drivers and barriers in their collaboration within the regional innovation context? 106
SRQ 3. What balancing and reinforcing behaviors, and causal relationships can be inferred among the actors within the regional innovation system? 144
Answering the Main Research Question (MRQ): “How do key actors perceive the interactions, mental mindsets, and feedback structure shaping the dynamics within the regional innovation system of Western Visayas and what systemic patterns could be inferred from these analyses?” 162

Chapter V: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 166
Summary of the Study 166
Summary of Key Findings 167
Conclusions 170
Structure and Interactions of RIS 170
Implications of the findings 174
Limitations of the Study 177
Recommendations 178

REFERENCES 182

APPENDICES 198
Appendix A: Research Ethics Committee Approval 199
Appendix: Informed Consent Form for Regional Innovation Ecosystem (RIS) Participants from University, Government, Industry and other Sectors 201

Appendix C: Semi-structured Interview Questionnaire 206
Appendix D: Iceberg Model Analysis Thematic Analysis
Appendix E: Mind Maps 222
Appendix F: Timeline for Conduct of the Study 226
Appendix G: Line Item Budget 227
Appendix H: Declaration of Tools and Artificial Intelligence (AI) Use in Research 228
Appendix I: Study Setting: Regional Profile of Western Visayas (Region VI) 232

LIST OF TABLES

Table 3.1 Participants of the study 62
Table 4.1 Profile of the Participants 83
Table 4.2 Distribution of Participants' Length of Involvement in RIS 84
Table 4.3 Roles and Functions of Key Actors in RIS 93
Table 4.4 Thematic Analysis of Communication and Interaction Modes in RIS 101
Table 4.5 Thematic Analysis in the structural gaps and challenges in RIS 105
Table 4.6 Thematic Analysis of Low Commercialization of R&D Outputs 114
Table 4.7 Thematic Analysis of Stakeholder's Receptiveness to Technology Adoption 124
Table 4.8 Thematic Analysis of Discontinuity of Technology Adoption Initiatives 135
Table 4.9 Thematic Analysis of the Drivers and Enablers of RIS 141
Table 4.10 Causal Relationships and Themes Forming Loops Inferring Reinforcing Behavior 151
Table 4.11 Causal Relationships and Themes Forming Loops Inferring Balancing Behavior 156
Table 4.12 Derivation of loop sequencing of events inferred from interview transcripts 157

LIST OF FIGURES

Figure 1.1 National and Regional Innovation System 11
Figure 2.1 Balanced triple helix model by Etzkowirtz and Leydesdorff 33
Figure 2.2 Sample Social Network Analysis 39
Figure 2.3 The Iceberg Model and its levels 42
Figure 2.4 Causal loop diagram illustration 48
Figure 2.5 Flowchart of Analytical Framework using integrated Systems Approach 52
Figure 3.1 Flowchart in using Social network in data analysis 68

Figure 3.2 Flowchart in using Iceberg Model in data analysis 70
Figure 3.3 Flowchart in using Causal Loop Diagramming in data analysis 72
Figure 4.1 Systems Mapping of the RIS 92
Figure 4.2 Social network of RIS 98
Figure 4.3 Interaction of RIS 100
Figure 4.4 Causal Loop Diagramming showing causal relationships among reinforcing and balancing loops 156

Chapter I

THE RESEARCH PROBLEM

Introduction

Innovation is widely recognized as the main leverage that could propel a country toward a competitive global innovation index (GII) ranking. Every country strives to edge out in this competition as it indicates technological supremacy, innovation prowess, and economic growth. For years, the Philippines has strived to edge out in the GII through the aggressive efforts of the government to expand the science and technology initiatives of several agencies led primarily by the Department of Science and Technology (DOST). Needless to say, innovation initiatives are one definite path in promoting inclusive and sustainable development as identified by the Sustainable Development Goals (SDGs) by directly addressing prevalent societal issues among developing countries such as poverty, inequality, weak economy and poor infrastructure, to name a few. Innovation initiatives of the government are deeply anchored in the SDGs to promote continuing and encompassing growth for the country. For one, SDG 9 (Industry, Innovation and Infrastructure) promotes sustainable economic growth hinged on inclusive industry, resilient infrastructure and innovation. This posits that an efficient and functioning innovation system in the country is key towards sustainable development. The innovation system could further be strengthened through collaborative effort and partnership by major stakeholders comprising the university, government, industry, civil society, and environment sector. This collaboration is essential to foster a fully functioning and effective innovation system in line with SDG 17: Partnership for the Goals, which highlights the importance of multi-stakeholder collaboration as the main driver for systemic growth (United

Nations, 2015; Leydesdorff, 2021). Ultimately, this integrated effort could lead to employment opportunities, local economic progress, and better quality of life, thereby addressing SDG 1: Reduced Poverty. These integrated initiatives could alleviate widespread societal issues and systemic problems to usher the country into a more sustainable and resilient path in aspects of economic, social, and environmental areas, the three dimensions of sustainable development as identified by the 2030 Agenda for Sustainable Development and the Millennium Development Goals for the country.

Among the countries vying for economic advancement, the Philippines is making a name being one of the most progressive in the last few years. As of October 2025, the latest report places the Philippines in the top 50 in the Global Innovation Index (WIPO, 2025). This standing is earned through the government's fervent pursuit in augmenting research and development, ultimately leading to technology generation and eventual commercialization. This catapulted into unprecedented innovation prowess, driving the economy and paving the way toward sustainability. The country's priority of advancing innovation systems and placing it at the helm of its national development agenda is what edges the country forward into being internationally competitive. The country recognizes that in this pursuit, collaboration is an imperative, particularly among the key institutions directly involved in the innovation process.

Presently, national and regional innovation systems are being strengthened across the globe as they are recognized to be a primary driver of economic resilience, global competitiveness, and technological supremacy. A country with an established system of developing technology through research, generating innovation as its by-product, and commercializing it successfully is a clear indication that it is on the right path towards achieving a self-sustaining economy because it can provide technology tailored to the precise needs of its people and geography. Thus, policies to strengthen

the National Innovation System (NIS) are being implemented rapidly, and commercialization efforts are being fast-tracked (Pinto, 2024). A competitive country realizes that to be technologically self-reliant, it has to scale up and prioritize innovation and technology processes to excel in the international competitive index arena.

Scholars have collectively defined NIS as a conceptual systematic framework postulating that innovation activities are not isolated efforts of remote enterprises or individuals. It is not an accumulation of intermittent success of one or two industries striking big in one business or two. Rather, governments and several institutions play vital roles in executing well-coordinated innovation activities within the country's economy, with key organizational structures and systems interacting in the ideation, development, and transmission of novel knowledge and technology (Crespo & Crespo, 2016). These key actors, despite coming from different institutions, are working together to refine the NIS framework to bring out a fully functioning and synchronized system where all could pitch in their contributions and work together.

Additionally, scholars realize that NIS alone could not promote widespread technological advancement as its context is too generic and broad to cover all the varied ecosystems at the regional level. NIS framework alone could not fully saturate or completely saturate the immense expanse of a countrywide ecosystem. It also could not be expected to be accurate or relevant, given the diverse strengths, potential, resources, geography, and expertise of each region or locality. The framework needs to go down and understand the sub-national diversity of the innovation ecosystem, which proves to be unequivocally distinct in its own geographical setting. Regional innovation systems (RIS) are inherently unique, varied, and multi-faceted due to their own diverse culture, structure, and geographical contextualization. This realization has

driven scholars and innovators to focus their endeavors on the NIS downward subsystem, recognizing the role of RIS as the more immediate and actionable level of governance for innovation policy (Doloreux & Porto Gomez, 2017). RIS reflects the distinct cultural and geographical characteristics and strengths of each region, making each local RIS complex, context- specific, and inimitable. RIS is the most tangible and measurable subsystem scale for implementing innovation policies and programs as an offset of the broader NIS.

An effective and functional RIS does not merely operate with other stakeholders in the ecosystem just because of their proximity. It is not a simple matter of co-surviving. Stakeholders from varying institutions exist because of the quality of their relationship and connection with other stakeholders in their ecosystem, specifically the conjoined effort and synergistic interaction of the academe, government, and industry, ideally known as the prime actors in innovation (Etzkowitz & Leydesdorff, 1995). For an RIS to fully thrive, the dynamic synergy among these central actors is needed to drive innovation through coordinated efforts and mutual reinforcement.

In the Philippines, the movement to reinforce a knowledge-based economy is taking great strides as the government implements national policy to prioritize innovation and mandate its ecosystem-based approach through the National Innovation Agenda and Strategy of 2023 (NIASD, 2023) and Republic Act No. 11293, also known as the Philippine Innovation Act (PIA), enacted on April 17, 2019. The PIA legislation placed innovation at the forefront of the national development agenda and established the National Innovation Council (NIC) to implement a whole-of-nation approach to ensure that innovation initiatives and policies reach even the lower level of the regional ecosystem. In addition, the Act supported and reinforced the need for a strong interrelationship between the business sector, academe, government, and

other involved sectors through an Innovation Alliance (Republic Act No. 11293, 2019). In addition, Republic Act No. 11337, otherwise known as the Innovative Startup Act, mandates the support of new businesses by offering incentives, funds, and simplified compliance procedures (DOST, 2021).

These legal mandates paved the way for the establishment of a conducive ecosystem where innovation systems could thrive through the empowerment of their key stakeholders, who are directly instrumental in developing technologies commercially viable in both local and international markets. The mandates act as a structured legal framework guiding the innovation ecosystem to provide support to its partner communities, agencies, and beneficiaries. The mandates also provide provisions for a strengthened policy development program to strengthen implementation and to foster a dynamic, thriving innovation ecosystem by working collaboratively toward a common goal. Lastly, the mandates recommend a differentiated strategy in uplifting the diverse strengths, expertise, and environment of each RIS to foster localized and inclusive economic growth in each region.

Despite its importance, national and regional innovation systems still lack thorough studies among scholars and researchers in the country. Persistent gaps in understanding RIS, particularly on its systemic interactions and feedback mechanisms, prevail in the body of knowledge. Existing literature in the Philippines and other developing countries only provides one-sided, linear analysis without recognizing the underlying causes of issues or the entire dynamics of the ecosystem on challenges that plague RIS (Patalinghug, 2021). Most studies focus only on identifying the overt common challenges, which are already quite obvious, and disregard the root institutional causes or the bottlenecks or holdups affecting innovation performance. Conducting a study with the main goal of exploring the in-

depth level and multidimensional components affecting the RIS leads to a comprehensive analysis and eventual understanding of its dynamics.

Background of the Study

Regional Innovation System in the Philippines

Implementing a functional RIS across the country is a tactical strategy that aims to remedy the persisting regional economic diversity that only leans in favor of the National Capital Region (NCR) and its neighboring metropolitan cities in Luzon, resulting in a slow-lagging economy and high poverty incidence in most rural provinces in Visayas and Mindanao (Andriesse, 2017). Presently, the strengthening of RIS is a way to counter rural provinces being overlooked in the innovation process by including them as an integral part of national wealth distribution to ensure countrywide sustainable and inclusive economic growth. Inclusive implies that progress and development have to reach even the farthest community in the region.

To enact this, the Regional Inclusive Innovation Centers (RIICs) were established through the collaborative effort of government agencies mandated to promote an encompassing innovation system. The Department of Science and Technology (DOST), in collaboration with the Department of Trade and Industry (DTI) and the Department of Economy, Planning, and Development (DEPDev, formerly NEDA), shifts its focus from the wide-scale national innovation system to its more manageable and concentrated subcluster, which is the RIS. Its primary aim is to decentralize economic programs and promote industrial upscaling equally among all regions (ISEAS, Yusof Ishak Institute, 2019). Part of the government's decentralization effort is to devolve functions, including economic reforms, to local government units

(LGUs), making this initiative readily accessible to each locality. One effort is to amplify efforts to promote and commercialize regionally developed innovation. This approach is foreseen to bring more centralized economic progress and equal opportunities among regions.

Major activities to augment the country's innovation performance include strengthening human capital through research and development (R&D) and entrepreneurship training, supporting priority industry sectors such as Information Technology and Business Process Management (IT-BPM) and agribusiness, and facilitating the commercialization of technologies. Studies and policy briefs emphasized that a core challenge remains the historically low public expenditure on R&D relative to gross domestic product (GDP), which the RIS framework attempts to overcome by fostering a market-oriented research policy and strengthening the collaboration between the academe and industry. This bodes well for RIS, who have been struggling to gain national support, as this move could lead to increased regional development and economic augmentation through the creation of high-value local jobs across all regions of the Philippines.

Overview of the Regional Innovation System in Western Visayas

The Regional Innovation System (RIS) was identified as a subcluster of NIS where innovation governance could be easily operationalized due to its manageable size and components. Innovation policy could better penetrate a smaller number of actors comprising the system, making the implementation effective and actionable. Innovation policies have to be developed in a way that they can address the different challenges and needs of every RIS, as each considerably differs in its innovative

capacity due to differences in institutional frameworks, resource opportunities, geographic productivity, and political environments.

A regional innovation system (RIS) is defined as the clustered and localized interactions among industries, universities, and government agencies within a proximal geographic space that support innovation processes and drive economic growth (Cario, 2023). Additionally, RIS is a complex network of interrelating public and private agencies and small-scale business organizations co-existing within a delimited geographical area, whose conjoined efforts generate collective learning and productive working processes that propel technological and economic development (Doloreux & Porto Gomez, 2017). This implies that for an RIS to work efficiently and effectively, it needs a strong and harmonious collaborative relationship with all other key actors in the system. Coexistence is not really a defining factor in the network. What matters most is their synchronized effort.

The National Innovation Agenda 2032 by the National Innovation Council created through the Philippine Innovation Act of 2019 drives and fuels the Philippines to have a thriving and competitive innovation ecosystem. It identified innovation actors and elements that will provide direct and significant contributions to national economic growth. Along with this Act is the strengthening of the regional innovation ecosystem and ensuring that clustered feasible policies such as regional economic development policy, entrepreneurial and business policy, and higher education policy enable the achievement of innovation goals (NIC, 2023).

In Western Visayas (WV - Region VI), several research and development consortia operate as vital components of the regional innovation system, facilitating multisectoral collaboration that is often led and participated in by state and private universities and research centers.

Western Visayas Agriculture and Resources Research and Development Consortium (WESVARRDEC). This consortium, chaired by West Visayas State University, comprises 29 member agencies from public and private institutions who are committed to pooling technical expertise and resources related to agriculture and natural resource R&D. It functions as a regional knowledge hub aimed at addressing the agriculture, aquaculture, and natural resources sector's needs through collaborative innovation and technology development, aligned with DOST- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) initiatives (DOST Region 6, 2025).

Western Visayas Health Research and Development Consortium (WVHRDC). WVHRDC strongly supports health research initiatives in the region by bringing together researchers, institutions, and funding agencies to identify health priorities and improve research capacity. It directly operates under the Philippine Council for Health Research and Development (PCHRD) (DOST Region 6, 2025).

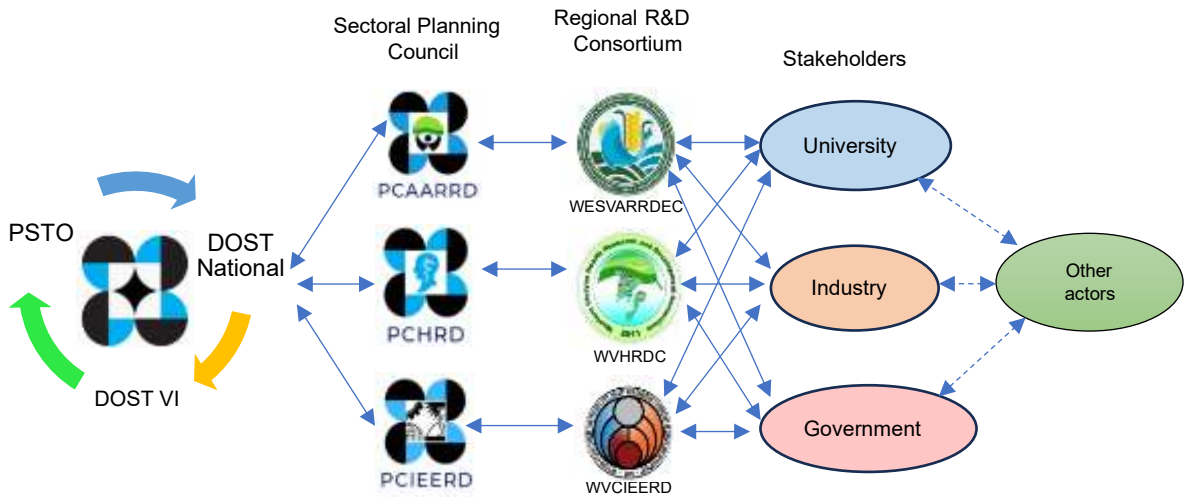
Western Visayas Consortium for Industry, Energy, and Emerging Technology Research and Development (WVCIEERD). This consortium focused on emerging industry-based innovation in the region, converging engineering, IT, energy, emerging technology, and numerous other sector partners to drive R&D related to regional industrial competitiveness. It is under DOST - Philippine Council for Industry, Energy and Emerging Technology [DOST-PCIEERD] (DOST Region 6, 2025).

At present, DOST-PCIEERD has invested P120 million, through the Regional Startup Enabler for Ecosystem Development (ReSEED) Program, to support Technology Business Incubators (TBIs) in establishing and strengthening the spinoff/startup ecosystem consortium in each region. PCIEERD RESEED program reported 91 incubators, 15 accelerators, 83 jobs, 43.9 million investment, and 27

million revenues as its accomplishments. On the other hand, PCAARRD reported a total partner of 94 State Universities and Colleges (SUCs) and Research and Development Institutes (RDIs) implementing 149 Regional Agri-Aqua Innovation System Enhancement (RAISE) projects nationwide, 1,746 Intellectual Property (IP) filed applications with 537 already granted, 407 mentored incubatees, 115 supported incubation technologies, 56 technologies commercialized, 25 operational Agri-Aqua Technology Business Incubators (ATBIs), ₱122 million generated revenue from incubatees, 11,509 trained participants, and 1,711 jobs created (PCAARRD, 2025). Additionally, PCHRD reported 54 TBIs established, 200 research projects funded, and 50 technologies commercialized as of 2023 (PCHRD, 2025).

These consortia were the starting point in the identification of other interlinked academe, government, industry, civil society, and other actors engaged in the innovation ecosystem of the region. As of the present, publicly accessible literature regarding specific dynamics, interactions, accomplishments, and other pertinent information of localized RIS in Western Visayas could not be readily found, thus prompting the need to conduct this study. Figure 1.1 presents the three national sectoral planning councils, regional R&D consortium, and partner stakeholders comprising the national and regional innovation ecosystem existing in the country. Other national R&D institutions were not mentioned since they do not have regional clusters in the country.

Figure 1.1. Active stakeholders and their interaction pattern within the National and Regional Innovation System.



Systems Approach and the Innovation Models in RIS

Several models highlight the crucial interrelationships among the key actors comprising the RIS. The Triple Helix (TH) model recognizes the trilateral relationship between academe, industry, and government as key drivers of regional innovation ecosystems (Xue, 2025). The TH framework postulates that the multi-directional, non-linear interactions among these institutional spheres—University (the organized source of knowledge generation), Industry (the source of wealth creation through commercialization and entrepreneurship), and Government (the source of normative control and regulatory framework)—are the fundamental engines of the knowledge-based economy as originally postulated by Etzkowitz and Leydesdorff (1995).

The quadruple helix model integrated civil society into the existing three key actors, emphasizing its importance in a participatory, sustainable, and inclusive innovation system (Hasche et al., 2019). Civil society represents the influence of local culture and public opinion in technology adoption. After being identified as the component with the lowest participation in the RIS, a study (Roman et al., 2021) noted

that it still needs further improvement, particularly for more sophisticated engagement mechanisms. The quadruple helix is currently viewed as a very promising innovation ecosystem model, but it is still an evolving framework for understanding the RIS. This indicates that although the latest identified civil society component is recognized for its importance, its involvement in the RIS is still weak and underperforming primarily because only a few groups are considered to be fully functioning and formalized organizations.

Another emerging model is the quintuple helix model, which extends the key actors by adding the natural environment to offer a model for a sustainable innovation ecosystem. Carayannis and Campbell (2010) noted that the natural environment provides natural capital or resources and ensures that innovation initiatives are ecologically sustainable. However, several studies are quite uncertain about its role and function in the RIS. Gutierrez et al. (2023) noted that the quintuple model lacks systemic properties in technology adoption, including incomplete or insubstantial stakeholder representation and a lack of organizational interaction.

Studies have pointed out that quadruple and quintuple models carry a significant risk of methodological barriers to a comprehensive RIS analysis. Medina et al. (2022) highlighted that these two models still lack a common ontology and still struggle to fully incorporate, organize, and manage their stakeholders in comparison to the triple helix model with its institutionalized and formalized system. In addition, Cai and Lattu (2022) mentioned that these two are very challenging to quantify as they do not have a clear scope and boundary of their organization. Further, cultural values and environmental considerations are very difficult to measure, making the contributions of civil society and environmental factors very hard to capture. Moreso, there is power asymmetry among the helices, with civil society and the environment

being the least influential sectors in the innovation process. Being included in the emerging models does not necessarily equate to eradicating these power imbalances in the RIS. The fact remains that these two emerging helices are still marginalized sectors in the innovation ecosystem (Cai & Lattu, 2022) and therefore hold less sway in the network. Additionally, Galvao et al. (2019) posited that most researchers would still prefer to focus on the triple helix model, being the most stable, tangible, quantifiable, and active interacting actors in the RIS.

Despite these findings, these models strongly uphold the significance of an interactive and supportive convergence of the integral entities in delivering their key functions of delivering knowledge generation, technology development, and innovative solutions. This vital partnership could hasten technology utilization and innovation diffusion, and enhance policies and laws that are highly responsive and adaptive to the diverse needs of RIS (Feola et al., 2019). Findings support that, among the models, Triple Helix (TH) is prevalently used in international studies and has evolved to encompass more helices or actors among progressive and highly developed countries that already have an established innovation process and identified active partners, particularly the civil society and environmental sectors. However, since most studies in the Philippines still imply weak connections or inactive performance of these latent partners, the interrelation among government, university, and industry remains the prevalent functioning framework of the innovation ecosystem in the country. Nonetheless, TH is a highly useful and advantageous framework in analyzing RIS, particularly in regional initiatives, providing insights into structural drivers and behavioral dynamics that influence innovation performance (Deakin, 2022). It is, therefore, a strategic move to begin an analysis starting with these three core actors and move outwards to identify more components and connecting networks.

Due to the interconnecting relationship among all key components of the RIS, a systems approach is a suitable and ideal method for understanding the complex dynamics by looking at the RIS as a whole system rather than its isolated and individual parts. The systems approach views the RIS functions and how its subsystems interact with each other and with their environment, not dissecting each component in isolation. Additionally, the systems approach prescribes the investigation of the entire system, its components, functions, processes, relationships, and dynamics. It seeks to identify and strengthen the multiple connections of the RIS through feedback loops, allowing for a more encompassing and authentic validation and analysis beyond the linear perspective of existing studies (Leydesdorff, 2021).

Historically, the systems approach stems from systems thinking theory, a disciplined theory that focuses on the interdependencies and interlinking of its parts. It emphasizes how each member of the system collaborates to result in the best possible process to accomplish its common goal. Systems thinking serves as the mindset and theoretical basis, while the systems approach is the method of enacting the theory. Thus, employing a systems approach as a method of analysis could uncover systemic barriers or drivers within the regional innovation context as it looks deeply into its components, ensuring that they carry out their intended functions and contribute to the accomplishment of its common goal (Arthur et al., 2023). Applying a systems approach could also track the innovation performance of each component and uncover weak links that could be levers for policy recommendations and initiatives.

Despite extensive studies on innovation systems, significant gaps remain in the literature. Many studies focused on national or global innovation frameworks, often overlooking the unique dynamics at the regional level, especially in emerging

economies or less-studied geographic areas (Wiley, 2024). Research on the actual systemic dynamics remains predominantly focused on institutional challenges and descriptive collaboration (Ybanes et al., 2021; Alinsunod et al., 2019). Critically, this body of knowledge, while important for policy development, tends to relay fragmented and disjointed components of the key actors rather than to analyze the non-linear, interdependent knowledge flows among the core helices.

Arthur (2023) studied the RIS comprehensively in the United Kingdom (UK) but still stressed the need for localized study to contextualize regional innovation dynamics, as this could uncover the missing or underperforming elements in the information feedback structure, thereby resulting in an interactive policy formulation process.

Thus, this research was conducted to address this critical void by formulating and applying a systems approach methodology to an existing and flourishing regional innovation system of Western Visayas, using the operationalized dynamics of the key actors' interactions based on their perception as the primary input and moving outward to identify their connecting networks. The subsequent result could serve as an in-depth and multi-dimensional examination of the innovation ecosystem in the region.

Statement of the Problem

The dearth of literature understanding the systemic dynamics of the national and regional innovation system is a continuing gap in the Philippine innovation context. Thus, exploring operational issues of central actors within the RIS, particularly in developing countries, is imperative to guide policymakers and institutional leaders to develop targeted and contextualized interventions adaptive to the varying challenges and needs of each RIS. These interventions bear potential to enhance the

performance of RIS as they foster genuine systemic synergy and accelerate regional economic sustainability.

Contextually, existing published literature on national and RIS mainly focuses on the issues and challenges faced by each actor or institution without delving deeper into the systemic factors that cause or amplify them. This is a blindsiding perspective that limits understanding of the importance of collaboration and that each actor is supposed to be a contributor in this interweaving innovation environment. The weakness of one area is not just an underperformance of one actor but the result of weak interconnection among the components of the system. Each actor has a role to play, and each has to function accordingly in this interconnected system. Understanding RIS and exploring its systems dynamics from this macro level leads to a detailed analysis of the multifaceted role of each actor and how they interconnect with other stakeholders to carry out their sanctioned responsibilities to reinforce innovation performance.

Research Questions

Guided by these identified problems and the study's objectives, the following research questions were developed:

Main Research Question (MRQ): How do key actors perceive the interactions, mental mindsets, and feedback structures shaping the dynamics within the regional innovation system of Western Visayas, and what systemic patterns could be inferred from these analyses?

Sub-research questions:

- SRQ 1. How do the actors perceive the structures, roles, functions, and manner of interaction among the key stakeholders within the regional innovation context?
- SRQ 2. What do the actors identify as drivers and barriers in their collaboration within the regional innovation context?
- SRQ 3. What balancing and reinforcing behaviors, and causal relationships can be inferred among the actors within the regional innovation system?

These SRQs acted as component questions to further reinforce the exploration of the main research question. They explored specifically the distinct composition, systemic dynamics, collaboration density, structural feedback mechanism, and policy recommendation opportunities among the actors directly engaged in the operationalization of the RIS in Western Visayas.

Objectives of the Study

This study's principal objective was to comprehensively analyze the RIS through the systems approach framework by examining its distinctive components, relationships, barriers and drivers, feedback mechanism, and causal loops based on the perceptions of the key actors in the RIS. The study also mapped the dynamics and interactions of the actively involved actors, encompassing the primary components of university, government, and industry, and all other identified subsequent stakeholders involved in the regional innovation system to provide a multi-layered lens on how they interact and collaborate within the ecosystem.

Specific objectives guiding this study were:

1. identify sector-based actors, their roles and functions, and interrelationships with other organizations within the regional innovation ecosystem based on the key actor perceptions through Social Network Analysis;
2. classify factors as drivers or barriers influencing innovation process outcomes using Iceberg Model Analysis; and
3. interpret the feedback mechanism and causal linkages that either stabilize or amplify innovation performance using Causal Loop Diagramming and analysis.

Scope and Limitation of the Study

The present study sought to analyze the Philippine regional innovation system focusing on the Western Visayas ecosystem. It covered topics regarding the unique structure, dynamics, barriers and drivers, and feedback mechanism as perceived and inferred by key actors in the RIS. The study was anchored on the system approach framework to analyze the relationship of all the key stakeholders directly engaged in innovation, starting from the primary component comprised of university, government, industry, and all other identified subsequent actors. Purposive selection of initial primary participants was guided by a particular set of criteria such as their years of engagement, expertise, and leadership in institutions involved in the RIS. These participants had varied roles to fulfill in the RIS. This multifaceted characteristic captured diverse and unique perspectives to ensure saturation of qualitative data relevant to the accomplishment of the study objectives. These diverse

participants also ensured representation of each group to assure generalizability of results.

The study employed a systems approach to explore the dynamic interactions of the whole innovation system by understanding each actor's role, functions, processes, systemic issues, challenges, feedback loops, and causal relationships that influence innovation processes and unfold outcomes at the regional level of the innovation ecosystem. For data analysis, the study utilized social network analysis, Iceberg Model Analysis, and Causal Loop Diagramming as methods to understand systemic interdependencies. The study focused on innovation activities relevant to economic development and knowledge-based growth in Western Visayas.

Delimitations: The study did not look into the financial aspect of each key actor institution or their performance success indicators and accomplishments in technology commercialization. It did not compare the Western Visayas RIS to other RIS or to the NIS in general. The research was delimited to the documents and interviews provided by the participants, excluding confidential internal reports and proceedings.

Limitations of the Study

The system approach framework, serving as a basis for analysis along with employing a qualitative multiple case study research design, focused only on studying one RIS, which is Western Visayas. Each stakeholder sector served as a distinct case, allowing detailed examination of their own functions, relationships, and contributions in the innovation process of the region. The system approach data collection and analysis tool comprised social network analysis, Iceberg Model analysis, and causal loop diagramming.

As this research was purely qualitative, biases in the responses of the participants and interpretation of the researcher could arise due to subjectivity or conflict of interest.

1. Location constraints – Although the study targeted Western Visayas, participation still largely depends on the acceptance of invitations from the participants. The researcher sought to achieve balanced representation from the region's major RIS institutions;

2. Variability of responses – Participants differed in the depth and detail of their responses, which affected the overall richness of the data. Some participants shared candid and detailed perspectives, while others provided brief answers unless prodded with a follow-up question. Nonetheless, ethical considerations were followed, respecting the refusal of some participants to answer questions that made them feel uncomfortable;

3. Timeliness constraints – Results were based only on the perspectives and views the participants reported during the KII. Given the region's rapid innovation dynamics, it may not reflect longer-term trends or prospective industry changes;

4. Generalization of findings – Although this study aimed to recommend interventions for identified weaknesses in the RIS dynamics, these may not suitably apply across all sectors, regions, or settings without contextual adaptation.

To counter these limitations, the researcher had to exert effort in uncovering hidden issues or concerns to ensure data consistency. The researcher also imbibed values of discretion and trustworthiness in dealing with participants for a positive and harmonious relationship during the research process. Moreover, the researcher had to strictly adhere to ethical protocol in probing questions. While recognizing these

limitations, the researcher strived to produce reliable findings and provide balanced and actionable conclusions and recommendations.

Significance of the Study

The following stakeholders stand to benefit from the findings generated by this study:

Universities and R&D Institutions. Findings from this study may prompt universities and other research institutions to take a deeper look into their own system and diagnose their weak or underperforming areas. Through this, they could lobby for policy intervention to strengthen their research and technology development initiatives.

Government agencies and R&D consortia. Government institutions and independent R&D consortia could focus their initiatives on addressing the weak links that affect innovation performance. They could lobby for funding and implement capacity-building programs to strengthen the system. They could also develop policies adaptive to the varying ecosystem climate of each region and allocate resources to stimulate economic growth through strengthened RIS programs.

Partner industries, TBIs, and startups. Findings in this study could further bolster and reinforce the relationship with partner industries as technology adopters. Policies could be lobbied by government policymakers to safeguard the investment of partner industries. This could attract more industries to partner with universities and government agencies in promoting a thriving technology incubation program in the region.

Regional innovation system. This study could explore and uncover the deep-seated weak or underperforming areas in the RIS. Thus, the results could identify

targeted weak points of the RIS so they could concentrate on improving areas where intervention is critically needed.

Local Communities and the general public. In the long run, they could indirectly benefit from this study. Subsequent strengthening of RIS could lead to a stronger sustainable economy, job creation, technology created tailored to the local community needs, with corresponding improvement to their living condition.

Future Researchers. This study lays the groundwork that future researchers may use as reference data. They could build upon the gaps of this study and pursue more analysis on RIS of other regions or other uninvestigated areas.

Chapter II

THEORETICAL BACKGROUND

Review of Literature

National and Regional Innovation System

Innovation is an interdisciplinary concept that prompts social action and extends to the behavioral, psychological, economic, and social aspects of discipline. First conceptualized by Joseph Schumpeter (1939) and later developed by Gabriel Tarde (1999), this concept has broadened considerably, encompassing not only product development and commercialization but also humanitarian, social, and institutional dimensions (Kochetkov, 2023). Most significantly, its direct impact on the economic stability and growth of a country was frequently espoused by most studies (Niosi et al., 2018). Innovation is the main fuel that drives sustainable and long-term economic progress and development. To achieve this, it requires rigorous effort and collaboration of several agencies and institutions working together to push innovation to become a forefront of the government agenda and priority (Simsek, 2022). It needs a culture of cooperation and openness, where the government could institute a functioning innovation system, the academe could generate knowledge with innovation potential, the private industry could invest in its commercialization, and the public could be all too willing to patronize locally developed technologies.

Innovation is also construed as a political and historical process because of its capacity to evolve conceptually through time at an unprecedented rate and unexpected outcomes because of its multidirectional nature and dynamics (Papaioannou et al., 2018). Like most existing literature, this study emphasized the

need for a concerted effort among stakeholders involved in the system and governed by a regulating body to enact policies and laws to further strengthen its performance and capacity. The study postulated that the innovation system is not an individual effort nor the sum of accomplishments of each institution but the collaborative output from the merged effort of all ecosystem actors, whether they represent individual, business, or institutional actors.

National Innovation System is an institutionalized set of evolving, interacting, and converging manpower, technology, and information serving as an indispensable foundation for the sustainable development of a nation. This network brings together private and public institutions and their subsystems in the development and diffusion of technology, offering solutions to community problems and improving their living standards (Granstrand, 2020). This was strongly supported by Peters (2015), who advocated that national innovation institutional linkages should be broadened to generate more subsystems under the national ecosystem, thus reinforcing the need to establish smaller clusters of regional innovation systems. As the transition of effort from the national innovation system shifted downward to its subclusters, several challenges were reported, including a lack of funding, local experts, and available resources, casting doubts on the RIS's capacity to sustain its operation, oversee its own management, and be completely self-reliant (Bathelt et al., 2017).

Another study drew the line to differentiate the scope of command of NIS and RIS. While these two share common linkages, they both differ in scope and concentration of work. NIS focuses more on establishing policies and legal frameworks, overseeing and regulating smaller clusters and external partners, instigating nationwide programs and projects, and sourcing out government funds. RIS deals mainly with developing regionally tailored technologies, identifying local industry

partners for scaling up production, and working directly with the community as material suppliers, extension efforts, and end users (Téllez-López Iván et al., 2022). NIS is more administrative, while RIS works more on the operational level.

The importance of implementing RIS as a subset of NIS has been stressed by López-Rubio et al. (2020), who argued that RIS should converge knowledge, technology, innovation, and networking as key to efficient RIS dynamics. Aside from these, policy measures targeting the uplifting of local businesses and competitiveness should be made as a focal outcome of every RIS (Katimertzopoulos et al., 2020). Entrepreneurship, particularly among small and medium businesses, should thrive, particularly among those from marginal and vulnerable communities in the region.

With the rising call to strengthen RIS across the globe, the Philippines heeded the call to boost its own national and regional innovation system with primary aims of reducing incidental poverty, lessening regional economic disparities, creating job opportunities, capacitating local inventors and researchers, fostering mutual partnership with local investors, and boosting technology diffusion and commercialization, thereby enhancing global competitiveness. All these efforts were based on the implementation of the Inclusive Innovation Industrial Strategy (i3S). A mandate is granted to the DOST to directly supervise the operationalization and implementation of i3S as the lead agency to strengthen the national and regional innovation system (Custodio et al., 2025). This policy has the primary aim of promoting innovation and upscaling entrepreneurship culture among all stakeholders involved. The policy affirms the need for a business mindset even at the earliest onset of research conception. Further, the policy enforces the establishment of a RIS within a thriving innovation ecosystem, forging partnerships with private industries, augmenting the supply and demand product value chain. It also calls for capacitating

human capital development and strengthening the three major components of the RIS identified as universities, government, and industry (Aldaba, 2018).

Despite the legal framework, RIS still faced persisting challenges that affect the innovation performance of the country, including a lack of robust infrastructure for research and technology development, limited funding from government and private sources, and insufficient human resources, particularly expert researchers and scientists to work on technology and innovation development. These challenges delayed the innovation process and stalled economic progress. To overcome these, Aldaba et al. (2024) suggested programs to build human capital, establish strong linkages among central stakeholders, adapt policies that would sustain the innovation process, and increase funding for research, technology development, startup programs, and micro, small, and medium enterprises (MSMEs). Andriesse (2017) also noted that there are prevailing regional inequalities and suggested that policy options could provide for balanced regional development. The study further noted that more programs and initiatives toward refinements in policy options targeting specific localities could curb regional disparities and reduce poverty.

Local studies examined the impact of government-funded facilities on MSMEs or the alignment of academic curricula with industry needs, which cover actual interactions and experiences occurring within the innovation sphere of industry, government, and university (Armas et al., 2024). While these studies are useful, they often treat the interactions as linear or bilateral. They did not analyze the synergistic efficiency of how key actors operationalize collaboration.

In one local study on the agricultural innovation system in the Philippines, Manlosa et al. (2019) underscored the importance of having an unimpeded feedback and networking relationship among stakeholders reaching even to the lowest rung of

the system. In agriculture, it is a necessity to include the farmers who are primary suppliers, the market as product receivers, and local governments as main implementers of programs in the agricultural sector. This communication network provides a feedback mechanism to uncover hidden issues plaguing the process, even up to the outlying members of the system.

Habaradas & Velasco (2018) noted that while the Philippines has adopted a cluster approach for regional innovation systems, there is minimal empirical examination of how these regional systems actually function across different regions in the country, as there is a dearth of published literature studying them. Unlike neighboring countries, specifically Korea, Malaysia, and Thailand, which conduct regular surveys on innovation, the Philippines has not yet attempted such comprehensive data collection, severely constraining understanding of clustered regional-level innovation activities, motivations, and barriers within regional contexts.

Most existing Philippine research has tended to focus narrowly on the identification of collaboration presence or actors' perceived competency, leaving other dimensions comparatively unexamined (Armas et al., 2024; Sampiano, 2023). These studies confirmed that linkages exist and described the nature of institutional challenges. However, these studies did not map the non-linear, reciprocal flows of knowledge, resources, and policy signals among the University, Industry, and Government. This leaves policymakers with only metrics of activity (inputs/outputs) rather than the overall picture of systemic dynamics and efficiency. Most of these studies focus on current challenges rather than the dynamics of the innovation system and how they co-evolve with other actors to achieve efficiency in the regional innovation system.

With this, Arthur et al. (2022) suggested that systems analysis can help identify structural drivers and relationships within regional innovation ecosystems, solidifying the need to conduct this study.

Theoretical Underpinnings of the Systems Approach

Systems Approach (SA) is an interdisciplinary and methodical process of understanding complex phenomena (Catalan, 2018), including the RIS. It is mainly used to uncover large-scale processes and practices, making it an ideal framework to analyze the expansive dynamics of the RIS considering its multitude of actors, connections, and complex processes. The systems approach has been generally linked to systems thinking, which guides systems practice and considers the entire system as a whole. SA looks at the whole system and its interaction with other entities in a wider environment. Analysis using the SA framework considers problems and issues as a result of a natural system environment with definite boundary limitations. Moreover, it pushes for solutions based on sound system principles to create an orderly and organized structure based on the understanding and judgment of all stakeholders in the system (Raunio et al., 2019).

Employing a systems approach in this study is anchored in the above-mentioned principles. Guided by the SA principles, this study also closely explored the complexities of relationships and interactions among the central stakeholders of the RIS, treating them not as individual parts but as interconnected components operating within a defined boundary (Sterman, 2000). Several innovation studies have been anchored on a systems approach, particularly in studying national and sectoral innovation systems (Granstrand et al., 2020).

Within an innovation system, structure refers to the network of institutions and organizations involved, while function refers to the dynamic process of knowledge generation, diffusion, and application. SA focuses on non-linear, multi-directional interactions and the co-evolution of these co-actors, moving beyond simplistic linear models of innovation (Leydesdorff, 2021).

Studies in Europe and Asia frequently employed the SA to analyze the operation of the RIS, aiming to map the “institutional thickness” and relational capital within regional clusters. This upgrades the analysis past simple descriptive narratives, as were usually done in previous studies, to focus on the interconnectedness of actors and the quality of their co-evolution, making the study more encompassing and wide-scale (Doloreux & Porto Gomez, 2017).

Using bibliometric analysis, Fernandez et al. (2020) mapped RIS research into four clusters – regional knowledge system, institutional systems, research and development systems, and regional network system. The study emphasized that RIS competitive dynamics and their effect on regional competitiveness merit priority attention across the ecosystem.

Furthermore, the SA formed the theoretical basis for System Dynamics (SD) methodology, which allows researchers to model the non-linear, iterative, time-dependent behavior of the RIS. This allows for the identification of leverage points leading to the formulation of policy interventions by analyzing the cyclical feedback structures that dictate whether the system grows (reinforcing loops) or stagnates (balancing loops) (Sterman, 2000).

This related literature emphasized that SA is a suitable and viable method for exploring RIS, as it systematically examines the unique interaction among all

institutions within the innovation ecosystem to better understand their performance, capacities, and dynamics (Coenen et al., 2019).

System Approach in Regional Innovation System

Several existing studies recognize the institutional dimensions as a core component of the innovation process, yet they predominantly focus only on a structural-descriptive approach without delving deeper into causal mechanisms, feedback dynamics, and mental models for a more in-depth analysis. Laursen et al. (2021) noted this gap by stating that most studies in RIS only provide rich descriptions of the system components, actors involved, and their connections. It is simply more of an elaborative reiteration of the significant components, which lacks the crucial analytical framework for understanding the actual cause of the emergence of the issues, how actors evolve in the dynamic process, and what deeper underlying interlinked causes perpetuate dysfunctional patterns. Additionally, Markard et al. (2023) pointed out that most studies in innovation system analysis predominantly relied only on singular case studies and network analysis, which produce “snapshot empiricism,” missing the crucial temporal dynamics and non-linear causality arising from multi-sectoral interactions.

It is therefore crucial to delve deeper into institutional factors as one factor that could influence innovation outcomes. Benner (2022) acknowledges this and thus advances institutional theory to challenge existing institutional arrangements to create new norms, practices, and policies, as these could catalyze innovation system transformation. Institutional analysis requires examining not just observable structures and events but also the hidden underlying mental models, cognitive frames,

and paradigmatic assumptions that shape how the actors function and make essential decisions in the innovation dynamics.

In a closer context, studies of Aldaba (2022) and Orbeta et al. (2023) enumerated limitations on Philippine innovation studies such as weak linkages, fragmented government programs, and limited R&D investment. However, these studies do have a systems approach in uncovering underlying issues, as they only view them as independent structural deficiencies rather than a symptom of deeper systemic patterns maintained by feedback loops and culturally embedded mental models.

This study was a shift from the usual descriptive literature because it conducted a dynamic causal analysis of the RIS. This moved beyond static descriptions of weak linkages and institutional deficiencies and delved deeper to explain how and why these problems or issues persist and self-reinforce over time or under certain conditions. By using CLD as one analytical tool, this study could uncover not just the missing or weak connections but also the self-sustaining system behaviors that require intervention so as to break the negative cycle. As of present, there are no existing Philippine RIS studies that employed this analytical tool, making this methodology a novel initiative for this research context.

Innovation Systems Framework

Most studies on innovation extensively used the Triple Helix Model to establish a clear understanding that the primary components of the innovation system are originally and foundationally limited only to university, industry, and government. TH model focuses only on the most active and important innovation players in the system to reduce the complexities of relationships and allow only the essential dynamics to

be discernible in studies (Cai & Lattu, 2022). The study of Porto-Gomez et al. (2019) also chose the TH model in analyzing the innovation system of Mexico because of its "'systemness' advantage" and further postulated that more subsequent players could be added to expand future models, but to have a clear understanding of the innovation context, interactions among key institutions must first be established. Each helix or actor contributes uniquely to strengthening the science, policy, and industry interface in the pursuit of sustainability (Saviano et al., 2019).

Historically, Etzkowitz and Leydesdorff (1995) originally explained this concept in their seminal work. At its core, this framework holds that a knowledge-based economy's innovation and growth hinge on the interplay of all its key actors. Additionally, the model posits the triadic interconnection of these key institutions in regional innovation, where processes are pre-structured and well-coordinated. There is an interconnected dynamic within the components, with the university's prime role as a knowledge generator through its systematic research and development programs, the government as the policy developer and enforcer to regulate the system, and the industry as an entrepreneur to invest in production or to commercialize the innovations (Etzkowitz, 2003).

Figure 2.1. Balanced triple helix model by Etzkowitz and Leydesdorff (2000).

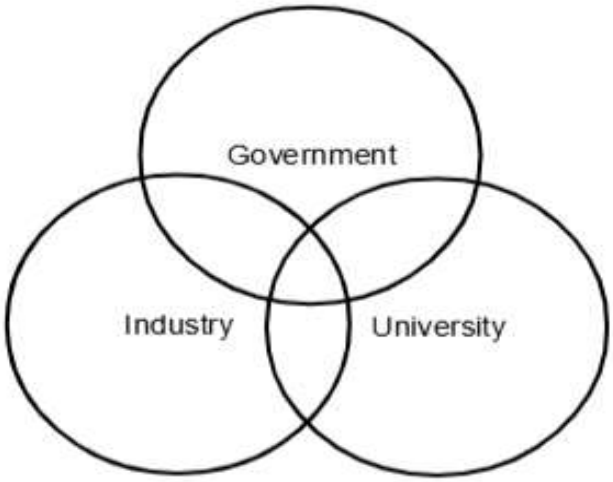


Figure 2.1 illustrates the interaction among the actors in the TH model, conceptualizing them in a complex, non-linear dynamic. The Venn diagram exhibits the varying spheres of each actor but ultimately converges to attain one concerted goal. This convergence indicates collaboration and merging of unified efforts among institutions as they work together from the earliest stage of knowledge generation, up to product development, and eventual technology diffusion and commercialization (Ranga et al., 2013).

The study of Tandon (2024) noted the importance of applying TH models even in RIS, as it could contribute immensely to regional economic development. The study further posited the necessity of conducting studies on small-scale innovation systems such as regional and sectoral innovation systems, as they are the direct implementers of nationwide innovation policies and legal frameworks. Implementing the TH model among RIS is a strategic move to address localized challenges, engage with more closely knit institutions, develop implementable policies in a smaller, manageable scope, and ensure that innovation answers specific localized needs of the community.

Through this, innovation initiatives could remain sustainable, inclusive, and suited for its RIS.

In a more localized context, Li (2021) characterized the Philippine innovation system as an "emergent type" where some system components are still missing and linkages between firms and public innovation system components are weak or almost non-existent. The study established that certain weaknesses and underperformance are present in the link dynamics among the actors, but they are not widely identified or pinpointed in the bigger context of the entire ecosystem.

Sulasula (2023) applied the Triple Helix framework to Zamboanga City in a study and found that while universities attempt to align programs with industry demands, industry-academia linkages remain weak. These findings indicate the need for a causal review and thorough understanding of the causes, effects, and possible areas to leverage interventions. Additionally, systematic studies examining these dynamics across regions using a systems approach are scarce. Further studies still need to be conducted to better understand the TH model within the context of regional interaction and entrepreneurship in each specific regional or sectoral innovation system (Lopes et al., 2020).

The quadruple helix model extended this network by adding a vital fourth component in the system, recognizing civil society as an essential and emerging actor (Carayannis & Campbell, 2009). Civil society refers to users, citizens, media, and cultural organizations engaged in the innovation initiative and engagements. This framework posits that not all formal institutions comprise the rigid innovation system. Civil society is viewed as the primary beneficiary of innovation and as a key user and consumer of the process. This concept cements the crucial role of public participation starting from the R&D process up to the eventual technology adoption. Key to

successful technological performance is social acceptance, cultural values, and citizen engagement, as they are the primary drivers of the success of innovation.

Roman et al. (2024) further elucidated that the quadruple helix model includes community participation and strengthens ethical consideration, focusing on the knowledge society and democracy. Lew et al. (2018) further argued that this concept plays a crucial role in RIS implementation, with private and public collaboration and international connectivity serving as key factors in its development.

Hasche et al. (2019) pointed out that civil society is not an entirely separate entity with different roles to play to create its own value in the system. Rather, it emphasizes the strong need for interconnectedness among all four helices in the RIS. Indeed, Carayannis et al. (2018) affirmed this, noting that RIS should be treated and viewed as a cooperating entrepreneurial ecosystem with fractal, multi-level configuration interacting within a confined environment to pursue the innovation process.

Kunwar et al. (2024) asserted the importance of the addition of another helix component, which is the environment in the system. The quintuple helix model, as a recent evolution of this framework, responds to the ongoing challenge of climate change, positioning inclusive and sustainable innovation ecosystems as central to addressing climate change. True to this, Grundel et al. (2016) claimed that environmental sustainability is key to sustainable transformation, as it could facilitate sustainable bio-economies by involving civil society in consumer behavior and technological developments. Moreover, Shkarupeta et al. (2024) discussed that the quintuple helix model enables R&D investment and broad innovation diffusion, addressing challenges like sustainable technology integration.

These three structured innovation models guided this study in identifying the primary actors involved in the RIS, mapping their interactions, and analyzing their collaboration patterns. Understanding these frameworks aided in the interpretation of findings on the emerging model that existed among the RIS, as guided by the Social Network Analysis. This study was a departure from existing RIS literature that focused only on descriptive and diagnostic analysis, which remained only on the surface level of the structural relationships. Systematic integration of SNA, the Iceberg Model, and CLD moved this study further from the linear approach into deeper analysis of the causal mechanisms of the frameworks.

Social Network Analysis

Social network analysis (SNA) is a systems-approach methodological tool used in analyzing how social networks operate. Specifically, its measures cover the dependencies of key actors within the system and their behaviors that affect the systemic process over time (Tabassum et al., 2018). What distinguishes this tool is its capacity to condense diverse topological networks and actor-level perspectives into a coherent overview.

SNA has been widely used in sociological studies as it focuses on investigating mechanisms involved in network formation and human connection. It has evolved to be greatly applicable in multi-disciplinary fields because of its way of conceptualizing social life. SNA looks deeply into the actors' interdependence, connectivity, and structured relations among social entities with the central aim of improving and upgrading social conditions (Knoke & Yang, 2020). The SNA has three levels of network analysis, but for this study, triadic relations were employed as it covered a combination of three actors at the same scope and time. This triadic structure analysis

concentrated on the sentiment ties among the actors, particularly their interrelationship limited by the boundaries of the RIS.

Similarly, Aydin et al. (2018) utilized SNA in examining complex system relationships and interactions, specifically the innovation process. SNA visualized the RIS network and processes, including the density of their interaction, and examined how information, processes, resources, and support diffused among component institutions in the TH model. SNA explained variations in structural relations and their consequences as it identified transactional, communication, instrumental, and boundary relations. Stuck et al. (2016) also conducted a related study in SNA, and the findings denote three primary research themes: network collaboration, communication networks, and technology networks, all applicable in studying the innovation process. When applied in the context of RIS, SNA explored structural relationships among the triple helix actors, concentrating on their knowledge exchange process, sharing of resources and collaboration in all research and innovation programs in a smaller, manageable and cohesive locale.

Guerrero-Ocampo et al. (2023) bibliographic analysis noted that SNA contributes significantly to understanding innovations in rural areas, particularly in agriculture and forestry, by enhancing social capital and facilitating social learning. SNA recognizes the relevance of social networks not only within individual productive sectors but also across all sectors coexisting within the same territory. It further supports evaluation of each stage of the innovation process – identifying key actors at the outset, analyzing and intervening in network configurations as the process unfolds, and assessing the impact of innovation initiatives in the rural environment once complete. Taken together, this points to the need for understanding innovation system

dynamics at every stage, to fully capture how actors and their functions interconnect through the process.

The study of Pinto et al. (2019) used Social Network Analysis to examine a region in Portugal to identify thematic groups for smart specialization and improve the innovation system. The findings suggest the need for public policies to strengthen cooperation and avoid resource concentration.

In terms of data collection tools, Benedict et al. (2024) identified that using a qualitative research design and mixing interviews with focus group discussions could be a suitable and appropriate method to be used in SNA. However, he also cautioned about ensuing coding and sampling biases that should be avoided and addressed in the conduct of the study to maintain result integrity and validity.

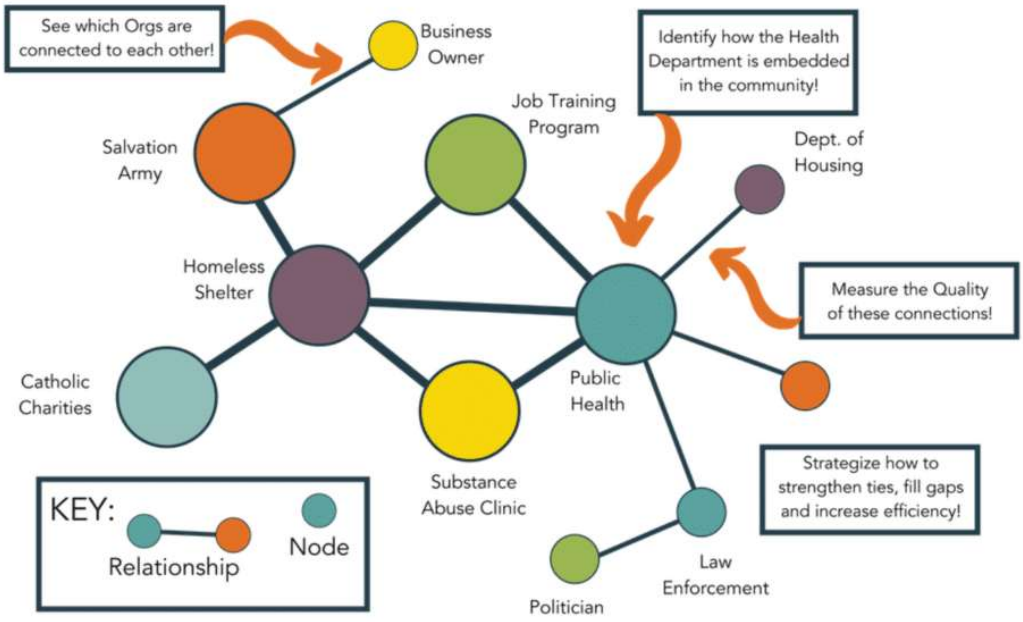
Another study using a qualitative research design was conducted to exhibit its suitability and complementarity in using SNA tools. Tiangco et al. (2025) focused the study on regional health referral networks employing community health volunteers as participants. Methods used were interviews, thematic analysis, and snowball sampling to map health workers' community collaboration, stakeholder influence, and sustainability of regional public health innovation. This study ascertained the feasibility of using SNA within the qualitative research design through a systems approach framework and interviews as a data collection strategy.

Additionally, Velasco (2010) examined Metro Manila's city innovation system, noting that academic researchers, government agencies, and private incubators create a social system that shares knowledge and support for start-ups—a structure that can be mapped and strengthened through SNA. Tiangco et al. (2025) used embedded network analysis to understand how social innovators and K! Leaders

influence health innovation and system sustainability in urban Philippine communities. However, the results were mainly expressed through a matrix and discussion and were not illustrated to visualize the actual network map.

Gaps identified in this literature include limited comprehensive studies using SNA in Philippine innovation systems, the need for more in-depth analysis of inter-organizational networks, and insufficient exploration of SNA's potential in regional development contexts. SNA analysis was needed across diverse regional innovation systems outside Metro Manila, especially linking government, academia, industry, and other clusters involved in the system to illustrate their unique dynamics and relationships in the rural and urban areas. Figure 2.2 exhibits how SNA is used to present the relationship of an inter-organizational network.

Figure 2.2. SNA showing nodes and edges to illustrate connectivity, relationship density, and network topology of the inter-organizational network.



This study adopted network analysis, given its aim of examining and understanding the connections and collaborations of all actors in the network – an approach suited to cases where network boundaries are known and a full list of actors is obtainable (Blanchet & James, 2011). Network properties were identified qualitatively, including the following key elements:

- **Density**: Actual connections existing versus possible connections were identified and counted as they indicated overall collaboration intensity
- **Centrality**: Most connected (central nodes) actors were identified, as this revealed key players or brokers
- **Clusters/Subgroups**: Dense pockets of collaboration were distinguished, as this indicated sector-specific or geographic clusters
- **Eigenvector Centrality**: This assesses a node's relative influence within a network, extending degree centrality by accounting for connection quality rather than quantity alone. A node tied to several well-connected nodes therefore registers a higher eigenvector centrality score.
- **Structural holes**: Gaps where connections are missing were analyzed, as these revealed barriers to collaboration

Iceberg Model Analysis

The Iceberg Model applies the metaphor of an iceberg as a systems thinking tool, distinguishing between a system's visible and hidden elements of problems among groups such as organizations, communities, or innovation systems. Only a small part of an iceberg is visible above water (the "events"), while a much larger portion is hidden below the surface (patterns, structures, and underlying mental models). This model examines how various components and stakeholders in the

system work with and influence one another. It delves deep beneath the hidden surface, recognizing that some influencing factors or issues in the innovation process of an RIS are beyond perception by the naked eye. Bigger issues and factors lie underneath the system (Sterman, 2000).

Additionally, the Iceberg Model seeks long-term solutions for prevailing systemic problems as it addresses issues beyond surface-level observation. Though not frequently used to study innovation systems, it has widespread multidisciplinary usage ranging from environmental and sociological to technological scopes of research studies. One of its advantages when used in framing research is that it gives a complete whole and integrity in the result. It is effective in dissecting problems prevailing in the system because it examines multi-layered components linked to the problem. It begins by understanding the surface or dominant factors and gradually delves deeper down to the invisible or recessive surface, which needs to be systematically analyzed and addressed (Liu et al., 2021).

In this study, the Iceberg Model was an appropriate and suitable data analysis tool used because it gave a deeper and more comprehensive evaluation of the RIS. It covered not only the obvious challenges and issues within the RIS as divulged by previous studies but also analyzed deeper underlying root causes of problems in the system. RIS is, in itself, a complex system, and applying the Iceberg Model to studies about it would be applicable. Several studies were cited using this model including study of Baloch et al. (2025) who used the Iceberg model to analyze the entire health system, Gui and Na (2019) who examined the factors influencing production logistics operations in manufacturing enterprises, Grigg et al. (2020) who focused on factors affecting profitability among small- and medium-sized enterprises, and Cao and Dong (2021) who explored human resource management models in forestry science and

technology enterprises. All these studies were similar in context to RIS as they focused on the complex environment or system in relation to the development process and growth process of the people within the same organization or ecosystem. Further, the Iceberg model hinges on a qualitative research design aiming to discover systemic issues from the level of visible events up to repetitive patterns, institutional structure, and deeply embedded cultural mental models (Liu et al, 2021).

Figure 2.3. Iceberg Model of analysis showing the levels to analyze problems and figure out deep underlying causes.

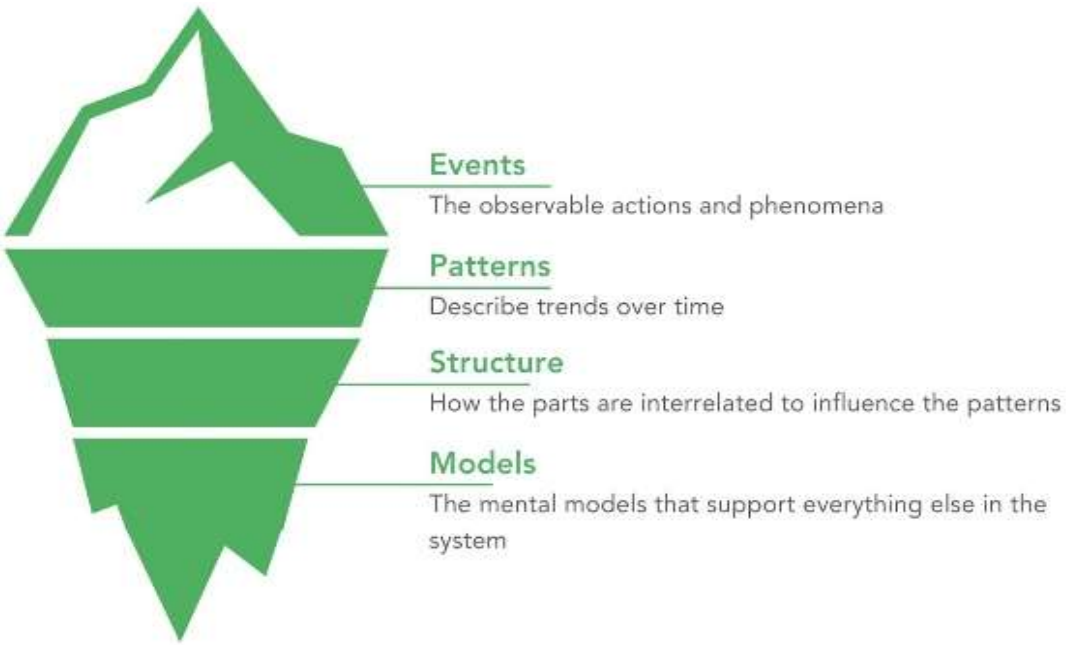


Figure 2.3 illustrates the levels at which issues were analyzed in the system. Each level explained the context of the problem to figure out underlying causes and came up with working solutions. The iceberg model posits that all issues and challenges are interconnected and linked to all components, no matter the size of the system. The first layer is overt experienced events, easily observed and measured. Second are recurring patterns that repeatedly occur in the system based on certain

conditions, such as time elements or seasons. The third layer is the structure, which covers organizational mechanisms such as institutional policies, practices, and rituals that might serve as drivers or barriers of the pattern. Last is the mental models, which are deeply ingrained assumptions, attitudes, morals, and values that support or hinder the innovation process (Egbude, 2022). By utilizing all these levels in data analysis, optimal solutions to the prevalent problems in the RIS were formulated.

Meadows (2008) further expounds the process of each analytical level as follows:

Level 1. Events and Issue identification – The first level reports on any visible and measurable problems in the innovation system. Analysis at this level involves looking out for visible surface-level occurrences or symptoms of the problem, and seeking out the obvious and measurable issues. Overt incidents are detailed to identify actors involved and ensuing incidents or situations leading to the issue.

Level 2. **Pattern Analysis** – This level determines the recurring patterns, trends, and frequency of incidents. It analyzes prevailing behavioral patterns and recurring issues that repeatedly occur over time and create a trend.

Level 3. Uncovering Underlying Institutional Structure – In this level, institutional structures such as policies, processes, resources, and practices are investigated to determine whether they directly cause the patterns or trends, as this indicates that issues might arise from the system's fundamental structure. Analysis focuses on how these institutional factors affect, sustain, or drive the trend.

Level 4. Delving into Mental Models – This level involves analysis of the shared beliefs, mindsets, attitudes, and values that created the system and influenced how it operates. Analysis and intervention reach up to this level because, in order to

initiate lasting change, it should first come from inculcating the right mindset and attitude among the people involved. Real transformation could only occur if the ideal thoughts leading to change are established first and foremost.

These progressive levels of inquiry are built upon each other. It progresses from the visible up to the covert systemic mindset and assumptions that sustain the system. If all levels of analysis are sufficient, understanding of the system and effective systemic intervention could ensue (Liu et al., 2021).

This is an ideal and suitable process for delving deep into the RIS. In conducting analysis, the root foundational cause of the problem should be determined through multiple layers and dimensions across all stakeholders (Zhang et al., 2023). The Iceberg model could be particularly useful in doing this by helping researchers identify hidden structural factors and explore interconnected ecosystem components.

Additionally, the study by Abercrombie et al. (2015) stressed that the Iceberg Model could be utilized as a framework in analyzing systemic issues and challenges across multiple causal levels. Researchers are guided to probe for the cause of the issue (events), how frequently it occurs and under what conditions (patterns), factors influencing such occurrence (structures), and foundational beliefs and mindsets that sustain such issues (mental models). Anchored in a systems approach through the lens of the triple helix, this will be a useful tool in discovering hidden systemic weaknesses and uncovering factors that could serve as barriers or drivers of the innovation process.

Due to the sensitive nature of the results that could surface when using the Iceberg Model, risk mitigation is recommended by some literature. Anonymity to avoid privacy and confidentiality breaches is advised to be observed in qualitative research.

This is essential, particularly in small communities where participants could still be identifiable. It is advised that researchers should take extra caution in presenting data, ensuring no unintended harm or exposure occurs (InnovateMR, 2025).

Informed consent procedures must be thorough enough to prepare participants for the depth of probing involved in Iceberg Model applications. All prospective participants must receive and understand the complete information necessary to make a fully informed and voluntary decision about their participation. This disclosure must explicitly cover the study's expected benefits, potential risks, sources of funding, and the institutional or ethics committee approval governing the conduct of the research (Nii &Ogbewe, 2023).

The researcher may omit data that cannot be fully anonymized. If specific data cannot be adequately anonymized without sacrificing substantive value, or if their disclosure risks reputational damage despite anonymization attempts, researchers should withhold them entirely. Instead of fabricating details to mask identities, researchers may opt to exclude data to avert deductive disclosure risks (Kaiser, 2009).

Causal Loop Diagramming

A causal loop diagram is a core tool of systems thinking as it analyzes and visualizes the interconnection and feedback loops, offering a perspective into the causal relationship among the primary stakeholders in a system. CLD reviews relationships in the system, including interactions between different system parts, non-linear effects of dynamics, time delays, and subsequent impact even beyond the system (Tomoaia-Cotisel, 2017). CLD traces how components of the system are systematically linked across time and network, making it possible to observe their behavior that emerges from these interactions rather than from any single variable.

Mainly used to map relationships, CLDs are used frequently to visualize dynamic complexities of a system and to qualify or quantify their interactions. This visual representation often helps policy developers, researchers, and innovation actors to see and understand the nature of these dynamics permeating within this unique system. This result into better understanding of the system for a more targeted policy intervention (Sterman, 2000).

Additionally, CLDs offer researchers a tool for analyzing systems, capturing how various components and factors attributed to the problem interrelate (McGlashan et al., 2016). CLDs expose the non-linear cause-and-effect relationship of the system and help understand how a behavior manifests itself in a system so that strategies can be developed to either counteract the negative behavior or sustain positive impact. It also seeks to uncover up to what extent and how the problem is connected with other components of the system.

CLDs complement the Iceberg model as it also analyzes the ingrained mental models affecting causal relationships. True to its systems thinking theoretical framework, CLDs' tactics are to “cure the symptom” of the problem rather than just diagnosing the “ailment.” Policymakers adhere to this method to ensure that policies developed and implemented could provide long-term solutions and not just “band-aid” or temporary relief to prevailing problems. CLDs also identify reinforcing and balancing feedback loops, provide problem perspective, and construct a qualitative approach to modelling system dynamics with the end goal of identifying leverage points for interventions (Franz, 2024).

CLDs use nodes and arrows to represent variables and relationships. The nodes represent important components of the system, also called variables, each capable of increasing or decreasing in magnitude depending on the number and

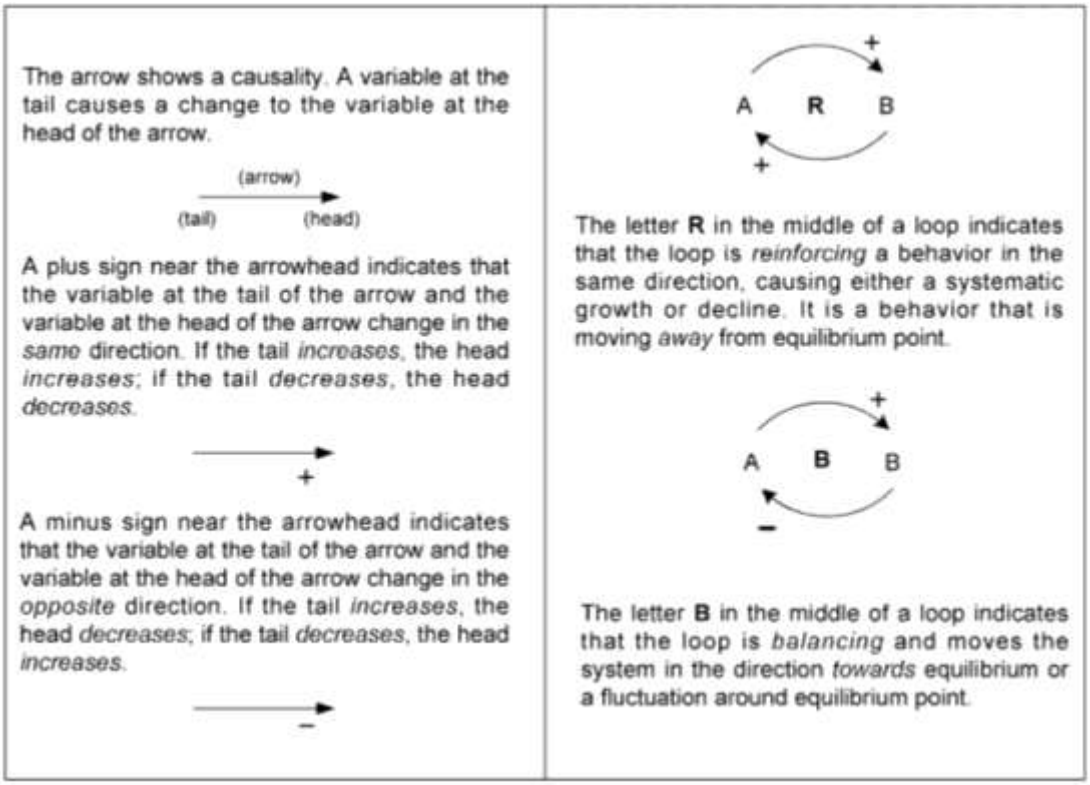
quality of its network. This indicates that variables could either increase or decrease over time once confronted with certain factors or incidents. CLD uses arrows to represent the direction of influence, allowing causality to be detected in the system. These arrows carry polarity – positive or negative. Positive arrows indicate that one drive or action amplifies the other along its chain. Positive polarity signifies the causal influence of one variable linked to another as they move in the same direction, whether increasing or decreasing in their implied progress (Haraldsson, 2004). By contrast, negative polarity describes variables that pull in opposing directions, with the movement of one factor leading to a different reaction. A negative arrow indicates an inverse relationship, demonstrating that an increase in one leads to the decline of the next succeeding factor in the loop (McGlashan et al., 2016). These polarities do not indicate growth in numbers or intensity but rather the direction of their projection, whether they move in a similar or opposing direction. These polarities influence the outcome of the systemic processes.

CLDs also use feedback loops to explain the polarity of this relationship. Loops are formed with the causal direction circling back to the original input variable. Loops

Loops are then classified as either reinforcing or balancing loops by counting the number of negative arrows or polarities in the loop. Even-numbered negative polarity loops are considered 'amplifying' or 'reinforcing (R).' A reinforcing loop indicates a behavior that causes the growth or decline of a system’s causal relationship as the behavior is moving away from the status quo or equilibrium point. Odd-numbered negative polarity loops are categorized as a 'balancing' loop (B). Balancing behavior implies that the relationship is steering towards achieving balance or equilibrium in the system dynamics. In summary, reinforcing loops or behavior amplify change while balancing loops or behavior perpetuate the status quo and counter

changes or deviations in the system (Farell et al., 2021). Figure 2.4 illustrates the causal loop concept adopted from one of the pioneering scholars in CLDs (Roberts et al., 1983).

Figure 2.4. Causal loop diagram concept adopted from Roberts (1983), depicting various arrows and loops to illustrate the causality of behavior.



When applied to the context of RIS studies, CLD is a very useful tool as it is compatible with several other data analysis tools. It is combined with other systems analysis tools, specifically social analysis, the Iceberg model, and the CLD, all utilized in a comprehensive identification of stakeholders, mapping their relationship and explaining their causal linkages. Lane & Smart (1996) further postulated that combining system dynamics with qualitative research methods could enhance understanding of complex social systems by making feedback structures clear and

unambiguous through visual representation as one of its tools. CLDs provide a structured way to organize qualitative insights about relationships and feedback loops. It is a viable step in identifying weak points to inform policy formulation (Littlejohns et al., 2021). Causal loop diagramming represents a promising but underutilized approach for qualitative research on regional innovation systems. This study was an opportune case to apply CLD to address gaps in the literature regarding its scarce usage in studying RIS. Additionally, this study reinforced the significance and viability of using CLD to provide multi-level analysis of the iterative and circular dynamics of an RIS, leading to identification of weak areas and subsequent policy recommendations.

Theoretical Framework

Grounded in the Systems Approach as its theoretical underpinning, the study was conducted adhering to its holistic, interconnected, and dynamic view of the RIS from data collection up to data analysis. The systems approach framework treats the actors, structures, and feedback processes not as isolated variables but as interconnected components of a unified evolving whole. The systems approach makes for a suitable and empirical method once applied to the analysis of RIS. Additionally, when used as an analytical framework in the study of RIS, it looks into innovation performance not merely as a sum of all its individual components or stakeholders but as a synergized result based on the quality of interactions among them (Meadows, 2008).

This study adopted critical realism as a philosophical and ontological assumption. Through this, it is assumed that objective realities exist, particularly the research innovation ecosystem phenomenon as well as the comprising actors and agencies, but empirically have limited ways of capturing the whole reality. There is

limited understanding of this reality, prompting the author to seek realities through the perceptions and interpretation of the key stakeholders or actors who are actually existing and interacting in the RIS through an interview.

According to Bhaskar (2020), critical realism holds that realities exist variably depending on how humans perceive them, but fully understanding them – filtered as they are through language, theory, and experience – can never be fully perfected. Critical realism seeks to uncover why something happens rather than observing what happens, allowing empirical processes to move beyond surface-level data. It seeks deeper into the unobservable structures, institutionalized mechanisms, and causal interlinking factors or series of actions that produce overt events.

Choosing critical realism is highly suitable because it allows the study to move beyond merely recognizing and tracing the visible elements of the research innovation interaction, instead uncovering hidden institutional mechanisms and power dynamics that actively shape how actors interact. However, a key limitation of this approach is that the data relies heavily on the subjective perceptions of these actors, meaning the uncovered structures remain interpretive and cannot be definitively proven as absolute objective truths. Consequently, while the study offers deep explanatory power regarding why certain ecosystem behaviors occur, the findings should be treated as applicable only to specific settings or contexts rather than a universal rule that governs the RIS in general.

For data analysis, multiple integrated systems thinking analysis tools were employed to yield a multi-tiered, comprehensive understanding of the system. The first level of data analysis utilized Social Network Analysis to recognize component actors, their defined roles and functions, and the density of their relationships with other actors comprising the system. This analysis traced knowledge flow, resource

sharing, and communication streams to understand the interconnected dynamics of the RIS. Comprehensive mapping was conducted to identify essential actors from different sectors.

The second level is the Iceberg model analysis, where factors acting as either drivers or barriers of the RIS were identified. It also delved deeper into understanding the foundational root of the issues to better address the symptoms of prevailing challenges in the RIS. This level probed into the four stages of causation: documentation of observable events, identifying behavioral patterns and trends, uncovering underlying institutional structures, and conducting deeper inquiry into mental models by examining decision-making rationale of actors, cultural assumptions, shared beliefs, and worldviews that ultimately affected behavior (Sterman, 2000).

The last analytical tool is Causal Loop Diagramming, which is used to illustrate and examine the feedback loops to understand the reinforcing or balancing behaviors consequential to the shaping of the RIS dynamics. CLD was conducted through a participatory construction where diverse stakeholders mapped out circular causal relationships, feedback mechanisms, and systemic interdependencies within their bounded RIS. This participatory analysis generated data about the actors' perceived system dynamics and identified key system variables to articulate causal relationships (Kim & Anderson, 2007). All integrated analytical tools were refined using iterative validation from the participants and a pool of experts.

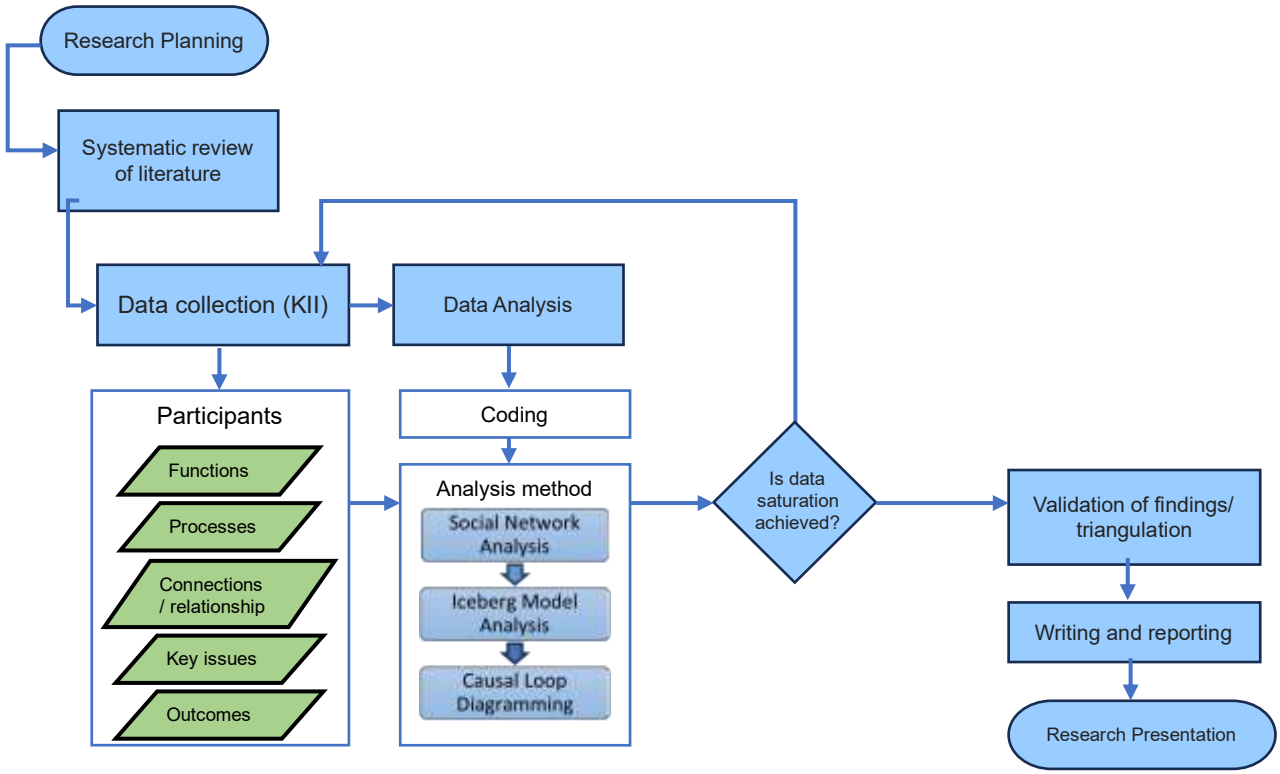
To summarize, the researcher deemed that employing a systems approach is the most suitable research framework, as the study integrates SNA to recognize and map relationships and collaboration patterns, the Iceberg Model to distinguish underlying systemic structures and mental models influencing innovation, and Causal

Loop Diagramming (CLD) to visualize and examine feedback loops and connecting interdependencies shaping regional innovation dynamics. By combining these analytical methods, the study set out to fill the gaps that existing literature had yet to address because this revealed not only how the system looks structurally but also how RIS behaved dynamically, why it produced desired outcomes, what sustained dysfunctional patterns, and where the possible leverage points for policy and intervention were.

Analytical Framework Process

Serving as the study's methodological guide, this analytical framework illustrates the stages and methods undertaken in the research process. Figure 2.5 illustrates this process.

Figure 2.5. Flowchart of the Analytical Framework using an integrated Systems Approach.



1. *Start with a thorough and systematic review of literature*. The researcher explored actors, connections, processes, relationships, and research methods to identify key components of the RIS.
2. *Delve into the functions, processes, connections/relationships, key issues, and outcomes* based on the knowledge and experiences of key actors in RIS.
    - Functions – primary roles and responsibilities portrayed by the key actors in RIS
    - Processes – main actions or operations conducted by the actors to promote innovation
    - Connections/relationship – interactions among various key actors and how these connections affect innovation processes
    - Key issues – challenges and barriers that impact or influence the outcome of actions in the innovation process
3. *Iterative data collection and analysis process.* Data collection and analysis were done in a cyclical, repetitive process. Sequentially collecting and analyzing data from each analysis tool allows insights from one phase (e.g., SNA systemic review and interview) to immediately inform and refine the data collection and focus of the next phase (e.g., Iceberg Model interviews and CLD variable selection). This continuous, iterative process ascertained that the evolving conceptual model of this study was validated and progressively deepened with each layer of analysis, increasing the validity and relevance of the final system map.
4. *Fact checking*. Constant back-checking or data fact-checking was conducted to guarantee accuracy and completeness of data.

5. *Coding strategies*. Coding was conducted to categorize and systematically organize the qualitative data to identify emerging themes from the responses of the participants based on the multi-level structure of the Iceberg Model and the relational nature of the SNA. This organized coding facilitated the subsequent analysis and synthesis of variables, links, and feedback structures necessary for constructing the Causal Loop Diagrams.
6. *Validation and triangulation of data.* Triangulation was conducted to ensure the validity of results. This was done by comparing results to existing literature or through expert validation, particularly on the policy recommendation.
7. *Writing and reporting*. The final output was the reporting and presentation of results. The researcher comprehensively analyzed and discussed the results, illustrated data in visual forms, explained implications of the findings, and suggested interventions.

Research Gaps

Studies in national and regional innovation systems were predominantly conducted in developed countries with established innovation programs. These studies emphasized the link between a functioning innovation system and economic growth and development. However, certain literature gaps could still be discerned, as some key aspects of RIS remain unexplored, particularly among developing countries such as the Philippines. Identified gaps are in the actual networking system within the local RIS, systemic and iterative interactions of key actors in the system, and causal relationships influencing innovation performance in the region. Addressing these gaps is critical for crafting policy recommendations that are more nuanced and tailored to the specific needs of the RIS.

Research Gap 1. Limited comprehensive analysis of rural or emerging RIS in the country. Most existing studies on RIS are predominantly in the Western and developing countries context. In the country, RIS analysis is dominantly conducted on metropolitan or well-developed regions, while studies on rural and less urbanized regions are largely scarce. As a result, most Filipino mental models or cultural influences that highly affect the decision-making of primary actors in the innovation ecosystem are not well reflected. Cultural dimensions and mindsets are rarely incorporated into analysis. Through the conduct of this study, a contextualized analysis of RIS in Western Visayas materialized to gain a holistic understanding of the unique innovation ecosystem that is away from the bustling Capital and Luzon areas, offering a unique insight into the cultural and institutional drivers that significantly shape actors' interaction and decision-making process.

Research Gap 2. Lack of innovation studies infusing deeper analytical methods such as the Iceberg Model and Causal Loop Diagramming in the operationalization of RIS. Most published literature regarding RIS is merely diagnostic. They focus more on identifying visible systemic issues and challenges. The underlying root cause of the problem and how it is influenced or affected by other components of the system remain mostly unknown. Using systems thinking tools to diagnose the entirety of the innovation ecosystem of the region remains underutilized, as most studies focus on the descriptive level without probing the deeper causes of systemic issues (Cai & Lattu, 2022). The application of the Iceberg Model and Causal Loop Diagramming could deeply examine the complex socio-economic and institutional challenges of the key actors. Iceberg Model could potentially be a powerful analytical tool to uncover hidden structural factors and institutional assumptions beneath observable events, allowing for a more in-depth analysis of the RIS. On the

other hand, CLD could identify the behavioral loops to help visualize feedback mechanism in the RIS, leading to possible discoveries of weak linkages, resource stagnation, and delays in implementation. However, the Iceberg Model and CLD have scarce systemic application in analyzing RIS in the country (Mapa & Bersales, 2020).

Research Gap 3. **Siloed views on RIS in the Philippine context.** Existing literature on RIS in the Philippines tends to focus only on the narrow perspective of an institutional lens, such as identifying only persisting problems in one institution without looking deeper into its possible interlinking causes with other actors. Issues are recognized as isolated cases unique only to each institution, such as low research productivity in universities, low innovation participation of industry, poor R&D funding by the government, and weak policies on science and technology. Interdependencies of these issues are not adequately explored. This siloed perspective gives a fragmented impression of the RIS, which is supposed to act as one unified unit and underplays the complex collaboration and interaction of a system with one concerted goal in innovation. This fragmentation causes a blind spot in understanding the Philippine RIS, leading to issues that remain unaddressed to this day (Aldaba, 2020).

This research aimed to address these identified research gaps by providing a holistic, systematic analysis of the system grounded in a systems approach and integrating systems thinking tools such as SNA, Iceberg Model Analysis, and CLD in data analysis. This research transcended the usual descriptive and diagnostic means of recognizing the observable and overt issues as it went deeper in understanding underlying issues that affected and amplified the challenges. This also looked into problems not as a remotely detached phenomenon but as a byproduct of systemic interdependencies, asserting that underperformance was not a weakness of one institution; it was a failure of the entire system. Analysis should uncover to what extent

and how the problem is connected with other components of the system (McGlashan et al., 2016).

To do this, this study employed integrated systems thinking analytical tools, particularly Social Network Analysis, Iceberg Model, and Causal Loop Diagramming, to analyze the Philippine RIS in Western Visayas. It identified expert participants who have active involvement in the innovation initiatives of the region, coming from multiple sectors. SNA looked into the density and quality of the relationship among the actors. Iceberg Model systematically probed beneath surface-level events, identified persisting trends in the process, discovered institutional structures affecting innovation performance, and revealed mental models and assumptions that shape the relationship, collaboration, and involvement of actors in the system. CLD uncovered the feedback mechanism in the RIS and identified unintended consequences and time delays that served as leverage points for intervention.

This systems-oriented approach of analysis generated a comprehensive understanding of how RIS functions, breaking beneath the surface level to reveal hidden institutional and cultural mindsets that impede effective collaboration among the actors and successful innovation initiatives. This study also provided a closer look at a more authentic analysis of how an RIS in the Philippine context actually works. This knowledge is essential for all stakeholders involved, as they were equipped with baseline data and a conceptual framework needed to tailor their initiatives and programs toward the improvement and strengthening of the innovation ecosystem in the region. Ultimately, this could redound to a more sustainable and high-performing RIS that can drive economic sufficiency, address pressing socio-economic challenges, and augment the country’s global competitiveness through a knowledge-driven economy.

Chapter III

RESEARCH METHODOLOGY

Introduction

This investigation employed a descriptive qualitative design integrated with a systems approach methodology. The aim was to describe, analyze, and critically present the operational dynamics characterizing the regional innovation system (RIS) in Western Visayas. Data were collected through interviews, enabling researchers to generate rich, contextual descriptions that illuminate the essence of the subject matter (Creswell & Creswell, 2018).

Research Method

The study's methodology was anchored in a qualitative multiple case research design integrated with a systems approach framework. This design was instrumental in gaining contextual, detailed knowledge about an existing phenomenon, as in this case, the collaborations in the regional innovation system.

Multiple case study research conducts a detailed examination of the interactions and collaborations of the key actors in the RIS from various identified sectors. It also provides a comprehensive, empirical way to explore how interrelationships among the key actors lead to knowledge creation, technology development, and eventual commercialization within the Western Visayas context.

Multiple case studies illuminate the complexity of an issue by drawing on purposely selected sampling cases tailored to the study at hand. It helps capture the

complexity of an issue and elicit findings and themes from evidence spanning a variety of contexts. Multiple cases were examined simultaneously to yield results that could capture the nature of the phenomenon (Ayton et al., 2016). For this study, within-case analysis was conducted to gain an in-depth investigation of key actors within each sector in the RIS, specifically in the university, government, and industry. This analyzed how knowledge diffusion, collective effort, and innovation networks operate within each sector. Cross-case analysis involved comparing the identified sectors to uncover common patterns, differences, and causal mechanisms in relation to their best practices, barriers and drivers to innovation, and feedback mechanisms.

In summary, within-case analysis explored detailed workings and contextual nuances to provide depth and context to the study, while cross-case analysis gave breadth and generalizability to the results. This was an ideal method to study the complex phenomenon characterizing the RIS.

Data were collected using key informant interviews among purposively selected stakeholders who possessed specialized knowledge about university-industry-government interactions within the Western Visayas RIS. They were composed of nine (9) government personnel from the three (3) research and development consortia and other government agencies, five (5) cooperating member institutions/university, four (4) industry partners directly engaged in the RIS, and two (2) identified emerging actors by the initial three components.

Data collected were coded to identify emerging themes. For data analysis, social network analysis was employed to identify components of the RIS, the Iceberg model to uncover the deep-seated systemic issues, and causal loop diagramming as a feedback mechanism and causal linkages to determine systemic behaviors that could either stabilize or amplify innovation outcomes within the regional system. The

integration of these data analysis methods within the systems approach resulted in the mapping of feedback loops and identification of emergent behaviors. This paved the way for the identification of weak or underperforming areas where recommended interventions were leveraged, tailored specifically to the regional innovation environment.

Study Setting

This study was conducted in Region 6 Western Visayas, encompassing participants from government, universities, industry, and other emerging sectors involved in RIS from the provinces of Aklan, Antique, Capiz, Guimaras, and Iloilo. Participants and their affiliated institutions were purposely chosen because of their function as key innovation hubs or as principal agencies that facilitate research, development, and innovation activities.

By including all provinces, the study captured the full scope of collaborative interactions and knowledge diffusion, which ensured data saturation for a holistic understanding of the regional innovation dynamics. Moreover, including all provinces ensured representative coverage of the region's innovation landscape.

Participants of the Study

Participants of the study included the three main actors of RIS from Western Visayas, comprising nine (9) government personnel from research and development consortia and other government line agencies, five (5) cooperating member institutions/university, four (4) industry partners directly engaged in RIS, and two (2)

identified emerging actors by the initial three components. Twenty (20) participants were more than the ideal sample size to attain saturation in qualitative research, particularly if using in-depth key informant interviews, as noted by Hennink (2022), who suggested only 9-17 participants. However, Dayton (2023) stated that for an in-depth interview, a sample size of twenty (20) or more is recommended. Only active and available partners in each of the sectors were included. Selection was purposive to capture diverse perspectives and comprehensive qualitative data essential to the accomplishment of the study objectives. Initial primary participants came from the university, government, and industry.

For the university, five (5) personnel from intellectual property, research and development, or technology transfer offices were identified based on their membership in research and development consortia. Participants from the university need to have prior extensive work as creators of knowledge, technology generators, and facilitators of technology transfer.

For the government, nine (9) personnel from DOST Regional Office, Provincial Science and Technology Office, DTI, LGU, and research and development consortia were identified due to their support and involvement in RIS. DOST Regional Office provided technical, financial, and administrative support to RIS, while DTI aided in the commercialization and entrepreneurship endeavors of TBIs and small and medium entrepreneurs. Provincial Science and Technology Office functioned as a local arm to implement the regional DOST programs, transfer technology at the provincial level, and enhance the development of technology-based livelihood in the rural areas.

LGU Iloilo Province representative was selected because they are the first LGU in the region to establish Provincial Ordinance No. 2025-332, which institutionalizes

community and academe-based startup development in the province, providing financial and technical support for qualified startups.

For the industry, four (4) managers of partner industries were selected as they serve as key implementers in technology absorption and commercialization. They were also formal organizations that support technology transfer and eventual commercialization to drive regional economic growth. They were technology adopters and manufacturers with an MOU or direct licensing agreement with the university to augment the production of technology and the commercialization process. They were the business groups with operations in the region, manufacturing companies, local businesses, or private companies who worked with DOST 6, regional research and development consortia, and the university to support technology adoption and commercialization of the research innovation outputs.

After the results of the interview among the three initial participants, two (2) emerging participants from the community were identified and subjected to the same interview process. Table 3.1 shows the allocation of participants based on their category.

Table 3.1

Participants of the study

Institution	Position	f
Government	Personnel/officials • 3 research and development consortia • 1 Department of Science and Technology VI Regional Office (DOST VI)	9

	• 1 Department of Trade and Industry VI (DTI 6) • 4 Provincial Science and Technology Offices per province	
University	IPMO, R&D, Technology Transfer Office Personnel from five universities in the region (1 from each province)	5
Industry	Managers/employee of partner industry	4
Others	2 Identified cooperative members from the community	2
TOTAL		20

Sampling Procedure

This qualitative research employed purposive and highly targeted means of identifying participants to ascertain that key informants and structural relationships were captured. With this, participants were selected through purposive criterion-based sampling – that is, chosen because they met specific pre-established inclusion and exclusion criteria. Criteria were established to identify the most knowledgeable and influential individuals in the initial three core helices starting on the three major sectors- the university, government, and industry. Subsequently identified actors with an important role in the RIS were included as long as they qualified for the inclusion criteria.

For the university, five (5) personnel from intellectual property, research and development, or technology transfer offices who have at least two years of experience in research, technology transfer, and commercialization were chosen.

For the government, personnel or officials with at least three years of service were selected from the 3 research consortia, one from the DOST regional office, four from the Provincial Science and Technology Office, one from DTI, and one from LGU.

Four participants from the industry sector with extensive involvement in technology adoption, production, and commercialization were included. These partners need to have either a MOA or a licensing agreement with any university in the region. Personnel to be interviewed need to have at least 2 years of working experience with their partner university.

Two (2) additional participants from the community were identified through referrals by the initial KIIs in the course of data collection. They were included in the study and selected through snowball sampling. Initial experts recommended knowledgeable informants for identifying previously unknown actors and relationships important for systems understanding.

Data Collection Method and Procedures

Semi-structured key informant interviews served as the primary source of data, conducted among the purposively selected participants who were identified to have direct and active engagement with the RIS. This data collection method focused on achieving information-rich sources to obtain detailed insights and a nuanced understanding of the system (Kibuacha, 2024).

Through KII, qualitative information was gathered from the participants who were widely recognized experts who have extensive years of engagement with the RIS (Busetto et al., 2020). The researcher first introduced a predetermined question guide to the participants to get their views on the dynamics of the RIS ecosystem. The researcher used this data collection strategy to gather rich, multi-perspective insights through structured but egalitarian dialogue. Each person is given an equal right to

participate (Gomez-Lanier, 2021). Participants for KII were assigned aliases for confidentiality and anonymity purposes.

Participants were contacted to set a schedule and preferred type of interview, whether online or face-to-face. Data collection was conducted following these steps.

1. *Participant recruitment and initial contact*. The first step in the process is identifying qualified participants who are directly involved in the innovation process and management in the RIS. Participants were mainly identified through their involvement as cooperating member universities in regional research consortia, as personnel in primary government agencies, or as industry partners that support RIS. Qualified participants were then contacted through email, calls, or social media messaging applications. The researcher thoroughly explained the study's purpose and requested voluntary participation. Participants were informed that non-participation would not have any adverse effect on their relationship with the researcher, the university, DOST, UPOU, or other institutions.
2. *Conduct of semi-structured interviews*. KIIs were conducted with all key informants from universities, industry, and government agencies. Each interview lasted 60-90 minutes, covering topics such as organizational roles, interaction patterns, collaboration experiences, barriers, drivers, and systemic dynamics. Snowball sampling was implemented to identify further case participants and previously unknown actors who bear a important role in the innovation system. This extended the scope of information, adding more depth to the study.
3. *Document Analysis.* A synchronous data collection process was conducted to simultaneously gather and analyze data, including a review of relevant literature, institutional framework, legal mandates, and other relevant data. Thorough and

meticulous review of materials and sources was enforced to ensure accuracy and authenticity of data.

4. *Validation consultation.* Key to ensuring the generalizability and authenticity of data was a rigorous validation process. As a last step, an expert was tapped for consultation for fact-checking and validation of data. Preliminary findings were discussed, and diagrams and maps were reviewed thoroughly in a participatory session. Findings and results were refined and enhanced to strengthen their validity and authenticity.

Data Analysis Procedure

For data analysis, three integrated systems thinking tools were used to strengthen the analytical method. These methods covered multiple multi-tiered analyses of the system through the multi-sectoral components. This was based on the systems approach framework, which postulated that innovation emerges not from isolated actors but from the relationships and underlying structures that shape their interactions over time. After coding and identification of recurring and emergent themes, data were analyzed at three levels.

Level 1. Social Network Analysis (SNA) to identify RIS components

SNA uncovered the structural components and patterns of relationships and interactions among identified actors in the Western Visayas RIS, directly addressing SRQ1 (how actors interact and collaborate) by visualizing network density, centrality, and connectivity patterns. The following are the steps in this analysis method (Borgatti et al., 2018). This is illustrated in Figure 3.1.

Step 1: Network Mapping

- A sociogram (network diagram) was created to plot all actors as nodes (circle patterns represented key actors from universities, industries, and government agencies)

- Lines (edges) were drawn between nodes representing relationships/ collaborations identified from interviews

- Different line thicknesses were used to show relationship strength (strong vs. weak ties)

Step 2: Identify Network Properties Qualitatively

- Density: Actual connections existing were counted and compared versus possible or projected connections to indicate overall collaboration intensity

- Centrality: Most connected actors (central nodes) were identified to reveal who were the key players or "brokers" in the system.

- Clusters/Subgroups: Dense pockets of collaboration were examined as they may indicate sector-specific or geographic clusters

- Eigenvector Centrality: A measure of a node's influence and extends the degree of centrality by weighing the quality of these connections rather than simply their number. A node connected to other well-connected nodes scores higher even if its own connections are limited.

- Structural holes: Gaps where connections are missing were identified to reveal barriers to collaboration.

Step 3: Interpret Patterns

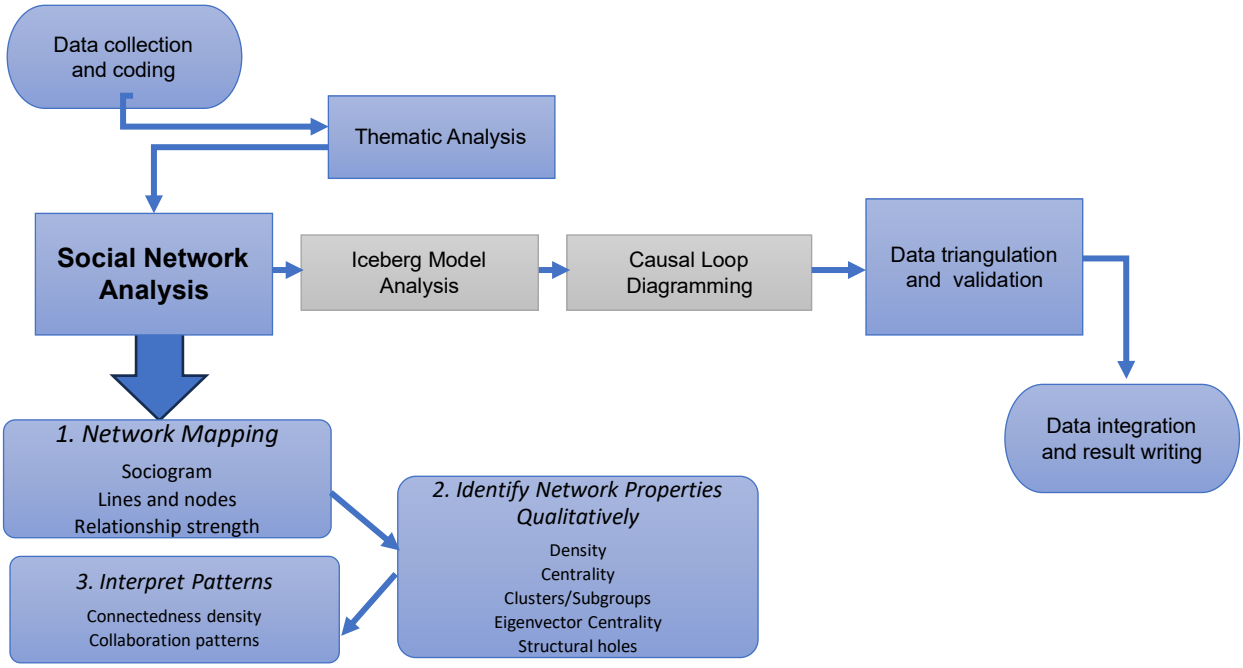
- Connectedness density was analyzed to identify who and why certain actors were central while others were peripheral.

- Collaboration patterns were examined if they aligned with formal institutional engagements or just functioned as informal networks.

- Brokers or peripheral actors were identified and their connections studied to discover if they were disconnected groups or an integral part of the system who were just previously unknown.

- Comparison of the illustrated SNA were compared with related innovation model configurations based on the literature.

Figure 3.1. Flowchart for using Social Network in data analysis.



Level 2. Iceberg Model Analysis to identify barriers and drivers of innovation

The Iceberg Model (developed by systems thinking scholars) revealed deeper systemic structures beneath visible events, moving from surface-level symptoms to underlying mental models and paradigms. This addressed SRQ2 to identify factors

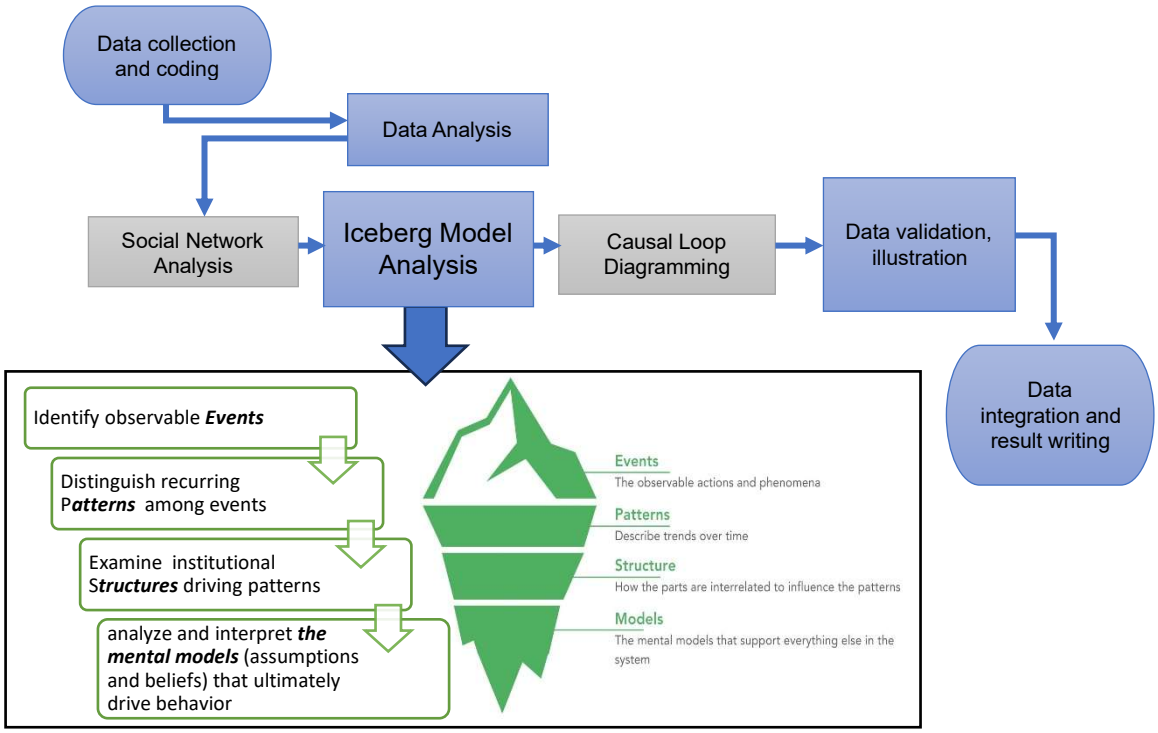
that would act as barriers and drivers in the innovation system by uncovering root causes rather than just observable problems (Goodman, 2018). It served as a deep qualitative diagnostic tool to uncover the invisible causes of observed RIS performance. Figure 3.2 illustrates the Iceberg Model process of analysis.

The procedure is as follows:

- After data collection and SNA, the researcher coded the initial data to identify *Events* (specific failures/successes) and *Patterns* (recurring trends). For *events*, discrete and actual incidents of collaboration success or failure were documented. For *patterns*, recurring trends mentioned by multiple informants were identified.
- The analysis then moved deeper to analyze the *Underlying Structures* (policies, formal linkages, resource flows) within each organization that perpetuates the patterns. This was achieved by reviewing existing institutional policies, resource flows, and other relevant documents that could influence the recurring patterns in the system.
- The deepest level involved analysis of mental models (shared beliefs, institutional biases, and tacit assumptions) that justify and maintain the systemic structures. This could be done by extracting underlying beliefs, assumptions, and organizational culture expressed by participants.
- In case of negative results that could compromise the participants, data was presented in an aggregated and anonymized form. Negative results were discussed in general to avoid deductive disclosure. Contextual details directly pinpointing one case/institution were avoided. If the negative result was an isolated case, cannot be adequately anonymized without sacrificing substantive

value, or disclosure risked reputational damage despite anonymization attempts, the researcher withheld them entirely.

Figure 3.2. Flowchart for using the Iceberg Model in data analysis, showing its multi-tiered level.



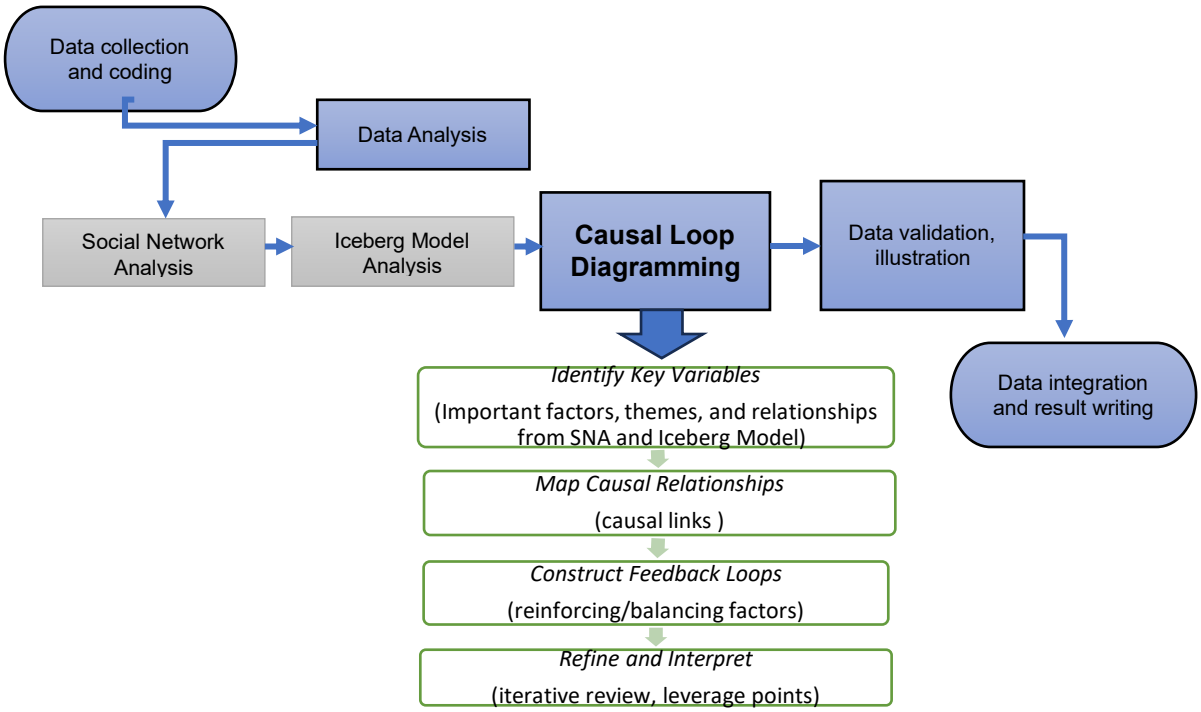
Level 3. Causal Loop Diagramming to synthesize dynamic systemic map

Causal Loop Diagramming (CLD) is the final qualitative modeling technique that synthesizes all previous findings into a dynamic systemic map. This final analysis explained and posited how the RIS behaved, highlighting the interconnectedness of each helix and causes and effects, and pinpointing the structural leverage points for high-impact policy recommendations (Lane, 2008). The following is the procedure for

applying Causal Loop Diagramming (CLD) after conducting SNA and Iceberg Model analysis in this qualitative study. Figure 3.3 illustrates this process.

1. *Identify Key Variables*. Important factors, themes, and relationships were extracted as revealed by the Social Network Analysis and Iceberg Model (such as actors, patterns, structures, and mental models) that influence the regional innovation system.
2. *Map Causal Relationships.* A causal map was illustrated to present the causal links between these key variables, denoting whether effects are positive (same direction) or negative (opposite direction), based on qualitative data from stakeholder interviews and earlier analyses.
3. *Construct Feedback Loops*. Causal connections were organized into loops to reveal reinforcing (amplifying) or balancing (stabilizing) feedback mechanisms within the system, highlighting dynamic interactions affecting innovation outcomes.
4. *Refine and Interpret*. Diagrams were then validated and refined through iterative review and stakeholder feedback. Structure was interpreted to understand system behavior and to identify systemic weaknesses as probable leverage points for policy and intervention.

Figure 3.3. Flowchart for using Causal Loop Diagramming in data analysis.



Risk Mitigating Strategies

The following strategies were employed as a risk mitigation plan for sensitive questions probing during the data collection process.

Overcoming emotional distress – The Informed Consent Form used in this study contained the objectives and purpose of the study to detail specific topics. Participants were given a chance to decide and participate voluntarily. At the onset, participants were duly informed of their rights to refuse to answer questions which they deemed to cause them harm or make them uncomfortable. They were also informed that they could withdraw from the study at any time without any repercussion, risk, or withdrawal of benefits on their part.

Strengthened privacy and confidentiality protocols–Thorough anonymization process was observed. Positions and identifying factors of the participants were safeguarded. Participants included all personnel of the institution qualified in the inclusion criteria. If possible, names of agencies were omitted.

Adequate Informed Consent Form - Informed consent procedures were thorough enough to prepare participants for the depth of probing involved in Iceberg Model applications. All prospective participants received and understood the complete information necessary to make a fully informed and voluntary decision about their participation. This disclosure explicitly covered the study's expected benefits, potential risks, sources of funding, and the institutional or ethics committee approval governing the conduct of the research

Generalized reporting to avoid reputational harm - Contextual details directly pinpointing to one case/institution were avoided. Problems and negative results were explained in general or in aggregate to ensure that even if negative behaviour would surface, they would not be directly linked to a certain person/institution. If it was just an isolated case, it would not be included. If specific data cannot be adequately anonymized without sacrificing substantive value, or if their disclosure risks reputational damage despite anonymization attempts, researchers withheld them entirely.

Research Instrument

To guide the interview process, an interview guide was crafted to ensure that discussion remains focused on the study's key objectives. Nonetheless, it still allows enough flexibility to probe unexpected but relevant insights from the participant's

perspective. The in-depth interview centers on covering topics such as organizational roles, interaction patterns, collaboration experiences, barriers, drivers, and systemic dynamics. Question statements were formulated from different literature.

The instrument underwent face and content validation. For content validation, the interview guide/questionnaire was submitted to 3-5 experts in instrument validation to assess whether questions adequately cover all dimensions of the research questions. For face validity, pilot interviews were conducted with 3-5 representatives from each sector not included in the main sample to test question comprehensibility, flow, appropriateness, and time requirements. Suggestions from the validation process were then incorporated into the initial questionnaire to further enhance the questions' coherence, clarity, and relevance to the study objectives.

Ensuring Trustworthiness of the Data

In this qualitative systems approach study, pictures were captured to exhibit the interaction of the actors. To ensure a comprehensive analysis of the RIS, this study followed the Trustworthiness of Data framework of Lincoln and Guba (1985).

To ensure credibility, findings were ascertained through an accurate representation of the RIS landscape through the triangulation method and member checking. Data from KIIs were cross-referenced with existing documents and literature to identify any discrepancies in the results and were analyzed to provide deeper truth. Backchecking was conducted to ensure that emerging themes were based on the participants' perspectives. This is to maintain the accuracy of interpretation throughout the data analysis process.

Since RIS heavily relied on local culture and policy, transferability was ensured through a thick description of findings. This study provided a detailed account of the RIS environment and conditions, the geographical location of the study, the research design, the data collection procedure, and the data analysis tools and process. This allowed other future researchers to verify the applicability of the results to their own regional context.

Dependability or reliability was maintained through a comprehensive audit trail, including the recorded KIIs, coded transcripts, documentation, and logs to support interpretation of findings up to conclusion. This allowed external verification of the analytical procedures completed, ensuring that the coding, categorization, and interpretation of data could be checked for their consistency and rigor.

Lastly, confirmability or objectivity was achieved by the researcher acting as a participant-observer, withholding any personal assumptions about RIS and ensuring that any biases did not cloud interpretation of data. All transcripts from the KII were archived and served as evidence to show a clear path from raw data to eventual systems analysis and conclusion.

All these measures mentioned were duly observed to ensure that the study presented a credible and comprehensive analysis of the interrelationship, barriers and drivers, and feedback mechanism of the Philippine RIS (Creswell & Poth, 2016; Lincoln & Guba, 1985).

Research Ethics

Ethical Considerations

The study abided by the set policies and regulations of the University Research Ethics Board. The welfare of the participants was prioritized in the pursuit of this study. Informed consent was duly elicited to ensure willing and voluntary participation without undue coercion or duress. Participants needed to understand the goals and objectives of the research and how their participation contributed to the achievement of its purpose.

Ethical clearance was secured from the Faculty of Management and Development Studies Institutional Research Ethics Committee before the conduct of the interviews. Invitation letters were sent to potential participants, reiterating the necessary information about the interview process and orienting them about the aim and procedure of the study. The researcher ensured that the research process abided strictly by the ethical guidelines in conducting research and religiously observed and respected the rights of the participants.

Protocols were developed to ensure that participants were protected from any physical, mental, spiritual, economic, social, or legal harm throughout the study. Questions in the KII took into consideration the background and beliefs of the participants, especially when dealing with sensitive topics.

Participants were given full entitlement to voluntarily join or withdraw their participation from the investigation. The participants were duly informed of all pertinent details of the research so they could decide conscientiously on their willingness to continue participating in the study.

Informed Consent

Informed consent was provided and discussed thoroughly before each interview. The consent served as proof that the participants were willing to participate, understood the nature and objectives of the study as well as the needed data, risks, and benefits of their participation. The participants were provided with the necessary information in the appropriate language and were given the right to refuse this assistance.

Confidentiality and Privacy

Information obtained about the participants during the course of this study was held with the utmost confidentiality. In cases of obtaining access to such information, the confidentiality protocol was explained to the participants as part of the procedure. Code numbers were assigned instead of their actual names to de-identify each participant. They were informed as to how they could contact the researcher for any inquiries regarding the study.

Data Management

All information obtained was stored and securely placed in a computer folder with a passcode that only the investigator can access. Privacy and anonymity were strictly observed in light of ethical sensitivities that the participant's narration and perspectives can bring up, particularly when it would directly associate information involving other individuals or groups (National Health Institute, 2022).

In this research, access to the transcripts and voice recordings during the interview could only be accessed by the researcher and the adviser to uphold privacy. Panel members could request access if needed to verify the results. Each key informant was assigned an alias to preserve their anonymity. In filing the data, their aliases were used for confidentiality purposes. After the investigation, all

questionnaires were encoded and transcribed. Documents related to data gathering identifying the participants were kept in a locked and secured cabinet.

All information obtained in the voice recorder and its transcription were stored in an invisible folder on a computer where only the interviewer can access it. The folder will be deleted after five years.

Artificial Intelligence (AI) Tools and other Software Applications

Advanced software was required in generating data and reports for this study, including AI technologies, a grammar checker, and data visualization software, to assist in the research process, identify negligible grammar errors, and generate visual maps. The researcher observed academic integrity by adhering to the following guidelines:

Disclosure and Citation: All AI tools used for grammatical refinement, data processing, or visual production were explicitly disclosed and properly cited in the final document. Participants were informed of any AI or software applications used in the data collection activities. These protocols adhere to the ethical requirement of integrity and accuracy in the research process.

Originality and Review: AI-generated content, particularly data and visuals, were thoroughly reviewed and validated against original sources and actual research data to maintain data authenticity and accuracy, and prevent erroneous data entry. All references and sources were duly cited to respect the intellectual property of authors and avoid plagiarism. These measures ensured integrity and reliability of findings while upholding ethical standards set to guide the research process.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter includes the findings of the systems approach methodological study conducted to address the following main and sub-research questions:

Main Research Question (MRQ): How do key actors perceive the interactions, mental mindsets, and feedback structure shaping the dynamics within the regional innovation system of Western Visayas, and what systemic patterns could be inferred from these analyses?

Sub-research questions:

- SRQ 1. How do the actors perceive the structures, roles, functions, and manner of interactions and collaborations among the key stakeholders within the regional innovation system?
- SRQ 2. What do the actors identify as drivers and barriers in their collaboration within the regional innovation context?
- SRQ 3. What balancing and reinforcing behaviors, and causal relationships can be inferred among the actors within the regional innovation system?

This chapter discusses the process of analysis leading to the findings anchored on the systems approach method using the analytical tools of structural analysis, the Iceberg model, and Causal Loop Diagramming. This chapter also exhibits demographics of the participants, utilizing tables and diagrams to elucidate the discussion. Analysis and evaluation procedures of the transcripts of twenty individual interviews aimed to identify codes and emerging themes were detailed.

A rigorous qualitative thematic analysis was used following the analytical procedure provided by Braun and Clarke (2006) for thematic qualitative research. Coding was conducted using both manual and Atlas TI. The first cycle of coding is Initial and Descriptive Coding. Descriptive codes were assigned to data segments based on the actual transcripts upon identifying their intended meaning. The second cycle is Structural Coding. Initial codes were clustered into macro-level organization to sort out primary stakeholders and to better represent their overall view. In this study, the categories are the government, industry, academe, and community. The third cycle is the axial coding, which mapped the interactions and interconnections of all stakeholders. Lastly, the thematic coding was used to identify underlying thematic narratives across all transcripts, such as the issues, challenges, drivers, barriers, and causal relationships in the RIS. Manual review of the codes and themes was frequently conducted to fact-check and validate findings. Tables, diagrams and direct quotations were provided to substantiate discussion and strengthen the findings.

Sampling Results

This qualitative research employed purposive and highly targeted means of identifying participants to ascertain that key informants and structural relationships were captured. Purposive criterion-based sampling was employed in selecting participants to ensure that they met pre-defined inclusion criteria. Purposive sampling is an ideal sampling method for multiple case studies as it concentrates only on people who have actual knowledge and substantive experience in shaping the RIS. This deliberate selection of participants adds to the validity and reliability of findings as it is focused on the depth of insights rather than numerical generalizability of sample

size.(Ishak & Baker, 2014). Consequently, participants were chosen based on their experience and expertise in the field of research and innovation. Some were recommended by their peers and immediate supervisor as they are notable experts in the RIS. This targeted selection process ensures that the participants possess specific pre-defined characteristics and knowledge relevant to the attainment of the study's purpose and goals. The researcher gathered relevant, discerning, and valuable data that enriched the results of this study. This focused approach enhanced the quality, reliability, relevance, and contextual validity of the research outcome by ensuring the sample represented the population of interest.

Twenty participants were initially selected to participate from the three major sectors operating in the region; five from the university, ten from the government, and five from the industry. However, despite several attempts to establish contact, only nine out of ten from the government sector and four out of five from the private industry agreed to participate. Nonetheless, data saturation was already established from the government sector as well as the industry sectors. Subsequently, an additional two from the cooperatives group, identified as the most active technology benefactor, were later included. In total, there were five (25%) from the university, nine (45%) from the government, four (20%) from the industry, and two (10%) from the community who participated in the study, making the total twenty participants. This number is already ideal, as Creswell (2014) noted that five to twenty-five interviews are considered ideal for qualitative research, seconded by Bernard (2016), who recommended 10-20 knowledgeable participants as long as they have sufficient understanding of the domains under study. This is shown in Table 4.1.

Codes were assigned to participants for their de-identification and anonymity to ensure that they will not be identified in their professional affiliation and personal

identity. Eight males and twelve females, all Filipinos and recognized for their notable works within the RIS, consented to voluntarily participate in the study. The majority of the participants were from Iloilo City, considering that most of the regional offices, consortium offices, and industry partners were based in the city. Although two participants came from Negros and Manila, they were industry partners of the academe in the Western Visayas Region and have branches or offices based in the region. Nonetheless, there were also representations from Aklan, Capiz, Guimaras, and the provinces of Iloilo to ensure data saturation. Despite repetitive attempts for contact, invited participants from Antique in both academe and government sectors did not give any response.

Table 4.1

Profile of the Participants

No.	Code	Sex	Institution Type	Location
1.	A1	F	SUC	Iloilo City
2.	A2	F	SUC	Iloilo Province (5th District)
3.	A3	F	SUC	Iloilo Province (3rd District)
4.	A4	M	SUC	Guimaras
5.	A5	F	SUC	Aklan
6.	G1	F	Government Agency	Aklan
7.	G2	F	Government Agency	Capiz
8.	G3	M	Government Agency	Guimaras
9.	G4	F	Government Agency	Iloilo City
10.	G5	F	Government Agency	Iloilo City (Regional Office)
11.	G6	F	Government Agency	Iloilo City (Regional Office)
12.	G7	M	Government Agency	Iloilo City (Consortium Member)
13.	G8	M	Government Agency	Iloilo City (Consortium Member)
14.	G9	M	LGU	Iloilo City
15.	I1	F	Private Industry	Iloilo City (nationwide operation)
16.	I2	M	Private Industry	Iloilo Province (other region collaboration)
17.	I3	M	Private Industry	Negros Island (nationwide operation)
18.	I4	F	Private Industry	Manila (nationwide operation)
19.	C1	M	Cooperative/Community	Iloilo Province (5th district)
20.	C2	F	Cooperative/Community	Iloilo Province (1st district)

Selected participants were all actively involved in the RIS at the time of the interview. Length of involvement includes the years of service they served in the research, product development, technology transfer, and commercialization offices. The majority of the participants have extensive background with the RIS, as 45% of them have more than 10 years of experience. Most of them came from academe and government sectors. The least number of years involved were from the industry partners. Table 4.2 exhibits this result.

Table 4.2

Participants' Length of Involvement in RIS

Years in RIS	F	Percentage
More than 10 years	9	45%
Five to ten years	7	35%
One to five years	4	20%
TOTAL	20	100%

Data Collection Results

The twenty research KII participants from the stakeholders of RIS representing the academe, government, industry, and community served as the main source of research data. Despite two participants coming in from other regions, they were part of the industry actively involved in the RIS and had physical branches or offices based in the region. The interview process was anchored on the developed semi-structured interview questionnaire to guide the researcher. The interview guide ensured that questions asked covered all the necessary dimensions of the research objectives

across all participants while still allowing a natural conversation flow to elicit rich, detailed responses. This ensured that experiences, perceptions, and meanings were captured, resulting in in-depth qualitative data.

After the interviews, transcripts were manually encoded and examined for emerging themes. The surfacing themes were compared and contrasted, first among the same sector; then compared across other sectors. The first step of comparison was conducted to check whether patterns hold the same for the majority of actors belonging to the same sector and not just an isolated view from a single participant. Emerging patterns have to reflect the perspectives and views of the majority and is a shared systemwide occurrence. This was part of the constant comparative analysis process to guarantee the integration of all themes and uncover the prevailing and recurring themes throughout the data gathering phase.

Themes Emerging from the Research Questions

The following sections elaborate on the principal themes that emerged from the rigorous thematic analysis of qualitative data collected through a multiple-case study design. These themes were drawn out through a repetitive coding process, first employing within-case analysis to examine the unique contextual dynamics and experiences specific to each case or stakeholder sector. This was then followed by cross-case analysis to identify similar patterns and varied perspectives across all cases or sectors. Constant comparative analysis and memo writing were employed to ensure conceptual coherence and theoretical saturation.

SRQ1. How do the actors perceive the structures, roles, functions, and manner of interaction and collaboration among the key stakeholders within the regional innovation system?

This section is used to detail the social network analysis of the regional innovation system as it addresses SRQ1. Findings and discussions were presented under four subtopics: roles and functions of the stakeholders; social network of RIS actors; communication and interaction modes; and structural gaps and challenges.

SRQ1.1. Roles and Functions in RIS

Table 4.3 and Figure 4.1 present the commonly identified roles and functions inferred through the perceptions of actors. The government sector was identified as the most central, active, and influential stakeholder in the RIS. They were identified as the strongest and most visible partner, particularly in funding, project implementation, and innovation support. Government line agencies are the financial backbone and legal protectors of the innovation pipeline. They collaborate through multi-agency frameworks such as the Regional Research, Development and Innovation Committee (RRDIC). Government line agencies mainly identified were the Department of Science and Technology (DOST) and its various sectoral planning councils, research and development institutes, provincial and regional offices, the Department of Trade and Industry (DTI), the Department of Agriculture (DA), and the Department of Information and Communications Technology (DICT).

"DICT, DOST, and DTI—the three main agencies for innovation and technology."

"The innovation ecosystem functions like a machine: the academe acts as the technology generator, DOST acts as the enabler and funding source, the

LGUs handle localized policy and implementation, and other agencies like DTI, DOT, and DILG provide market access and institutional support. When all these pieces align toward a single direction, the impact on MSMEs and the community is massive."

DOST serves as the primary source of financial grants and enablement. They deploy key funding programs to augment the innovation process of the region, including Grants in Aid (GIA), the SETUP Program for MSMEs, and the CEST (Community Empowerment through Science and Technology) program, in which some of the participants were actively involved. To cascade their responsibilities, DOST has Provincial Science and Technology Offices to deliver programs at the provincial level, allowing for deeper and more widespread dissemination and implementation in the locality. In addition, DOST also supports the national research sectoral council to harmonize science and technology efforts, pool resources, and align local research to the national agenda. Most notable and active among them is DOST-PCAARRD (Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development). Cascaded down to the regional level, the DOST VI regional office is unanimously cited as the most influential actor in the system.

"DOST VI provides the technology and funding."

"DOST-TAPI handles most of the funding for fees."

"They've (DOST VI) been supporting us, giving us funds to conduct research, at the same time protecting it and commercializing it.

"So, the number one that helps is really the DOST VI from research, from FIC, until commercialization and protection."

"Our role (PSTO) is to provide the bridge or to close the gap for our communities that have needs regarding technology and innovation. Since we have a pool of knowledge regarding resources for technology, innovation, and science, we are the ones providing access to the community so those resources can be brought to them.

"We have partnered with DOST-PCAARRD for our RAISE project. They are very instrumental too in the innovation system here in ___ for the funds they give to us."

Local Government Units (LGUs) and other local line offices are the most visible ground-level partners. Most government and academic institutions describe the LGU as their primary community interface, providing and sharing facilities, mobilizing participants for extension programs and livelihood trainings in their locality.

"(They) provide physical facilities and space."

"They help in the successful research extension programs."

"They help implement our projects in the communities."

"Local Government Units (LGUs), we invite them to our activities and give them active roles so they feel integrated into the ecosystem. We partner with the Provincial Economic Development Office (PEDO), the Local Economic Development Office, and the Provincial Development Council."

Academe's role is widely regarded as the primary knowledge production and technology generation node of the system. SUCs handle research and community extension, and develop technologies to upgrade livelihoods and create local jobs. Directors and heads of office of most research consortia are from the SUCs, linking academe, industry, and government, accessible to all concerned. TBIs in the region

are predominantly based in SUCs. University-based TBIs and hubs are instrumental in handling business incubation and the startup phase for budding businesses.

"Our strongest bond is definitely with the academe as our primary technology generator."

"SUCs because they have the knowledge and research outputs."

"State Universities and colleges because they work on micro-algae as part of their thesis. And then they also have on-the-job training and immersion. So, that's where we also teach them through lecture-demos on how to apply this technology to aquaculture, on how to make use of this for other possible applications."

The industry sector was described as institutions that would take the university-developed technologies and transform them into market-ready products. They take the conceptual technologies from the university and handle the mass fabrication to make them commercially available to the market. SUCs frequently look for industry who would be willing to partner with them so they could collaborate directly on research and development to solve production bottlenecks and introduce regional products to domestic and international markets.

"We have also partnered with other industries here in ---- for the commercialization of technologies. We market the products developed at FIC (Food Innovation Center), and transfer them to them."

"They (industry) take technologies developed by universities and handle the fabrication, making them available to the market.

"PCCI Iloilo over the last three years, specifically regarding the startup ecosystem."

“Small industries usually assist us by testing our products on an industrial scale. Some conduct market tests to see if the product clicks with customers.”

The system also shows engagement with cooperatives made up of farmers, producers, weavers, and fishers from the community. The community acts as direct end-users and adopters of technologies as they adopt university innovations to address their challenges, including food safety and crop production.

“Cooperatives, farmers, and fishers are the direct beneficiaries.”

“Our main partners (in the community) have been the mango growers' cooperative and our food processors' group.”

Notable among these roles is the evolving function of the community, particularly for the organized cooperatives who have successfully sustained their business models. One participant in the study confirms its growing market and increasing profit, which enabled it to supply big companies with its products showcased even in the international arena. The weaver’s cooperative started with a government-supported infrastructure and access to sustainable local fibers and materials produced by the Regional Yarn Production and Innovation Center, a facility supported by DOST-PTRI.

In addition, several industries divulged that they have strong partnerships with farmer communities to ensure that they have a steady supply of good-quality materials. One industry participant had to visit the farms and observe the actual process of yielding fibers from pineapple leaves to ensure that they would provide quality materials. Another industry has a strong partnership with some indigenous

people in the community and trains them in efficient ways in crop production so they could produce quality raw materials for their product. These raw materials were then purchased by the industry. In most innovation processes where the community is often seen as the “end-user” in a linear process, these testaments signify the circularity of the innovation process once the community transitions from being “beneficiaries” to entrepreneurs and partner agencies themselves.

The evolving role of these farmer and weaver communities transforms the RIS from the traditional linear knowledge transfer cascading and ending at end-users to a co-production innovation model where circularity is achieved as the community takes an active role as industry partners, a primary innovation agent role. This community brings the innovation system into a full cycle by ensuring that they are connecting as MSMEs and industry partner, not just at the end of the winding process.

> *“Farmers, they are the producer/supplier of raw materials. We include Indigenous People communities in farming and profit sharing. They cultivate raw materials with good genetic resources for competitive supply costs.”*

> *“The weavers before were just beneficiaries of technology from DOST. Now, their organized cooperative supplies international designers, schools, government officials, and top airline companies.”*

In the RIS, where most cooperatives end because they could not achieve sustainability, these cooperatives are proof that a community could also sustain business models, grow markets, and increase profits as long as all hands in the RIS are working together from production up to commercialization. This reverse knowledge flow demonstrates that community-driven innovation could also influence industry

practices, creating bidirectional innovation pathways rather than the traditional government-academe-industry-community cascading.

Figure 4.1. Systems Mapping of the RIS, identifying key actors and their interaction with other stakeholders.

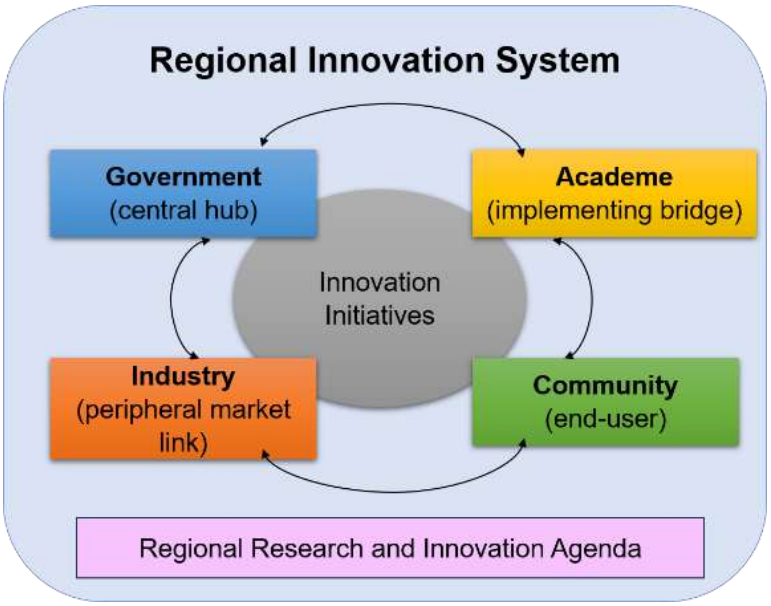


Table 4.3

Roles and Functions of Key Actors in RIS

Sector	Role	Functions
Government	• central, active, and influential stakeholder • strongest and most visible partner • financial backbone and legal protectors	• Funding research and innovation projects • Technology transfer •Technology commercialization •Policy support and development •Infrastructure and resource provision
DOST	• Funding agency • Enabler of innovation	•deploy key funding programs •harmonize S&T efforts •align local research to national agenda •pool resources
LGU	• most visible ground-level partners	•primary community interface-providing and sharing facilities •mobilizing participants for extension programs and livelihood trainings
Academe	• primary knowledge production and technology generation • operational implementation backbone	•Knowledge creation •Technology development •Capacity building and training •Startup incubation support
Industry	• Production and Market link partners	•Fabrication and mass production •Commercialization and adoption of technologies •Market linkage •Entrepreneurship development
Community	• End-users	•Beneficiaries of innovation projects through grants •Community-based implementation of projects •Validation and adoption of research outputs.
Cooperatives	• evolving role	•sustain business models, grow markets and increase profits •sustained their business models - becoming entrepreneurs engaged in product development and sales.

SRQ1.2. Social network of RIS Actors

The Social Network Analysis uses several network properties to understand the structure of relationships among the stakeholders as shown in Figure 4.2. Density is the number of connections, indicating overall collaboration intensity, and is represented by a solid line connecting each institution to demonstrate strong ties and a dashed line for weak ties. Centrality shows the most active actors, depicted by the number of links or connections. The size of the node indicates the quantity of these connections. The bigger the nodes, the more active and highly connected the actors. The clusters or subgroups are dense pockets of collaborators who are identified as always working together in the system and are shown encapsulated in circles that represent each sector. Eigenvector centrality evaluates the quality of these connections. Influence is signified by the connection to other highly influential nodes and not just by the number of connections to the network. Nodes with connections to many highly influential or well-connected institutions have higher eigenvector centrality. This is represented by a red circle around the nodes, indicating that they are high betweenness brokers in the system.

The Regional Innovation System exhibits a highly connected structure consisting of the academe, government, industry, and community stakeholders. KII divulged that the government emerges as the most influential actor among all stakeholders, as it has the highest number of engagements and connections with other institutions. Specifically, DOST holds the highest eigenvector centrality in the entire network, indicating that it is not only the most connected actor but also the actor most connected to other high-influence or connected actors. This demonstrates the DOST's central coordinating position. Interviews further ascertained that almost every actor in the government, academe, industry, and community routes through the DOST with

varying purposes of transaction. Though DOST might not be directly or strongly involved in some industry or community activities, it still has an indirect link to them as most of its programs are cascaded to the community through SUCs or other implementing agencies. This is apparent in programs such as Community Empowerment through Science and Technology (CEST), Grants in Aid (GIA), Institutional/Industry/Innovation support to Commercialize Technologies (IMPACT), Regional Agri-Aqua Innovation System Enhancement (RAISE), Collaborative Research and Development to Leverage Philippine Economy (CRADLE), and Regional Startup Enabler for Ecosystem Development (ReSEED), to name a few, that were coursed through the SUCs before reaching end-users such as organized cooperatives, civil organizations, and communities. This is the cascade implementation mechanism usually conducted at the RIS, where the government sets policy, pools resources, and develops programs while the academe serves as knowledge intermediaries facilitating technology transfer and program implementation to the industry and community.

SUC is its closest network, functioning as the operational implementation backbone across all government offices, communities, and other academic institutions. The academe demonstrates a high degree of centrality second to DOST through its extensive collaborations with national government line agencies, including DOST, DA, DTI, DICT, and LGUs as its most active partners. It is also actively working with MSMEs, private industry, and TBIs from the industry sector for both knowledge and technology transfer to its partner communities through cooperatives and community organizations. Several of these collaborations are noted to be the most active by several partner institutions, indicating intensive interaction, resource exchange, and generous support by the SUCs.

LGU is the most critical broker, parallel with DOST, in terms of highest betweenness centrality in the network, particularly to those with weak connections to other institutions. This means that it sits on the shortest paths and the interconnection between unconnected pairs more than any other node. This indicates that LGU serves as the gateway to connect all other institutions to their common node of interaction, which is the community who is seen as the end user and receiver of all innovation endeavors. If LGU were to be removed, significant portions of institutions in the government-academe and government-community would be severed. This indicates that though DOST is more connected to well-connected actors, LGU is more connected to institutions with lower or weak connections. The presence of LGUs across all major stakeholders also contributes significantly to network density by facilitating dynamic interactions among otherwise disconnected actors. As a result, LGUs are instrumental in translating innovation policies and research outputs into tangible local development outcomes.

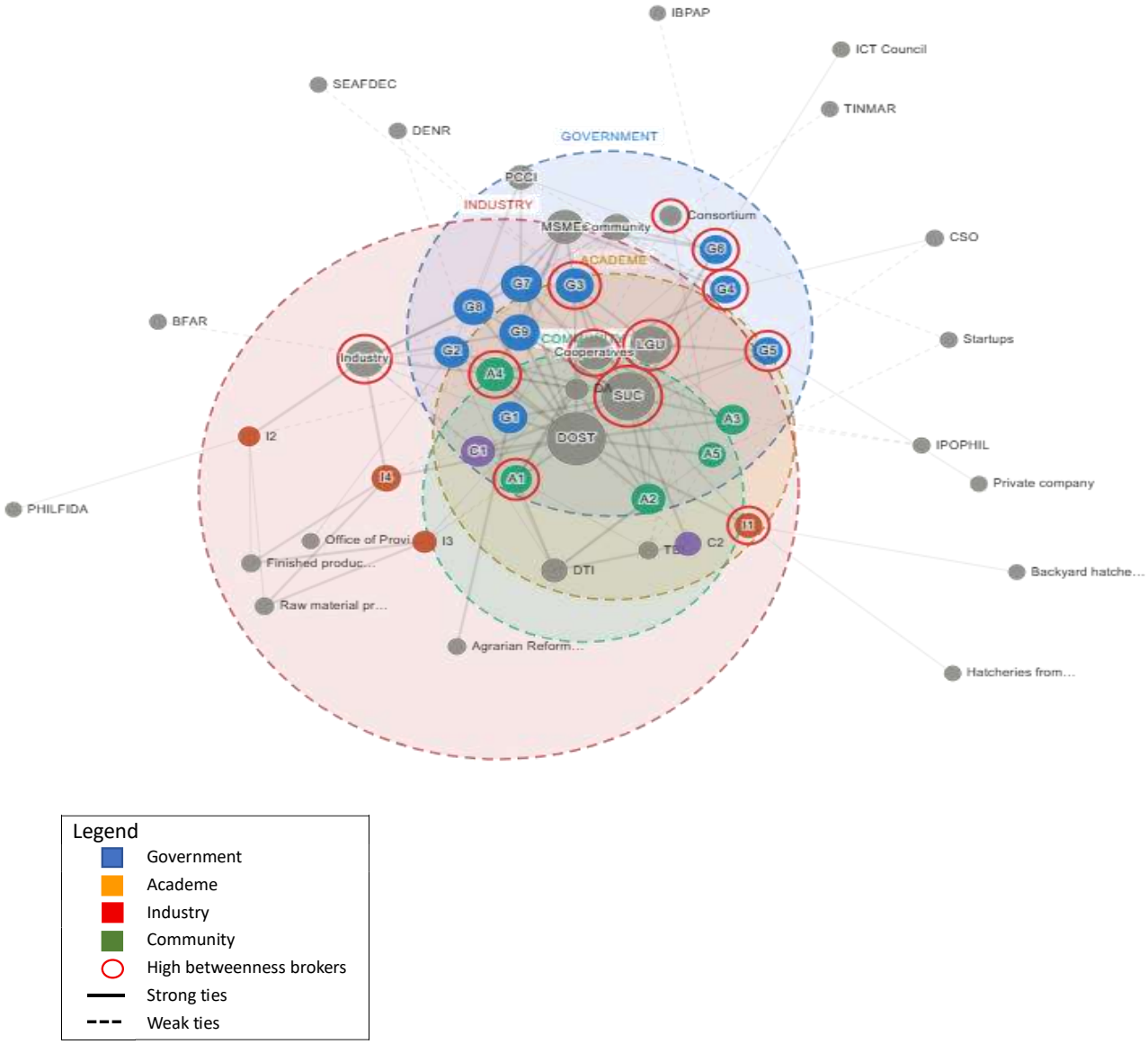
The industry sector occupies a moderately central but strategically important position in the RIS. Though it is also connected to several key stakeholders such as academe, government, and community, its degree of centrality is concentrated more on MSMEs, manufacturers, cooperatives, and processors. Participants from the industry are more connected to the community and other industries, indicating that it is embedded more in the network's core innovation cluster rather than the research and extension aspect. Their network density suggests that they operate mainly in facilitating the movement of technologies, products, and market knowledge. In comparison to academe and government, industry exhibits lower density as it is focused more on commercialization and production functions rather than broad system-wide coordination. This finding suggests that industry is more concentrated in

commercialization and market linkage in the RIS, making way for translating research outputs into economic value.

Centrality for the community is lower compared to other actors in the RIS because it is connected to nodes or institutions with relatively low connections or influence. Community organizers are seen mainly as end-users. Network density within the community is also low, indicating that direct connections among all other cooperatives or communities are also limited, signifying weak horizontal cooperative networks. For some cooperatives, they are seen as terminal nodes in the innovation diffusion chain rather than as central coordinating actors.

These findings suggest that the RIS network is strong in government-academe collaboration but still struggles to improve and fully integrate industry, community, and commercialization partners into the innovation system. The main function of the government is as a funding agency, and it has strong ties with the academe as the primary technology generator. Findings affirm this, as transcripts revealed that they have a highly supportive relationship frequently described by participants as “very supportive of each other.” However, this structural imbalance results in limited commercialization capacity and innovation diffusion bottlenecks. The strong government-academe interaction indeed creates a solid knowledge generation pipeline, but it remains underutilized for market transformation because industry and commercialization are inadequately integrated into the RIS structure. The RIS risks being a research-intensive but commercially weak system where innovation remains confined to the government and the academe cluster rather than permeating through industry channels to reach end-users and generate economic value. This undermines the quadruple helix model’s premise of integrating community and industry as active, equal partners in innovation creation (Zhang & Leydesdorff, 2020).

Figure 4.2. A diagram of the social network of RIS, illustrating the nodes representing the actors, the lines indicating the strength of relationship, and the circle encompassing the active clusters among the institutions comprising the social network of RIS.



SQ1.3. Communication and Interaction Modes

Most participants signify the harmonious and highly supportive relationship among all stakeholders as the most common theme. The relationship is characterized

by support, trust, resource sharing, and mutual benefits. This could be inferred from the interview transcript of the participants as presented in Table 4.4. The relationship among RIS stakeholders signifies high network cohesion and communication density, which are critical determinants of innovation system effectiveness from a social network perspective. This relationship is illustrated in Figure 4.3.

The smooth and easy communication among actors, as cited below, implies limited bureaucracy and reduced structural loopholes between nodes or institutions, enabling rapid information flow and idea sharing across the RIS. The statement "*We are supportive of each other*" and "*It (communication) is very smooth because it's mutually beneficial"* reflects high reciprocity in communication, where stakeholders have bidirectional resource exchange rather than unilateral transactions. The absence of *"rigid bureaucratic walls"* and the willingness *to "pick up the phone and ask an expert for help"* across institutions indicates high network permeability and weak institutional boundaries (government and academe), which are indicative of faster innovation diffusion and higher collaboration. This communication permeability enables cross-institutional collaboration among key stakeholders as they seamlessly integrate innovation initiatives, creating what Stejskal and Hajek (2012) term a functional governance framework in the RIS. The mutual support and resource sharing described by the participants demonstrate high social capital within the network, which is linked to enhanced innovation outcomes in the RIS.

"We are very supportive of each other."

"It (communication) is very smooth because it's mutually beneficial."

"Once you build rapport, bureaucratic channels are minimal—we just use Messenger or Viber."

"Whether you are from ____ (SUCs), or DOST, everyone is willing to collaborate. No rigid bureaucratic walls are preventing us from picking up the phone and asking an expert for help."

Specifically, communication among partner institutions was often described as generally effective, informal, and relationship-based. Belonging to a close-knit innovation community, people involved are generally acquainted with each other as they already have extensive experience in the innovation system. Due to this familiarity, communication is facilitated through both formal channels (MOA, emails) and informal channels (Messenger, Viber), resulting in efficient coordination and stronger interpersonal trust.

"With us here, everyone is warm and approachable."

"It's more casual but still professional. However, if we need official documents, we use email and MOAs."

Figure 4.3. An illustration of the Interaction of identified key actors and the strength of their interaction with other stakeholders in the RIS.

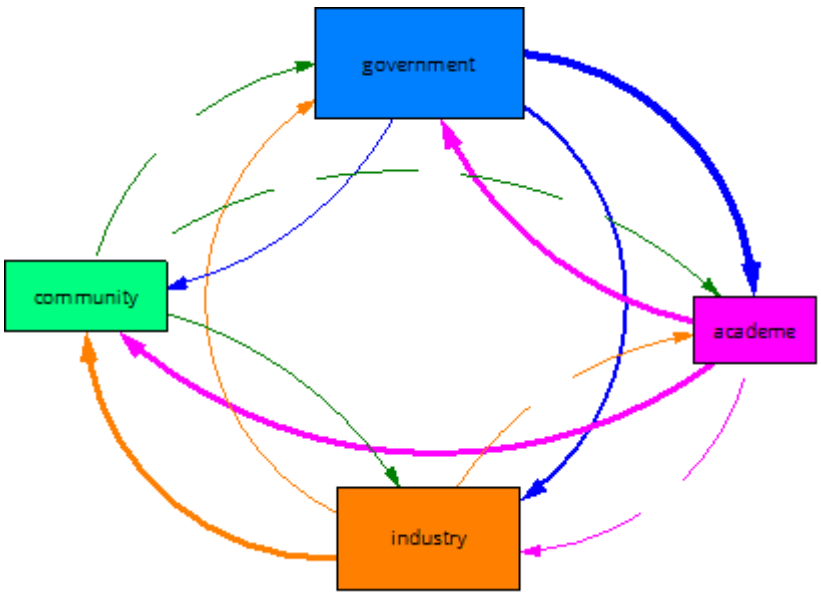


Table 4.4

Thematic Analysis of the Communication and Interaction Modes in RIS

Theme	Category	Code	Keywords	Key Quotations
harmonious and highly supportive relationship and smooth communication among actors	Relationship characteristic	Supportive relationship	supportive	"We are supportive of each other"
		Warm and approachable relationship	Warm and approachable	"Diri sa aton, ka-warm kag approachable ang tanan."
	Communication characteristic	Smooth communication	Smooth and mutually beneficial communication	It (communication) is very smooth because it's mutually beneficial"
			Smooth communication flow	Communication flow itself isn't a problem.
			Chat for communication	The form of communication is okay, Ma'am, especially with DOST and Sir ____, if we need something from them, I just chat with them.
		Well established rapport and communication channel	Rapport; no bureaucratic channels	"Once you build rapport, wala na gawa bureaucratic channels—we just use Messenger or Viber."
			no rigid bureaucratic walls	"Whether you are from ____ (SUCs), or DOST, everyone is willing to collaborate. There are no rigid bureaucratic walls preventing us from picking up the phone and asking an expert for help."
		Casual and professional communication	Casual and professional	"It's more casual but still professional. However, kun needed ang official documents, we use email and MOAs."
		Open communication	Open communication is important	Communication is the most important. Open communication and trust-building are the only ways to solve problems.

SQ1.4. Structural Gaps and Challenges

Dashed edges and outlying nodes in Figure 4.2 indicate that collaboration is nominal rather than functional among these institutions. Taklong Island National Marine Reserve (TINMAR), Department of Environment and Natural Resources (DENR), Southeast Asian Fisheries Development Center (SEAFDEC), Bureau of

Fisheries and Aquatic Resources (BFAR), private companies, TBI, startups, Philippine Fiber Industry Development Authority (PhilFIDA), and Information and Communications Technology (ICT) Councils all have a low degree of centrality and betweenness, confirming that they are peripheral actors with single-stakeholder connections and no bridging function in the RIS. They have no linking capacity to facilitate information flow across social networks, creating a gap or dead end in the system.

Their peripheral status implies that they lack network brokerage functions and operate as terminal nodes rather than connectors or gateways. Their engagement in the RIS is low, tethered to only one to three stakeholders at most. This indicates that these actors have limited access to diverse knowledge in the system and are susceptible to knowledge lock-in. They cannot effectively diffuse innovation across clusters, reducing potential innovation reach, and they represent structural isolation that may require intervention to strengthen connectivity.

Startups and private industries, despite being end-recipients of technology transfer, are barely embedded in the network, confirming what the majority of the KII repeatedly flagged: industry engagement is being approached as an afterthought rather than as a co-ideation partner from the onset of the innovation process. DENR node signals that the environmental component is not yet strongly integrated into the innovation agenda, either meaning that researchers in the region may be proceeding without ecological grounding or that they do not yet find the need to seek DENR compliance. PHILFIDA's isolation alone reveals that the fiber and textile value chain is weakening as yarn production is steadily declining due to the decade-long decrease in domestic cotton production (Trading Economics, 2024; Report Linker, 2026) and the closing of a yarn spinning company in the country (Bureau of Customs, 2016). It is

notable, though, that the DOST-PTRI is making efforts to revive the fiber and textile industry in the region by establishing micro-scale spinning yarn production, which could entail the possible strengthening of its network in the coming years (PTRI, 2019).

Further structural gaps were inferred by the actors as presented in Table 4.5. A commonly emerging theme in terms of challenges in collaboration is weak industry engagement and commercialization. Although research outputs are being generated, several KIIs divulged that they are not market-ready. Industry adoption, startup creation, and commercialization remain weak. This poses the biggest and most pressing hurdle in the RIS. Several SUCs admitted that they still lack takers for their research outputs and that they struggle to find industry to market their products.

“Private industry remains a significant challenge”

“There are not many commercial 'takers’ here.”

“We seriously lack private startup spin-offs.”

“Most of our available technologies don't fit; they don't fit the needs of the industry.”

“Commercialization is rare.”

“We are the ones pushing them (industry) to commercialize our product.”

The root causes of weak industry adoption and commercialization lie in the structural misalignment of how research is designed and what the industry actually needs. The SNA data confirms this: private industry has the lowest eigenvector centrality in the network, meaning it is not only poorly connected but also connected to actors who are weakly positioned, as they sit outside the influential sphere where research agendas are set. When research agendas are determined only by governing regulatory bodies or institutional boards without the inclusion of market demand

signals, the resulting output will be “technology push” rather than “demand pull.” This mismatch is best captured in the transcript: *“most of our available technologies don’t fit, they don’t fit the need of the industry.”*

As a result, most technology deployment is being assumed by LGUs through extension programs and donations rather than market creation, as acknowledged by one participant: “*usually, with LGUs, the mode of technology transfer is through deployment or extension; commercialization is rare."* The result is a system that produces output without producing enterprise or return on investment. The inverted dynamics, where SUCs and research centers chase commercial takers rather than the reverse, signals the absence of entrepreneurial culture in the RIS system. With the low involvement of industry in the innovation process, the RIS is at risk of being a closed loop-generating intellectual property, publications, and prototypes that accumulate over time without economic translation. RIS policy interventions must “pull” private industry, startups, and TBIs into the core network to initiate and strengthen programs like industry challenge grants, pitching sessions, and co-investment schemes that would give industry actors, particularly MSMEs of local entrepreneurs, incentives or business opportunities to become genuine partners and not just passive recipients.

Another commonly occurring challenge is the limited LGU prioritization and funding for science and technology initiatives. Political support and funding from LGUs vary significantly, affecting project sustainability. Though most transcripts divulged active LGU support for S&T programs, only a few actually provided funding to establish a startup, instigate the commercialization process, or assume monitoring and continuity of government-funded projects once funding ends. Most transcripts noted that S&T is frequently not a top priority at the municipal/provincial levels, leaving

resource mobilization dependent purely on whether individual local leaders happen to have the political will to support it.

> *"Currently, S&T isn't a top priority for most local government units."*
>
> *"Science and Technology (S&T) would become much more mainstream if LGUs prioritized it at the municipal and provincial levels."*
>
> *"But with LGUs, it is very rare to find one that will actually provide funds."*
>
> *"Here in ____, the Mayor did not face us; he/she just send a staff during the planning. DOST has an ICT office in ____ that developed a "Smart Gov" system. It handles HR and online communications to make things faster. We offered this to LGUs for free—even just the HR management system with facial recognition. But in _____, we found out they bought a separate HR system—old biometrics—for 1 million pesos."*

Table 4.5

Thematic analysis in the structural gaps and challenges in RIS

Theme	Category	Code	Keywords	Key Quotations
Low startups and private industries involvement	Weak and inactive startups in the region	Lack of startup and spin-off companies in the region	Lack of startup and spinoff	"We seriously lack private startup spin-offs."
		Inactive startups in some provinces	Not active in startups	Regarding startups, we aren't as active in terms of activities compared to what is happening in Iloilo right now.
Weak industry engagement and commercialization	Weak industry linkages	Low Industry partnership	Challenge in Private industry	"Private industry remains a significant challenge"

		Lack of commercial takers	No commercial takers	“There are not many commercial ‘takers’ here.”
	Technology mismatched to industry needs	Low commercialization of technology	Rare commercialization	“Commercialization is rare.”
		Mismatch technologies to industry needs	Technologies don’t fit the needs of industry	“Most of our available technologies don't fit; they don't fit the need of the industry.”
		Technology push to industry	Pushing product commercialization	“We are the ones pushing them (industry) to commercialize our product.”
Limited LGU prioritization and funding for science and technology initiatives	Lack of return of investment	Technology deployed as extension projects in LGUs	Technology transfer is mostly extension among LGUs	“Usually, with LGUs, the mode of technology transfer is through deployment or extension;
	Lack of support and funding for S&T initiatives by LGU	Unprioritized S&T initiatives	S&T not top priority	“Currently, S&T isn't a top priority for most local government units.”
		Unprioritized S&T initiatives	LGUs do not prioritize S&T	“Science and Technology (S&T) would become much more mainstream if LGUs prioritized it at the municipal and provincial levels.”
		Lack of funding for S&T	Rare funding from LGU	“But with LGUs, it is very rare to find one that will actually provide funds.”
	Lack of support among LGU leaders	Lack of collaboration and cooperation from LGU officials	LGU officials do not collaborate with PSTO for free SMART Gov Technology adoption	“Here in ____, the Mayor did not face us; he/she just send a staff during the planning. DOST has an ICT office in ____ that developed a "Smart Gov" system. It handles HR and online communications to make things faster. We offered this to LGUs for free—even just the HR management system with facial recognition. But in _____, we found out they bought a separate HR system—old biometrics—for 1 million pesos.”

SRQ 2. What do the actors identify as drivers and barriers in their collaboration within the regional innovation context?

SRQ 2.1. Low Commercialization of Research and Development Outputs Theme

The most prevailing barrier in the collaboration among actors is evident in the low commercialization of research and development outputs among SUCs and research centers. Using the Iceberg Model Framework of analysis, this condition shows that commercialization is not failing because of one isolated barrier but because the whole research-to-market system is misaligned. Table 4.6 supports these findings.

Events. At the events level, visible symptoms or immediate occurrences in the system were identified. The primary issue is the stagnation of academic research within university archives, although complemented by intellectual property (IP) generation, with negligible market adoption. Almost all universities reported a significant increase in IP filings for patents, utility models (UMs), and industrial designs; the majority of these outputs failed to transition into viable commercial products or services. Even to date, these IP filings, specifically patents, UMs, and industrial designs, still fail to fetch a return on investment to cover the cost of their expenditures. The majority of these developed technologies are not yet successfully commercialized. In the academe, these IP filings remain only in papers where social and economic impact remains unrealized, particularly among potential beneficiaries. Participants attested:

> *"Most of our patents are not commercialized… we have filed a patent successfully, but there is no market for it. It is not commerciable."*

> *“Of course, here in the academe, our goal is that research should not only be in papers.”*

Several obstacles were identified to hinder the commercialization of these technologies, as reported by most participants. Most of them noted that the biggest challenges lie in the lengthy technology development process, the rigid regulatory

testing and evaluation process, and the stiff documentary requirements for the Fairness Opinion Board, non-disclosure agreements, licensing agreements, royalty sharing, MOAs with partner institutions, and other financial and liquidation procedures. One participant shared:

> *"Our major issue is the compliance of FOB requirements. It is discouraging for partner industries, particularly if lawyers are involved."*

Patterns of Behavior. Research-to-industry mismatch and low startup formation are the recurring themes inferred by most participants. These inferences imply that there is still a gap between the academe and the industry in the crucial stage of technology transfer and upscaling toward commercialization. This condition should be addressed as it limits the diffusion of research outputs into marketable products, ultimately decreasing economic and societal impact. Due to the low market viability of these technologies, the formation of startups among technology generators could never materialize as it lacks market feasibility. Consequently, most local MSMEs and investors remain cautious in adopting these products or technologies as they do not project a promising steady income stream or economic gains.

> *"Most researchers would develop technology, but later, we will just find out that it is not the actual need of the industry and the market."*

> *"There are not many startups and spin-offs established and had been successful in the region."*

Underlying Structures. Underneath the research-to-industry mismatch and low startup formation issues are underlying institutional factors that impede the commercialization pathways. As inferred from participants, structural causes pointed to inadequate initiatives by academe, industry, and government to strengthen the weak

academe-industry linkages, augment the limited manufacturing capacity in the region, and implement promotion evaluation criteria that would adequately incentivize commercialization efforts to encourage an entrepreneurial mindset among the researchers. These findings imply that the bottleneck in commercialization is not just a one-sided weakness of one institution, but a deeper structural and institutional limitation. It is a connected problem that needs collaborative effort.

"The researcher doesn't always know the actual problems of the industry. Also, the industry doesn't know how to communicate with our researchers and inventors."

"So, the link between the academe, the industry, and the LGUs (Local Government Units) is not that strong."

"There is a lack of a link between the industry sector and the academe."

"There are not many manufacturing companies or industry here in the region."

"The whole region is not that focused on manufacturing; it is more on services (provision). So there are not many manufacturing companies here."

DTI (2018) noted that a possible cause for the stalling of commercialization of university-developed technologies is inadequacy in the number of personnel in technology transfer offices to assist university-based researchers and inventors in the intellectual property protection and commercialization process. The common scenario in the academe is that research, commercialization, and policy gaps continue to prevail despite the high patent filing activities.

Academe does not have the infrastructure capacity to scale up locally developed technology; thus, they have to secure partnerships with manufacturing

companies for mass production. Failure to mass-produce products is attributed to the region's limited industrial and manufacturing plants to produce the market-demand quantity, so researchers would instead opt for industries from other regions, which would entail additional logistics costs. Additionally, technology transfer procedures require a tedious and hefty documentary process for compliance to regulating bodies. The excessive amount of paperwork and documentary and financial requirements discourages industry partner participation. This creates a barrier and a shade in a supposed collaboration between industry and academe for commercialization efforts (Siegel et al., 2003; Lundvall, 2010).

Specifically, transcripts showed another institutional challenge, particularly in the promotion systems that reward patent filing or publication more than actual commercialization. The institutional criteria for career advancement (National Budget Circular or NBC 461 and the DBM-CHED Joint Circular or JC No. 3, s. 2022 - Faculty reclassification in State Universities and Colleges) heavily incentivize the initiation and filing phases of research rather than its utilization, including the social and economic returns. Once a patent is filed and points are secured for promotion, there is no structural reward to push it to market, as spin-off policy is still being deliberated among SUCs in the region.

> *"They only seem to get motivated because of our JC [Joint Circular/Promotion system]. Yes, so they can get points. Yes, that's true. So, it seems to stop there at filing."*

> *"Faculty members do not have compelling reasons to commercialize because IP applications are already enough for promotion. Why would they be burdened to commercialize when they could not gain certain points out of it? Plus, it needs a lot of paperwork."*

Among the SUCs, the identified structural barrier that discourages researchers and inventors from furthering their research toward commercialization is the rigid promotion evaluation criteria, which do not give enough attribution to commercial deployment of technology but are more inclined toward scholarly outputs. This discourages researchers who would vouch for the difficulty of the commercialization process and would instead opt to prioritize academic outputs since it requires less effort to comply. This situation highly diminishes the desire to pursue entrepreneurial inclinations in the academe and instead promotes a risk-averse attitude toward business, as they would rather opt to expend their effort on accomplishing scholarly output over economically risky startup establishments. Literature supports these inferences, suggesting that these institutional occurrences in the innovation system can highly dissuade actors from engaging in entrepreneurial action (Cunningham et al., 2022).

Mental Models. Deeply ingrained cultural and cognitive factors contribute to the persistence of these challenges as they influence the perceptions and attitudes of the actors. Mental models are the underlying causes of these issues according to the Iceberg Model Analysis. One mental model uncovered by this study is the disparity in the mindset between a researcher and a businessperson. Whereas researchers are adept with technical knowledge and skills characterized by their accuracy, rigor, and empirical soundness in their iterative experimentation, this contrasts with entrepreneurs who prefer to work in a speedy, time-bound, opportunity-grabbing, and risk-taking manner. These two actors have contradictory work conditions, prompting them to diverge in their beliefs and attitudes. Researchers and scientists are trained to go by the book, be methodical, and achieve consistency and precision in research. By contrast, entrepreneurs are decisive and rapid in pursuing any business and profit-

generating opportunity. They are also used to working with iterative failures and are more tolerant of risk. This comparison illustrates the stark contrast in the mental model of these two integral actors in the system. One participant's description of this contrast was:

> *"Businessmen are opportunistic; they always grab opportunities to make money. They are often impatient and cannot wait for our technology. The researchers have a different mindset and pace in working."*

The institutional barriers are deterrents to the flourishing of an entrepreneurial mindset among the researchers. Certain measures had to be adopted by universities to promote entrepreneurial ideation and slowly familiarize researchers with the business rigors, mindset, and environment. Entrepreneurial culture could only thrive in a supportive ecosystem where stakeholders are encouraged to take on a proactive and open-minded stance to learn the skills and knowledge of establishing a business. The universities' stance on promoting technology transfer highly influences the prevailing cultural norms in the academe and could eventually affect the researchers' perception toward change and uncertainties accompanying startup formations (Stam & Van de Ven, 2021; Spigel & Harrison, 2018).

Another perpetuating negative stigma about startup formation in the academe is the firm belief that research and extension are just the core functions of the faculty members aside from instruction. This is legally true, as is the mandate of CHED among higher education institutions. Commercializing technology is viewed as an additional burden and an optional task, as they are already overloaded with academic assignments. For them, economic impact is attained only through scholarly outputs and eventual promotions, not through side income gained through risky business

pursuits. Thus, they are hesitant to engage in business. This was noted by one industry participant:

> *"At first, I heard some say, 'Oh, she's doing business now, that's not research anymore. When we are in the university, publications are what count."*

Several academe participants corroborated this mental model, noting that veteran researchers or senior teachers expressed the view that *“it's not our responsibility to commercialize; that is beyond our duties and responsibilities as faculty and researchers.”*

This “researcher identity” mental model is most likely to produce a common outcome: even when technologies are patent-ready and commercially viable, the researchers who developed them have a high tendency not to pursue commercialization, leaving a gap in the technology transfer cycle. Etzkowitz and Leydesdorff (2000) characterize this as the dominance of knowledge production norms common among the academe, where professional and scholarly value are defined exclusively by peer recognition and publication impact, but any entrepreneurial orientation is not part of their function. Unless this mental model has dissipated, recognizing commercialization as an essential scholarly impact will always be a barrier.

As an overview of these findings, commercialization outcomes require more than just improving the organic infrastructure, augmenting funds for research projects, or implementing institutional policies. It requires transforming the mindset of the people as reflected in their beliefs and values, as this could greatly affect their stance toward commercialization. Establishing an entrepreneurial culture by cultivating a risk-tolerant and business-minded environment could encourage more faculty members to engage

in research leading to commercialization. When actors feel that their efforts are supported and eventually rewarded by their own institution, they would be willing to invest effort and resources to progress their work beyond the research stage (Cunningham et al., 2022).

Consequently, fostering an entrepreneurial culture, encouraging calculated risk-taking, and promoting shared ownership of innovation among community, researchers, industry actors, and government institutions are critical for developing a more dynamic and commercialization-oriented innovation system (Stam & Van de Ven, 2021; Cunningham et al., 2022).

Table 4.6

Thematic Analysis of Low Commercialization of R&D Outputs

Theme	Iceberg Level Category	Code	Key Quotations
low commercialization of R&D outputs	visible events and immediate occurrences in RIS	patents not commercialized	*"We have patents that are not commercialized… you get a patent but it's not commercializable"*
		increase in IP filings for patents, & UM	*"There is an increase in IP filings for patents, UMs and industry design because they are key to promotion among faculty."*
		Bureaucratic tech-transfer process (FOB, valuation)	*"Our major issue is the compliance of FOB requirements. It is discouraging for partner industries, particularly if lawyers are involved."*
	recurring patterns of behavior	Research–industry mismatch	*"Most researchers would develop technology, but later, we will just find out that it is not the actual need of the industry and the market."*

	low start-up formation	*"There are not many startups and spin-offs established and have been successful in the region."*
underlying processes and systemic structures producing the pattern	weak academe-industry link	*"The researcher doesn't always know the actual problems of the industry. Also, the industry doesn't know how to communicate with our researchers and inventors."*
	limited manufacturing capacity in the region	*"There are not many manufacturing companies and plants in the region."*
	rigid promotion evaluation disincentivizing commercialization	*"They only seem to get motivated because of our JC… so they can get points. So it seems to stop there at filing."*
		"Faculty members do not have compelling reasons to commercialize because IP applications are already enough for promotion. Why would they be burdened to commercialize when they could not gain certain points out of it? Plus, it needs a lot of paperwork."
ingrained mental models and attitudes that maintain the structure	Business-research mindset gap (speed vs. rigor)	*"Businessmen are opportunistic; they always grab opportunities to make money. They are often impatient and could not wait for our technology. The researchers have a different mindset and pace in working."*
	Researcher identity	*"Faculty members do not have compelling reasons to commercialize because IP applications are already enough for promotion. Why would they be burdened to commercialize when they could not gain certain points out of it? Plus, it needs a lot of paperwork."*

SRQ 2.2. Stakeholders' Receptiveness to New Technology

Stakeholder receptiveness to emerging technology and their willingness to engage in new business ventures are pivotal determinants of whether research and development (R&D) outputs successfully transition from research laboratory settings into productive, market-oriented applications. Thematic analysis in the identification of this emerging theme is presented in Table 4.7.

Events. The abandonment of technologies after project funding ends constitutes a glaring visible event that signals deep-seated receptiveness problems. One government participant described events of equipment handover followed by immediate disuse, which happened quite a few times already:

> *"I've seen many instances where the equipment was already turned over, but because there was no local ownership or policy, the machinery just ends up idle and reverts to government inventory. There is no impact."*

Abandonment of this funded technology constitutes a glaring gap in the technology transfer process because it merely proves the unsuitability and inadequacy of the technology to meet the technological needs of the farmers. This is proof that most researchers develop technology without prior communication with the industry or community adopters. Despite the ample time given to the farmers to subject the machines to trial testing, several indicated their insufficiency of operation compared to manual labor, which they are accustomed to. A participant from the academe narrated this event in the introduction of government-funded mechanical scrapers to pineapple farmers:

> *Some farmers gave feedback that the solutions provided by the machine are not necessarily better. Many of them still prefer to work manually,*

particularly in extracting fibers from pineapple leaves, as they could yield more high-quality fibers. They are considering the trade-off. Even if the machines could work faster, they do not produce quality products that are highly valued. Machines also lack the meticulousness and care of farmers, and they are complaining because there is more wastage or surplus of materials."

These visible challenges stemming from the community sector and academe sectors are actual crises occurring from the early stage of ideation and the later stage of transfer. This indicates that in between these stages, no intervention or communication has been conducted to fine-tune the technology according to the specifications of the end users.

Patterns of Behavior. Discontinued use of technology after its transfer leads to patterns of repetitive behavior among adopters. Particularly among farmers, they became hesitant to accept newly introduced technologies because of repeated unsuitability of the machine to their actual needs. As a result, they would often require visible and proven proof if they wanted to adopt new machinery, engage in new business ventures, or even just participate in programs on innovation. One participant voiced:

"Farmers are not easily convinced because they are going to look for proof first. We have to convince them and gain their trust that these innovations are indeed working."

Cease of operation and dissolution of cooperatives are repeated events in the community. Most participants shared this observation all across the region. Despite strong support by the local government unit and other agencies, many cooperatives ceased to function after just a few years of operation for various reasons. One

participant who worked closely with cooperatives for years described this frequent occurrence:

> *"Some cooperatives in the community have difficulty in augmenting their incomes. Others may start successfully as many members are volunteering and working together. However, members began fighting with each other once they started earning. This is the main reason why many cooperatives just disappear after a few years of operation."*

Underlying Structure. These repetitive occurrences stemmed from structural causes. Community-based cooperatives have predominantly low income due to unorganized financial management and small-scale business. In terms of individual farmers, they are also reported to have low income in their harvest production. Financial constraint is the prevailing institutional issue preventing them from expanding their business or purchasing new technology. One participant highlighted this concern among farmers and MSMEs:

> *"The investors and farmers are already taking a big financial risk. They don't have 'extra' money to gamble further by introducing new technologies."*

Potential adopters, particularly MSMEs and farmers, perceived innovation adoption as financially risky because they already operated under limited resources and uncertain returns. Financial risk is not something they would easily embrace. Participants from the government and academe sectors described a familiar scenario:

> *"In here, the MSMEs and farmers are already taking a big financial risk in production. They don't have extra money to risk further by buying new technologies. That is one of the challenges."*

“Another issue is, mango in particular, the production is very risky already in itself given that it is very dependent on weather. So recently, the weather has been very unpredictable unlike before when we say dry season, it is really very hot throughout. Nowadays, we experience storms in February with heavy rainfall. And that is exactly the time when trees are flowering so the rain will really damage it. So right there alone, there is already a lot of risk to the money that our investors and farmers put in. There is really nothing extra left for them to take on more risk by introducing new technology.”

Another consequential structural force generating low technology receptiveness is the mismatch between the technologies being introduced and the actual, immediate needs and livelihood realities of target communities. A participant from academe described: *'The technology we introduce does not address their immediate daily needs.”*

Another structural hindrance is the role of actors at home and in society, particularly among women beneficiaries. Despite the free livelihood trainings based on technology adoption programs, many women participants still refused to participate or would just attend sporadically. One participant from the government sector who would always spearhead this kind of program narrated:

“Most of our target participants are mothers from the barangays. They have lots of responsibilities at home like tending to their children, taking care of their livestock, and cooking for their family. If the schedule of our training conflicts with their household work, they would choose their family responsibilities first because, for them, they have to prioritize their survival. We just have to adjust our schedule to their daily routine.”

In one study, Rogers (2003) specified that the present needs and past experiences of the beneficiaries should be met by the technology to increase the adoption possibility. If technology or innovation interferes with the daily events of the adopters, they would easily be dissuaded, particularly if it could affect their main income stream, household duties, role in their social circle, and deeply embedded traditions.

Mental Models. Technology adoption remains a crucial issue in the innovation process as acceptance remains low, particularly among industry and community sectors. In the community, innovation and technology are largely perceived as an existential threat, not so much as an opportunity. People are averse to new ideas or concepts and are hesitant to change their established practices just to learn new things and adapt. Technology adoption is considered a disruption that could unhinge the comfort and equilibrium in the livelihood of the people in the community. It challenges their time-tested practices in labor and livelihood. One participant articulated:

> *"Our biggest challenge (in technology adoption) is the mindset of the people. They are afraid to try out new things and to change."*

This existential fear, caused by repeated adoption failure and end users' aversion to change, undermines and devalues technology. Despite the awareness and promotional campaign to endorse the technology, this psychological condition sets back all efforts. They became selective and biased as they weighed potential benefits against their perceived threats and risks. This condition is reflected in several responses from the participants:

> *"They are afraid of change."*

"Many adopters are resistant to change because they have doubts about everything new. They are hesitant to try out new technologies. They have fear and anxiety over them because they are still untested."

This fear is mostly apparent with farmers and fisherfolk from remote and isolated areas or small communities who are not exposed to modern technology. For them, adoption of new machines for farming is a significant disruption to their time-tested farming practices and ingrained cultural beliefs (Fisher et al., 2021).

All these psychological conditions and deeply embedded cultural beliefs imply a mental model of risk minimization and self- preservation in decision-making among the concerned actors. Indecisiveness to adopt innovation stems from the mental conditioning that they have to avoid risks and threats as they preserve their own comfort and accustomed ways. Similarly, this mental conditioning, particularly low risk tolerance and lack of entrepreneurial mindset, constrains innovation adoption and entrepreneurial pursuit of actors in emerging innovation ecosystems (Stam &Ven de Ven, 2021).

Another prevailing belief among the community is that government provision of technology and other services will always be available to them and that, as constituents, they are entitled to these free programs without due financial obligations or counterpart. This mindset was shaped because of prolonged dependency on government assistance, making the people accustomed to such arrangements. They are used to free services and dole-outs without any obligatory returns. One participant noted:

"*People in the community see technology adoption or innovation as a financial risk, and they do not want to invest. They are already used to the idea that everything given to them by the government is free.*"

However, one government participant cautioned about the psychological consequence of this dependency. No value is ascribed to technology or services if beneficiaries would acquire them easily and for free.

"One issue about this condition is that if it is always free, people do not see its value. Sustainability is an issue because people do not value our technology, and they did not work hard for it."

Another participant noted that prolonged dependency led to habitual reliance on external support rather than initiating or augmenting their own business. They prefer easier options in dealing with their business pursuit, which is oftentimes relying only on grants and services offered by government agencies like DOST and universities.

"Many beneficiaries prefer the easy way. They do not want to do the hard work of keeping their business rolling or upscaling it because they expect that the government will keep giving them free services or grants."

This mental conditioning cannot be blamed on the community actors alone. The government has its fair share of accountability as it is the root cause of proliferating this mindset. Some participants acknowledged this issue:

"We have to slowly inculcate among people that not all of the government programs and technology will always be free of accountability. This is a deep-seated belief that is hard to break because free provisioning goes back decades. People are deeply conditioned into this habit."

"People are thinking that government provisioning will just be free forever."

This recurring mental mindset implies the prevalence of a dole-out mentality among some actors within the ecosystem. Prolonged and heavy reliance on government programs, although helpful in some sense, failed to fully inculcate independence among the beneficiaries, particularly in initiating their own enterprise. They see government provision as a right, not a reciprocal investment or a pathway to self-reliance. This prevents them from gaining self-sufficiency. Some participants attested:

"Beneficiaries just want to keep on receiving."

"There is widespread and hard-set 'dole-out' mentality among the community. People just rely mainly on the government.

These values are exhibited even in some minor encounters as narrated by one participant in a post-implementation event of one government project:

"They do not talk to us anymore because they could no longer get anything from us since the project has already ended. They just want to keep receiving on and on."

One study noticed this prevalent psychological mindset among Filipinos, particularly those who have enjoyed decade-long government assistance. The study affirmed the discussions herewith that prolonged unconditional provision without any counterpart could lead to failure in imbibing a self-sufficiency attitude among the beneficiaries. Moreover, this exacerbates beneficiaries' dependence on continued assistance, particularly in government technology programs (Yusingco, 2015).

Table 4.7

Thematic Analysis of Stakeholders' Receptiveness to Technology Adoption

Theme	Iceberg Level Category	Code	Key Quotations
Stakeholder's receptiveness to technology adoption	Visible events and immediate occurrences in	Equipment turnover post-funding project	*"I've seen many instances where the equipment was already turned over, but because there was no local ownership or policy, the machinery just ends up idle and reverts to government inventory. There is no impact."*
			Some farmers gave feedback that the solutions provided by the machine are not necessarily better. Many of them still prefer to work manually, particularly in extracting fibers from pineapple leaves, as they could yield more high-quality fibers. They are considering the trade-off. Even if the machines could work faster, they do not produce quality products that are highly valued. Machines also lack the meticulousness and care of farmers, and they are complaining because there is more wastage or surplus of materials."
	recurring patterns of behavior	internal conflicts	*"Some cooperatives in the community have difficulty in augmenting their incomes. Others may start successfully as many members are volunteering and working together. However, members began fighting with each other once they started earning. This is the main reason why many cooperatives just disappear after a few years of operation."*
		preference for proven solutions	*"Farmers are not easily convinced because they are going to look for proof first. We have to convince them and gain their trust that these innovations are indeed working."*

underlying processes and systemic structures producing the pattern	financial constraints among farmers and MSMEs	*"In here, the MSMEs and farmers are already taking a big financial risk in production. They don't have extra money to risk further by buying new technologies. That is one of the challenges."*
	mismatch in between technology and needs of community	*The technology we introduce does not address their immediate daily needs."*
	conflicts with livelihood imperatives	*"Most of our target participants are mothers from the barangays. They have lots of responsibilities at home like tending to their children, taking care of their livestock, and cooking for their family. If the schedule of our training would conflict with their household work, they would choose their family responsibilities first because, for them, they have to prioritize their survival. We just have to adjust our schedule to their daily routine."*
ingrained mental models and attitudes that maintain the structure	"dole-out mentality"; dependency mindset	*""There is widespread and hard-set 'dole-out' mentality among the community. People just rely mainly on the government.* *"They do not talk to us anymore because they could no longer get anything from us since the project has already ended. They just want to keep receiving on and on."*
	Afraid of change; Risk aversion	*"Our biggest challenge (in technology adoption) is the mindset of the people. They are afraid to try out new things and to change."* *"They are afraid of change."* *"Many adopters are resistant to change because they have doubts about everything new. They are hesitant to try out new technologies. They have fear and anxiety over them because they are still untested."*

SRQ 2.3. Discontinuity of Technology Adoption Initiatives

This is another prevalent issue inferred from the actors' perception of RIS, as it affects the four fundamental institutions in the system. Despite the effort of funding, investment of time, and concerted energy on collaborations, the majority of technology adoption initiatives launched failed to sustain and endure beyond their target implementation. This recurring unsustainability and discontinuity of technology adoption issues occur uniformly in almost all kinds of innovation, such as farm implements, food product value-adding, MSMEs development, and cooperative-based livelihood programs. Table 4.8 reflects this analysis.

Events. Several observable failures could be easily discerned in the rising number of discontinued government-funded projects. Actors unanimously reported experiencing this phenomenon across all sectors but mostly in the community. One government participant detailed this situation on several projects involving LGU partners:

> *"As much as we would have wanted our projects to be successful, most of them are discontinued and unsustained. We are assuming that after our project and funding ended, the LGU would take over and continue sustaining the projects, but it is not what usually happens."*

Participants, particularly those who are involved in government Grants-in-Aid, expressed optimism that LGUs' assumption of post-project implementations would ensure long-term sustainability. Local government units have direct connections and engagements with the people in the community, thus could exercise due influence and supervision over the projects through their assumed offices.

“Unless our programs are supervised by a government agency post-project, unless it would be adopted by the local government… by then, we could probably guarantee sustainability.”

“We are expecting the LGU to assume our project once our contract ends after three years. However, if they do not have enough resources or political leaders change, and the new ones do not appreciate our project, our project would just die.”

Participants also acknowledged that LGU project takeover would be met with several obstacles. They inferred that LGUs already have their own set of priority programs and projects, making it hard to add or insert unanticipated project monitoring to their existing workload. In addition, their budget may already be allocated to other programs and services, leaving limited room to support the project further.

“LGUs have very limited budgets.”

“Science, Technology and Innovation is not a major part of the plans of municipal LGUs yet.”

“Sometimes their perception (LGU) is that when we provide projects to LGUs, it’s just "added work" for them, rather than seeing the potential impact on the community.

“Science and Technology (S&T) would become much more mainstream if LGUs prioritized it at the municipal and provincial levels.”

A second visible event was the high rate of raw material wastage during processing and undersupply or shortage, which is a direct, measurable consequence of low and inconsistent yields from the farming production line. Participants from the

industry specifically noted that local yields of raw materials are low, particularly in yarn production, as the produce is still from another region.

"Not many people plant cotton here anymore. We get them from Negros."

Additionally, the quality of raw materials could not even be assured. This leads to high wastage during the processing stage — a quantifiable production event that erodes the economic viability of continued operation.

"The cotton fiber still has many seeds. It was not processed well."

"We need to look at the quality of the raw materials or else we will be left with so many substandard materials which we could not use. This wastage is going to cost us a lot. There are also cases when they send us packed raw materials saying they are all high quality. But when we open them, only the outside of the bulk is of quality but the inside materials, they are low grade. We need to avoid this."

"We have to see how they process pineapple leaves and make sure that they remove all the residues. We are buying fibers per kilo, so we want to make sure that the raw material is worth it or else most would just go to waste."

The persistent undersupply and disregard for the quality of raw materials is highly evident at the grassroots level. More often, industry interventions are needed to ensure that the raw materials supplied are derived from good genetic resources. This entails tight supervision of crop production through partnership with farming communities. Though this could result in more benefits to the farmers, it could not fully sustain the growing demand for quality raw materials to augment product manufacturing at the larger scale. There is still a persistent gaping undersupply of

quality raw materials for some manufacturing sectors in the region, particularly in yarn production. Participants repeatedly described how raw materials quality is compromised by impurities, how weather affects production, and that suppliers do not impose quality control over their supplied products.

> *"There are many seeds in the cotton (for yarn production). The ginning process was not done well."*

The Department of Science and Technology–Philippine Textile Research Institute has documented a persistent "local yarn supply gap" stemming from declining domestic cotton and abaca cultivation (DOST, 2020), which has been steadily decreasing for more than a decade now, while industry analysts have noted that Philippine textile producers remain heavily dependent on imported raw fiber due to insufficient and inconsistent local production (BusinessWorld, 2022). This finding implies that there is a prevalent national supply chain weakness in the yarn and fiber industry, and not just a localized problem in the region.

Weather-related disruptions greatly disturb the supply chain of the yarn industry and aggravate its existing vulnerability. As a dominantly agricultural region, Western Visayas often suffers from natural disasters that heavily affect its crop production and harvest. The region suffers from lengthy bouts of drought in the dry season and excessive flooding during the rainy season. These weather disruptions have a severe economic impact on the dominantly agricultural and aquaculture region. Technologies developed aligned with the demands in agriculture, aquaculture, and natural resources sectors have to be recalibrated and modified to adapt to these erratic and intensifying weather conditions. Actors, therefore, have to factor in the evolving climate conditions as a fundamental basis in developing adaptive and resilient technology and innovation initiatives.

"Unpredictable weather like typhoons and long droughts severely damage our crops and affect our harvest."

"In agri-aquaculture, climate change is one of our biggest challenges. Typhoons are getting stronger than they used to be. Our fishponds and fields would get flooded. We could not do anything about it as it is beyond our control."

Weather vulnerability resulting in declining harvest and quality degradation of crops produces a pattern that decreases the technology adoption success rate due to a weak supply input chain.

Patterns of Behavior. A frequently occurring trend or pattern of behaviour discerned from the transcripts is leadership discontinuity among local government units in terms of project implementation. Recurring management change hampers the spontaneous flow of technology transfer and other science and technology programs to the community. All sectors attest that political or personnel turnover disrupts project continuity because most succeeding local leaders lack support and appreciation for the project. Some LGUs have inadequate resources to fund personnel salaries during project absorption. In addition, project personnel turnover can break the established rapport between the lead agency and the beneficiary. This makes short-term projects vulnerable and more prone to being discontinued. This discredits well-designed and implemented projects, as LGUs could not fully fulfill the commitment needed to continue the project.

"The challenge is the change of barangay leadership after election."

"It is hard for the community to work with the project if there is a change of personnel handling supervision. Community values long-term engagements

and rapport with personnel, and adapting to a newly hired person who has no background or connection with them would take some time."

Another emerging common trend is the weak value chain analysis skills among researchers. Overlooking the value chain in the research process weakens the economic projections of technology adoption. In most institutions, value chain studies are disregarded, resulting in weak market viability of technologies developed. Participants narrated that:

"Researchers do not use value chain analysis as much as needed."

"There are not many farmers planting cotton or abaca in the locality."

"Many national and local yarn manufacturing companies are closing. This is a dying industry."

"Suppliers do not really exercise strict quality control over the raw materials they process."

These findings imply that technology generation lies on a precarious edge, based mainly on the estimates and assumptions of researchers who did not consider supply inputs or market demands. As a result, products developed are unscalable as raw materials are too expensive or supply is too limited. Technology has no immediate return on investment as there are no identified takers due to logistics and production costs. Both products and technology have reduced profitability and feasibility as a result of weak supply chain analysis. Mass production encountered challenges such as quality inconsistency and weak cost-competitiveness. These are hindrances that lead to discontinued commercialization of some technologies.

Underlying Structure. At the structural level, the transcripts revealed deep-seated institutional weaknesses that constrain technology adoption among industry and community. Participants highlighted misaligned priorities between government agencies and local governments. Quotations implied that the weak sustainability of innovation and technology programs is not mainly a technical problem, but a coordination problem across institutions. The participants were describing a system where all institutions are not working toward a shared direction, so initiatives become fragmented, duplicated, and less likely to produce long-term results. When every implementing agency has separate targets, separate programs, separate deliverables, and separate reporting lines, projects may be implemented but not sustained. The broader implication is that successful innovation requires a “one government” mindset, shared planning, collaborative implementation, and joint accountability; otherwise even good projects can become duplicated, problematic, and eventually unsustainable.

> *“The problem is the gap between the National Government Agency and the Local Government Unit. Our priorities aren't always aligned.”*
>
> *“One obstacle that hinders us in faster decision-making and planning is that there is still somewhat of a ‘silo’ in how we operate. It is as if there is still unwillingness to share information from other sectors.”*
>
> *“There is a disconnect. In other countries like Japan, their government projects are "one government" approach. They do not work in silos. In here, DTI has their own program for MSMEs, DOST also have their own program for MSMEs, DA for agriculture. This results to duplication or unsustainable projects. DTI and DOST have overlapping assistance to MSMEs. DA and*

DOST-PCAARRD also overlap with rice technologies. There are many documents needed, and they are overlapping."

Another cause of the discontinuity of technology adoption as identified by one participant was the absence of S&T representation in LGUs. One participant noted that although they were tapped for collaborations in planning and budget deliberations, there is still a need to augment co-partnership, particularly in the area of research, production, and innovation to increase sustainability of technology adoption.

"One reason is the lack of representation in that area. Unlike other agencies (social work or agriculture) that have offices within the LGUs, we are a Provincial Office under a National Government Agency. We only provide input if we are invited to their planning or budget deliberations. We sometimes miss opportunities to establish our presence in general LGU operations."

This political dimension was an acknowledgment that even when projects are technically completed and formally turned over, the intended long-term result of sustained and self-reliant operation may still fail to happen. This can occur because political priorities may shift, the LGU's agenda may not align with the project's goals, there may be no political will to assume the project, there may be a lack of leadership support due to political turnover, or there may be insufficient funding to support the project's continued implementation.

Mental Models. Mental models shaping actors' behaviour could be traced to the '*kanya-kanya'* or siloed thinking, a mindset that would prioritize oneself or one's own institution over a collective goal. This thinking leads to the protection of self-interest or territorial and institutional domains rather than working for the good of the majority. This internalized orientation shapes the behaviour and actions of actors.

Several government line agencies noticed this among the RIS actors, whom they described as working only on the accomplishment of their institution's interest and would refuse to share resources and effort. Some participants observed *that "everyone is doing their own thing - 'masig-kanya-kanya'"* and they acknowledged that "*they might be competing against other agencies"* in their accomplished targets and performance. This affirms the assumption that some government actors see other stakeholders as co-competitors rather than partners, thus creating fragmented relationships and limiting collaboration.

> *"Everyone is just doing their own things and working on their own institutions' targets. There is 'kanya-kanya' mentality. There are silos in the ecosystem.*
>
> *"The prevailing mindset is the silo mentality. Government offices do not want other agencies to take credit for their accomplishments. They are not sharing information with us. That is why innovation still lags here in _____. Startups are not progressing much. Only the DOST is pushing for more startup formation."*

Siloed mentality reinforces a fragmented network where each actor acts only out of self-interest and institutional preservation rather than concertedly working to achieve a common vision for the RIS. Weak knowledge sharing and uncommitted resource sharing threaten regional collaboration and technology adoption progress.

Table 4.8

Thematic Analysis of Discontinuity of Technology Adoption Initiatives

Theme	Iceberg Level Category	Code	Key Quotations
Discontinuity of technology adoption initiatives	visible events and immediate occurrences in	Projects collapse post-funding	"As much as we would have wanted our projects to be successful, most of them are discontinued and unsustained. We are assuming that after our project and funding ended, the LGU would take over and continue sustaining the projects, but it is not what usually happens."
			"We are expecting the LGU to assume our project once our contract ends after three years. However, if they do not have enough resources or political leaders change, and the new ones do not appreciate our project, our project would just die."
		raw material wastage and undersupply	We have to see how they process pineapple leaves and make sure that they remove all the residues. We are buying fibers per kilo so we want to make sure that the raw material is worth it or else, most would just go to waste."
	recurring patterns of behavior	Management issues among cooperatives	"Management issues. Other beneficiaries, cooperatives and associations develop internal conflicts and do not sustain and continue."
		Lack of support due to administrative discontinuity (political turnover)	"The problem only arises when there is a change in administration and a lack of continuity."
	underlying processes and systemic structures	Absence of S&T representation in LGUs	One reason is the lack of representation in that area. Unlike other agencies (like social work or agriculture) that have offices within the LGUs, we are a Provincial Office under a National Government Agency. We only

producing the pattern		provide inputs if we are invited to their planning or budget deliberations. We sometimes miss opportunities to establish our presence in general LGU operations.”
	weak supply chain infrastructure	"Undeveloped supply chain" / "Local yarn manufacturing are slowly dying and closing."
	Misaligned NGA–LGU priorities	“The problem is the gap between the National Government Agency and the Local Government Unit. Our priorities aren't always aligned.”
Mindsets and attitudes threatening collaboration	"Kanya-kanya" or siloed thinking	“Everyone is just doing their own things and working on their own institutions’ targets. There is ‘kanya-kanya’ mentality. There are silos in the ecosystem.

SRQ 2.4 Drivers and Enablers of the RIS

Using thematic analysis, the study recognized drivers and enablers critical to the progress of RIS. By categorizing the codes and recognizing the core overarching themes, underlying factors pushing the RIS forward were uncovered. These identified drivers could provide direction on furthering best practices and employing strategies to boost the RIS strengths, while the barriers could be leverage points for intervention to address systemic gaps in the system. The thematic analysis table to uncover barriers and enablers is presented in Table 4.9.

Strong academe-industry collaboration through co-creation. Several drivers to augment commercialization outputs were identified among the transcripts, and the first is the conditioning of the researcher to establish more engagements with the industry and to understand the needs of the end users. Research should be

demand-driven rather than technology-driven. Early industry participation can reduce research–market mismatch and increase adoption rates.

"*Commercialization is easier if based on the needs of the industry compared to pushing it."*

"The technologies we should develop should really address the need or the problem of the industry."

"So, it would really be better to have the industry as a partner in the research we are doing. That's what we need to strengthen."

Trust, collaboration and relationship building. Another driver identified was the established trust, strengthened communication lines, and relationship building. Trust, open communication, and collaborative attitudes reduce uncertainty, facilitate knowledge sharing, and encourage stakeholders to work toward common innovation goals. The findings suggested that a strong innovation ecosystem is built on credible partnerships where stakeholders consistently fulfill commitments, manage expectations, and maintain long-term relationships.

"Relationship-building is a huge factor."

"We need a more collaborative attitude."

"Without trust, no one will talk or collaborate."

"Communication is the most important. Open communication and trust-building are the only ways to solve problems."

Visionary and Innovation-Oriented Leadership. Participants repeatedly attributed successful innovation initiatives to leaders who actively champion commercialization and innovation. They were described as visionary and innovation-

oriented leaders. Innovation and commercialization are strongly influenced by the presence of visionary leaders who can articulate a clear direction, mobilize stakeholders, and create an environment that supports innovation. These references to people with position and influence suggested that leaders serve as champion catalysts who could bridge institutional boundaries, earn trust, and navigate the system through coordinated effort toward sharing a common goal.

The importance of these leader advocates is affirmed by a study that noted that innovation-oriented leaders have a crucial role in fostering innovation culture in the ecosystem as they lobby for more programs and support from funding agencies, strengthen collaboration with partner agencies, shape dynamics to embolden each actor, and cultivate a culture of risk-taking as entrepreneurs (Bagheri, 2022; Elia et al., 2020).

> *"The Regional Director is the biggest influence in our office. He/She sets the direction of our efforts through his innovative vision."*

> *"If the leader is visionary, there is no limit on what we can do and overcome. We can always make a way."*

> *"The mindset of the President is key to success. He is pro-innovation. He understands the responsibility, applies it, and instills innovative values among all of his employees."*

> *"It is important that we have a 'navigator. We need someone loud enough to champion our advocacy."*

Success Stories as key to Entrepreneurial Mindset Development. Another enabling factor that could overcome risk aversion among hesitant entrepreneurs is visible proof of success in business and startups. Based on the inferences of the

participants, one way of circumventing the conservative and risk-averse mindset toward business is by presenting tangible proof through a trusted advocate who could recount success stories of a progressive startup. Hesitant actors are more inclined to engage in entrepreneurial pursuits if they see or hear stories of success from a trusted source who vouches and advocates for innovation adoption. The region's culture often reflects "*copying*" or *"gaya-gaya"* syndrome. One participant shared, *"They will copy businesses which they see have big earnings. That is why most businesses are sari-sari stores and carinderia because they are the most obvious."*

Demonstrating successful commercialization cases of technologies and novel ideas can help imbibe entrepreneurial behavior and calculated risk-taking among the RIS.

> *"We need success stories to inspire us."*
>
> *"Once they see the success, they start initiating the proposals themselves. Gabulig lang kami sa ila obra dayun."*

Value Chain Orientation and Market Readiness. KII participants stressed the importance of understanding markets, supply chains, and commercialization pathways before developing technologies. This is the barrier that most researchers fail to overcome. A value-chain approach can address the identified barriers of fragmented supply chains, weak manufacturing linkages, and poor market readiness. Industry sectors are very particular and meticulous in looking into the value chain, going as far as to the farms to ensure good genetic resources and good quality of raw materials. There is then a pressing need for all sectors to consider the value chain in both research and business endeavors.

"We need to see the farms and talk to the farmers. We want to see what kind of pineapples they plant, how they plant them, how they manage waste and how much supply they could give us to ensure continued supply of the operation."

"Intervention covers the entire value chain: from production to post-harvest and processing."

"The industry has to look closely into the value chain process."

Ecosystem Collaboration and Shared Vision. Several participants described research development and commercialization as dependent on coordinated action among academe, government, industry, and support institutions. Most participants agree that the continuing rise of economic stature and proliferation of MSMEs in the region could be attributed to the consolidated efforts of all these major sectors working together in one shared goal - Strengthening the regional innovation system requires coordinated stakeholder action rather than isolated institutional efforts.

"The innovation ecosystem here functions like a machine: the academe acts as the technology generator, DOST acts as the enabler and funding source, the LGUs handle localized policy and implementation, and other agencies like DTI, DOT, and DILG provide market access and institutional support."

"When all these pieces align toward a single direction, the impact on MSMEs and the community is massive."

"Biskan wala daku nga budget, if all institutions are committed to a single vision, kaya ta ini. We could find ways and get things done."

Table 4.9

Thematic Analysis of the Drivers and Enablers of RIS

Theme	Category	Code	Keywords	Key Quotations
Strong academe-industry collaboration through co-creation	Co-creation of technology	technology developed based on industry needs	Based on the needs of industry	*"Commercialization is easier if based on the needs of the industry compared to pushing it."*
			Address the needs of the industry	*"So, I think that's where we need to strengthen: that the technologies we should develop should really address the need or the problem of the industry.*
			Based on needs of industry	*"Commercialization is easier if based on the needs of industry compared to pushing it."*
	Collaboration between academe and industry	Strengthened relationship with industry	Strengthen relationship with academe and industry	*"Strengthen relationships with academe and industry for further collaborations."*
			Industry partner; strengthen	*"So, it would really be better to have the industry as a partner in the research we are doing. That's what we need to strengthen."*
	Co-creation of technology	Technology developed based on local needs	Address local needs	*"When introducing innovation, it doesn't necessarily have to be 'advanced.' What's important is practicality, ease of use, and addressing a local need."*
Trust, collaboration and relationship building	Attributes that drive RIS	Relationship building	Relationship-building	*"Relationship-building is a huge factor."*
			Relationship and trust building	*"Relationships and trust-building—doing what you promised and managing expectations. Importante ini sila for a strong ecosystem."*
			Strengthen Relationship	*Strengthen relationships for further collaborations*
		Collaboration	Collaboration and synergy	*Collaboration and synergy are important drivers*
			Collaborative attitude	*"We need a more collaborative attitude."*
			Collaboration; partnership	*There should be partnership and collaboration*
		Trust	Trust	*"Without trust, no one will talk or collaborate."*
			Trust building through communication	*"Communication is the most important. Open communication and trust-building are the only ways to solve problems."*
			Trusted local leader	*Another strategy we use is identifying a trusted local leader or "focal person" within the community or indigenous groups.*
Visionary and Innovation-Oriented Leadership	Visionary attribute of a leader that drives RIS	Visionary and trusted leadership	Visionary leadership of Regional Director	*"The biggest influence is the leadership of the Regional Director. The direction of the office depends on their vision."*
			Visionary mayor or director	*"If a Mayor or a Director is visionary, there are no limits."*

			Trusted local leader	*"Another strategy we used is identifying a trusted local leader or "focal person" within the community or indigenous groups."*
			Need for visionaries	*If we observe how technology works today, the technology of today was based on research that started ten or twenty years ago. Take AI, for example—it has existed since the 1950s, but we are only fully appreciating its impact now. So, we need visionaries who aren't just reactive.*
	Innovative attribute of a leader that enables innovation	Innovative leader and champion	Pro-innovation mindset of president	*"The key factor is the mindset of the President. He is pro-innovation. He understands it, applies it, and instills it in his employees."*
			Champion with advocacy for innovation	*"Having a "navigator"—someone who champions the advocacy and provides the platform for innovation—is vital."*
Success Stories as key to Entrepreneurial Mindset Development	Mental model	Emulating successful business practices	Copying other successful businesses	*"kun ano damo nga gakita nga negosyo, ilog-ilog man na sila. Amo na puro sari-sari store or carinderia ang kalabanan negosyo."*
			Copying or gaya-gaya	*"Western Visayas have copying or 'gaya-gaya' culture."*
	Condition for Entrepreneurship mindset setting	Visible and proven business success stories to motivate and inspire	Success stories to inspire	*"We need success stories to inspire us."*
			Visible success to motivate	*"Kun makita sang tawo nga gakita na, may kwarta na, they become motivated kag indi lang ina para sa promotion."*
			See the success to motivate	*"Once they see the success, they start initiating the proposals themselves. Gabulig lang kami sa ila obra dayun."*
			See the benefit	*"It should come from within because they see the benefit to themselves and the community."*
Value Chain Orientation and Market Readiness	Strengthened Value Chain Orientation	Need for continuous and quality supply operation	Continuous supply operation	*"We need to see the farms and talk to the farmers. We want to see what kind of pineapples they plant, how they plant them, how they manage waste and how much supply they could give us to ensure continues supply of the operation."*
			Quality production of supply	*"We work with the IP communities. They have a share in our profit. We ensure quality even at the production of the supply. We want good genetic resources but we also preserve traditional knowledge and method of farming to enhance the value and protection of biodiversity resources. We give them sustainable livelihood and make them steward of resources and biodiversity."*
			Supply price issues	*"Isa lang ang bulk buyer diri sang seaweeds kag siya lang ang ga-set sang presyo kay waay sya kakompetensya. Indi ma-regulate ang presyo sang seaweeds ti pirme pirde ang mga farmers kay nubo kayo ang presyuhanay."*

		Need to strengthen value chain process	Industry needs to look into value chain process	*The industry has to look closely into the value chain process. Every aspect is being looked at. This is to prepare for risks in the future that might affect the supply of yarn.*
			Intervention covers entire value chain	*Intervention covers the entire value chain: from production (long-line culture and single-oyster methods) to post-harvest (depuration technology) and processing.*
			Funding for value chain process	*We need to focus heavily on our competitive advantages—like aquaculture and smart agriculture in Capiz—and fully fund those value chains from end to end.*
			Challenges in supply chain	*Undeveloped supply chain*
	Technology Market Readiness	Strengthen and extend market reach	Market opportunity for food products	*Market opportunity for food products such as chips, pickles, noodles and other seaweed products.*
			Challenges in marketing R&D product	*SUCs always tell us that their expertise is in R&D and product development, but marketing is their challenge. they need help to monetize their inventions.*
			Wider market reach	*We need a wider market reach.*
			Upscaling of production to balance market demand and raw material supply	*Sometimes they insist on just R&D, when it shouldn't be for R&D anymore. It should be for upscaling at the production end so that when an industry adopts it, they already know the best way to produce it and the maximum production capacity to make it sustainable—balancing the market demand with the raw material supply.*
Ecosystem Collaboration and Shared Vision	Ecosystem collaboration and partnership as driver of RIS	Partnership and commitment to innovation	Innovation ecosystem functions like a machine	*"The innovation ecosystem here functions like a machine: the academe acts as the technology generator, DOST acts as the enabler and funding source, the LGUs handle localized policy and implementation, and other agencies like DTI, DOT, and DILG provide market access and institutional support."*
			Institution commitment	*"Biskan wala daku nga budget, if all institutions are committed to a single vision, kaya ta ini. We could find ways and get things done."*
			Partnership and collaboration	*"There should be partnership and collaboration."*
			Collaboration and synergy	*"Collaboration and synergy."*
	Shared vision and direction in the RIS	Impact of single direction of RIS	Single direction	*"When all these pieces (institutions) align toward a single direction, the impact on MSMEs and the community is massive."*

SRQ 3. What balancing and reinforcing behaviors, and causal relationships can be inferred among the actors within the regional innovation system?

SRQ 3.1 Reinforcing Behavior and Causal Relationships in RIS

This section discusses the substantive patterns revealed beneath the surface using Social Network Analysis, Iceberg Model analysis, and interview responses. Specifically, it examines how reinforcing behaviors and causal relationships within the RIS operate as the underlying structures driving or impeding regional innovation dynamics. Reinforcing behavioral loops are identified in Table 4.10 and presented in Figure 4.4. Table 4.12 outlines the sequential progression of systemic events and feedback loops extracted from the stakeholder interviews, mapping out how individual actions naturally trigger subsequent outcomes within the regional innovation ecosystem.

R1. Reinforcing Behavior in Commercialization Success Loop.

Commercialization success can be considered a reinforcing loop because success at one stage of commercialization increases the likelihood of success in subsequent stages, creating a self-amplifying cycle of research and innovation development. When researchers produce patents and publications, and duly sustained through technology transfer processes, the likelihood of generating market-viable technologies increases. Potentially marketable technologies then lead to the creation of startups, spin-offs, and stronger market linkages, which would ultimately generate employment, income, and community empowerment. Socio-economic impact is felt and enjoyed at the community level. As other stakeholders observe these successful tangible socioeconomic outcomes, confidence in research commercialization grows, encouraging universities, government agencies, and

industry partners to invest more resources in research, intellectual property protection, and commercialization activities. Consequently, each successful commercialization outcome strengthens the conditions that produce future commercialization successes, creating a virtuous cycle of innovation and regional development. A virtuous cycle occurs when a series of events or actions produces a continuous result of improvement, which this loop clearly manifests. This dynamic is consistent with innovation ecosystem theory, which argues that successful innovation outcomes attract additional resources, partnerships, and entrepreneurial activity that further reinforce innovation performance (Stam & Van de Ven, 2021).

R2. Reinforcing Behavior in Visionary Leader Loop. This is a reinforcing loop with the visionary leader at the helm setting off a series of linked actions or events, one leading to the other. A visionary leader or champion creates direction and navigates the people toward a shared goal. He is a “loud” advocate, a champion of innovation in the region. Two figures prominently arise from the transcripts, proving that they have left an indelible impression and influence on the other stakeholders. Their leadership style supports open communication and trust; trust makes it easier to form unified goals across sectors, and aligned goals encourage harmonized and collaborative programs that improve technology diffusion and adoption success. “*Collaboration and partnership*” are commonly associated words for the success of RIS, as suggested by the participants.

When adoption succeeds, the project produces visible success stories, and those success stories strengthen confidence in the leader, the collaboration, and the innovation process, making it more likely that the same cycle will repeat. Success stories are true and visible testaments that could convince people that R&D commercialization in the region could result in fruition. This is reinforcing because

success stories validate the leadership approach and motivate more actors to participate, which further increases trust and coordination.

Success stories will lend credibility to the advocacy of the leaders and dissuade the constant hesitance and aversion of the people toward commercialization. This is another virtuous loop that should be strengthened. Recent studies support this logic: open communication builds trust and alignment, trust improves technology adoption, and collaborative diffusion models are more effective when stakeholders share goals and communication channels (Judijanto, 2025).

R3. Reinforcing Behavior in Knowledge of Market Needs Loop. This causal relationship among the string of actions in this loop constitutes a reinforcing loop because increased knowledge of market needs encourages deeper engagement in value chain analysis, which improves researchers' understanding of customer demands, supply chain requirements, and industry challenges. Industry sectors are very particular and rigorous in adhering to this cycle, often adding more procedures to strengthen the value chain process. In the present research condition of the region, several participants from technology transfer offices divulged their struggles as most R&D outputs are not market-viable, thus prompting the need to conduct rigorous value chain analysis first as part of the research work plan. As researchers become more familiar with market conditions, they are more able to develop technologies that address actual industry problems rather than perceived needs. This results in more market-aligned technologies, which are more attractive to industry partners and end users. Greater industry participation, in turn, provides researchers with additional access to market intelligence, supply and demand chains, and user feedback, further expanding their knowledge of market needs. Thus, this is a virtuous cycle as it strengthens the next chain of action, creating a positive feedback mechanism in which

market knowledge continuously improves the relevance and commercial potential of innovation outputs. These dynamics imply that close interaction between knowledge producers from the academe and end users from the community enhances innovation performance and hastens the technology adoption process, increasing the likelihood of potential commercialization success (Cohen et al., 2002; Grunert et al., 2022).

Conducting value chain studies before product or technology development is an essential aspect of the technology development process. Detailing specific actions, participants narrated that:

> *"We have to see the farms ourselves and talk to the farmers. We have to see the variety of the pineapples they use, their process of planting, their waste disposal system, and the amount of supply they could provide so we could be assured of steady and quality raw materials to sustain our operation."*

These measures enable the industry to address constraints at the onset and build on opportunities throughout the entire process of production, manufacturing, processing, and marketing stages of their operation, resulting in successful commercialization, thereby making this a virtuous loop.

R4. Reinforcing Behavior in the Dole Out System Loop. This reinforcing loop recognizes the prevailing dole-out system among some actors from the community, often resulting in continued dependency on external funding, which ultimately projects toward declining entrepreneurial initiatives of their own. Participants inferred that continued and prolonged dependency reduces entrepreneurial capabilities to invest their own resources, expand their business models, or pursue other business ventures. Instead, dependency cultivates reliance, which confines business ingenuity. This is reflected in the narrations of participants:

"There is a rampant dole-out mentality in the communities where they mostly depend on the government."

"They lack enthusiasm to participate when the project ends, and we have nothing more to give. They just want to keep on receiving benefits."

The more that communities and organizations are accustomed to external support, the more they would refuse to assume ownership, take control of the project, or undertake risks involving their own investments in business establishment. This situation exacerbates the negative mentality of reliance on government assistance and refusing to initiate or invest in one's own enterprise.

These findings are also similar to some studies which claimed that prolonged reliance on government provisions and assistance can weaken local business initiative, diminish entrepreneurial culture, and reduce innovation success rates. Overly reliant stakeholders are more inclined to avail free resources rather than engaging in work and labor toward self-sufficiency (Kimmitt et al., 2020; Korsgaard et al., 2022). As this cycle projects toward innovation stagnation, this is categorized as a vicious cycle that amplifies degradation of ingenuity and unfavorable innovation outcomes.

R5. Reinforcing Behavior in Sustainability of Technology Adoption Programs Loop through Adequate External Funding.

This chain of events represents a reinforcing loop as it promotes positive outcomes for innovation progress. This loop implies that adequate funding could increase the success rate of technology transfer programs, as it could help sustain monitoring, readiness levels, and eventual commercialization. Proven, documented commercial success provides strong evidence to encourage more investment and

funding agencies to continue and expand the initial project. Fully allocated and implemented funding builds integrity among the implementing agency, which could attract more development partners from industry and government agencies in a collaboration. Participants stressed the importance of sustained funding as a support mechanism toward successful commercialization.

> *"We are falling short on our funding as we need more to augment our research to develop the most viable products, increase technology readiness level and comply with regulatory requirements."*

> *"Admittedly, we have no funding to sustain projects beyond the research stage, even to augment the "readiness" of our technology. There is no allocated funding for that. Our current capacity is just to produce laboratory-scale technology."*

This finding implies scarcity of funding, particularly among university technology generators. There is a need to scale up research toward the development phase so as to develop market-viable technologies, and this entails sufficient funding support. As more successful projects become visible in the market, technology adoption would be easier to integrate into the community. This visible impact could attract more investments and partners, creating a cycle wherein funding reinforces sustainability, and sustainability in turn is one strong cause for additional funding support.

Thus, long-term financial support is essential in sustaining more innovation adoption initiatives as it enables capacity building, increases stakeholder engagement, and reinforces continuous technology deployment and development (Hermans et al., 2022). This chain of events creates a virtuous cycle because effective fund allocation and management forge an image of competence, integrity, accountability, and

transparency in the disbursement of resources, which strengthens investors' confidence in implementing agencies. As integrity and trust are established, technology generators could easily secure cooperation to support future initiatives to sustain further technology upgrades and achieve better project outcomes.

R6. Reinforcing Behavior in Silo or Kanya-Kanya Mindset Loop.

The relationship of this series of events could be interpreted as a reinforcing loop starting. This loop has a core theme of silo or kanya-kanya mindset, which is the internal orientation to focus and prioritize more on the well-being of oneself or one's institution, particularly in the attainment of its own mandate, objectives, goals, and accomplishments over the pursuit of collective goals.

As the silo or "kanya-kanya" mindset continues to proliferate in the system, so is the heightened exclusion of other agencies, collapse of communication, overlapping of responsibilities, duplication of programs, and fragmented initiatives. These dynamics could be inferred from a participant's statement:

> *"I have observed that some agencies are just doing their own thing – they do not care about the other. It is a 'kanya-kanya' manner of doing things."*

> *"There is a silo among national government agencies because we have our own separate targets to accomplish."*

Participants detailed several cases where beneficiaries enjoy funding grants from government agencies for the same project, although deliverables might be different. This stems from a lack of coordination among government funding agencies due to fragmentation and the desire to accomplish their own institutional targets, as this is an indicator of their performance. This fragmented network is marked by a lack of information sharing and withholding of resources, alarmingly leading to reduced

opportunities for joint strategic planning, collective goal-setting, communal problem-solving, and wider scope of benefiting community. In the long run, fragmentation could erode collaboration and collegial resource sharing, thereby reinforcing the negative silo mentality. One study affirms this, noting that fragmentation could further aggravate coordination failures among cross-sectoral networks if actors fail to institute mechanisms for collective action (Ansell & Gash, 2018). This is a vicious cycle as it only perpetuates weak collaboration, leading to diminished success and progress in the RIS.

Table 4.10

Causal Relationships and Themes Forming Loops Inferring Reinforcing Behavior

Type	Causal Relationships Themes	Category	Polarity	Code	Keywords/quotations
Loop 1 Reinforcing Behavior (R1)	Commercialization Success loop (Virtuous loop)	Visible occurrences	+	patent filing/ publication commitment	Increased patents but not commerciable; published but later perish
		Institutional mandate causes	+	Tech Transfer Requirement compliance	stringent documentation process and rigid financial audit
		Recurring trends and Institutional causes	+	Need for market viable technology	technologies are not marketable
		Institutional effect	+	Low startup - spin-off formation	low technology-based startups in the locale
			+	market link	marketable as they are not aligned with the demand of the industry or community search for diversified markets
		Social Effect	+	community employment and empowerment	empowered community; imbibed innovative culture
		Ultimate loop driver	+	Commercialization sustainability and success	Sustainability of projects through commercialization

Loop 2 Reinforcing Behavior (R2)	Visionary Leader (champion, navigator) loop (Virtuous loop)	Primary Driver	+	open communication	open communication and collaboration with other key players
			+	trust	Trust with partners and other stakeholders
		Needed attribute	+	unified goals across sectors	unified and delivered goals
			+	harmonized and collaborative programs	Harmonious collaboration, speedy project implementation, trust
		Effect	+	technology diffusion and adoption success	low adoption of tech by industry partners and community
			+	success stories	boost success stories more
		Ultimate loop driver	+	Visionary Leader	Visionary leadership and adequate manpower
Loop 3 Reinforcing Behavior (R3)	Market Needs Knowledge loop (Virtuous loop)	Needed attribute	+	engagement in value chain analysis	value chain is not much studied by many scientists and is much needed in making proposal
		Effect	+	market aligned technology	technology is less marketable; not market ready
		Effect	+	industry participation/ technology pull	not aligned with the demand of the industry or community; not the pressing needs
		Ultimate loop driver	+	Market Needs Knowledge	Market access and institutional support.
Loop 4 Reinforcing Behavior (R4)	Dole-out System (Vicious Loop)	Observable occurrence	+	dependency to external funding agencies	Communities have a dependency on the government.
		Cultural and mental model	+	conservative and risk averse culture toward business	Risk averse, hesitance to try out new business venture or product devt, afraid of losing money and waste effort
		Ultimate loop driver	+	Dole-out mentality	Dole-out mentality, over reliance
Loop 5 Reinforcing Behavior (R5)	Continuity of Technology Adoption Programs	Key driver	+	adequate external funding	funding—it requires money to support ideas and solve problems through R&D; support in funding of product devt
	(Virtuous loop)	Ultimate loop driver	+	Continuity of Technology Adoption Programs	funding could be continuous up until we improve the "readiness" of our technology.

Loop 6 Reinforcing Behavior (R6)	Silo or Kanya-Kanya Mindset (Vicious Loop)	Observable occurrence	+	responsibility overlapping and duplication	Siloed S&T initiatives, overlapping of S&T projects, duplication of beneficiaries though different deliverables but similar projects
		Effect	+	fragmented network	disconnect among institutions
		Effect	-	open communication	Open communication and trust-building are the only ways to solve problems
		Ultimate loop driver	-	Silo or Kanya-Kanya Mindset	Silo relationship among NGAs; People are afraid other agencies will take credit for their accomplishments.

SRQ3.2 Balancing Behaviour and Causal Relationships in RIS

This section discusses the identified patterns inferred by the actors through the Social Network Analysis, Iceberg Model analysis, and interview responses. Specifically, balancing behaviors and causal relationships were identified as underlying structures driving or impeding regional innovation dynamics. Balancing behavioral loops, which constrain or offset those tendencies by introducing limits, delays, or corrective pressures, are identified in Table 4.11 and illustrated in Figure 4.4.

B1. Balancing Behavior in the Internal Conflicts Loop. This chain of actions can be understood as a balancing loop because increases in the number of community or cooperative adopters can challenge the sustainability of technology adoption programs because of internal conflicts. Initially, a larger number of adopters bolster the competence, accountability, and transparency placed on the program implementation. This, in turn, expands technology diffusion and increases the potential socio-economic benefits generated by the innovation among the beneficiaries. However, as membership and participation grow, differences in interests, expectations, leadership styles, and resource allocation concerns also become more

pronounced, increasing the likelihood of internal conflict. One participant affirmed this in the narrative: *“(We have) management issues. Some beneficiaries are cooperatives or associations that later face internal conflicts and disband.”*

This condition highlights the importance of collective cohesion through the observation that *“Pride, purpose, and shared identity enable cooperative success,”* implying that the absence of these factors may undermine sustainability. As internal conflict rises, coordination becomes more difficult, trust among members may decline, and participation in program activities may weaken. Consequently, the sustainability of the technology adoption program decreases, limiting further growth in the number of adopters. This creates a balancing mechanism whereby growth in participation generates pressures that constrain further expansion and sustainability (Stam et al., 2021).

B2. Balancing Behaviour in the Dole-out System Loop in the Understanding of Entrepreneurial Culture. Balancing behaviour is exhibited in the relationship of causal actions in this series of events. These events imply that technology adoption programs can initially be sustained by external funding support. However, continued overreliance poses a risk of reducing initiative and independence among stakeholders to pursue or expand their own business. This could lessen the application of their entrepreneurial skills, thereby limiting their understanding and experience. Ultimately, as their business acumen diminishes, technology adoption for supposed business expansion remains unpatronized, weakening the impact of the government's technology transfer program. The interview transcripts repeatedly underscore this dependency mindset as one government sector participant retold:

> *“Instead of fully understanding the reason why we are implementing this program, and realizing that we are doing this to help them be self-sufficient,*

nothing changes after the project ended. They will just keep asking for more support. It seems like they developed a habit of being dependent forever."

Literature has shown that projects heavily relying on grants, subsidies, and external assistance may result in beneficiaries who have the tendency to develop declining initiatives to improve their own entrepreneurial skills, such as risk-taking, resource pooling, and business model formulation. These weakened entrepreneurial initiatives and behaviors could proliferate across the community involved in the same project, making them less capable of converting the technology grants into a steady income-generating business. Support programs could eventually decline as they provide minimal impact on both the social and economic benefits to the community. This balancing loop shows that although external funding is beneficial to aid beneficiaries with short-term resources, long-term grants could inhibit dependency and unintentionally constrain local entrepreneurial capacity (Korsgaard et al., 2022).

Figure 4.4. Causal Loop Diagramming showing causal relationships among reinforcing and balancing loops.

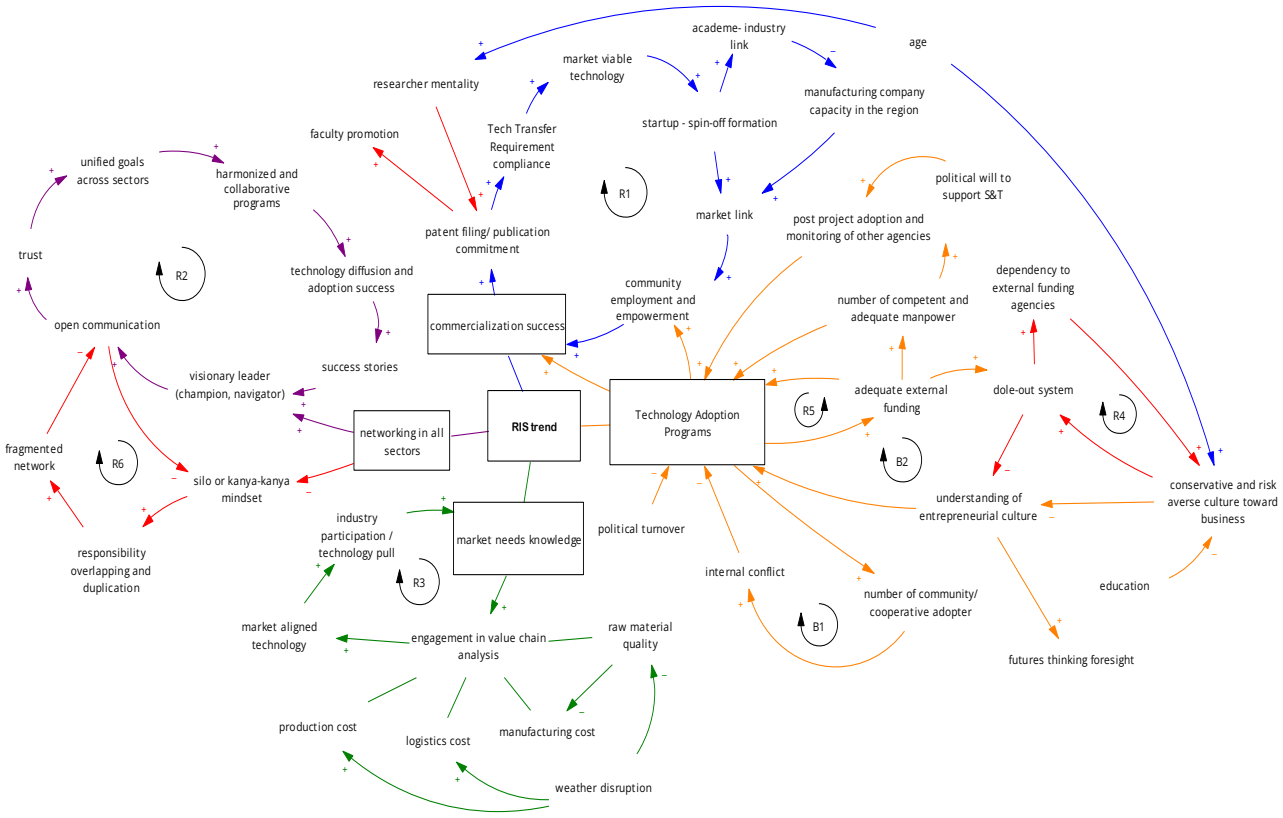


Table 4.11

Causal Relationships and Themes Forming Loops Inferring Balancing Behavior

Type	Causal Relationship Themes	Category	Polarity	Code	Keywords/quotations
Loop 7 Balancing Behavior (B1)	Technology Adoption Programs	Observable occurrences	+	Number of community/ cooperative adopter	Usually, with LGUs, the mode of technology transfer is through deployment or extension; Assistance is the acquisition of equipment awarded to the LGU; In cooperatives, the acceptance of innovation is very low.
		Institutional issues	+	Internal Conflict	Some beneficiaries are cooperatives or associations that

					later face internal conflicts and disband
		Ultimate loop driver	-	Technology Adoption Programs	Many socio-cultural factors regarding technology adoption. Many traditional farmers and fisherfolk are set in their ways.
Loop 8 Balancing Behavior (B2)	Dole-out system	Institutional issue	-	understanding of entrepreneurial culture	Having a hard time with business mindset because I'm a researcher.
		effect	+	sustainability of technology adoption programs	Successful and sustainable cooperative due to organized management, transparent financial reports, and booming market.
		driver	+	adequate external funding	Delayed or limited funding
		Ultimate loop driver	+	Dole-out system	dole-out mentality; wants everything or most to be provided or supported by govt

Table 4.12

Derivation of loop sequencing of events inferred from interview transcripts

Identified Factors influencing change in RIS	**Identified Cause Variable/ Primary driver**	**Ensuing Immediate Effect Variable**	**Subsequent consequences**	**Outcome**	**Inferences Description**
Commercializati on sustainability and success	patent filing/ publication commitment +	Tech Transfer Requirement compliance +	Need for market-viable technology + Low startup - spin-off formation + market link +	community employment and empowerment +	Reinforcing loop – virtuous cycle Commercialization success becomes tangible socio-economic outcome – such as market-viable technologies and jobs – which amplify more innovation performance.
Visionary Leader (champion, navigator) loop	open communication + trust +	unified goals across sectors +	harmonized and collaborative programs +	technology diffusion and adoption success +	Reinforcing loop – virtuous cycle Visionary leader's ability to foster trust and open communication drives successful collaboration program, generate visible success stories that validate leadership and inspire more actors to participate in RIS.

				more success stories +	
Market Needs Knowledge loop	engagement in value chain analysis +	market aligned technology +	industry participation/ technology pull +	Market Needs Knowledge +	Reinforcing loop – virtuous cycle Conducting rigorous value chain analysis allows researchers to develop market-aligned technologies, which attracts greater industry participation and feedback that continuously enriches the market intelligence driving future innovation.
Dole-out System	dependency on external funding agencies +	conservative and risk-averse culture toward business +		Dole-out mentality +	Reinforcing loop –Vicious cycle Continuous reliance on external grants fosters a "dole-out" dependency that erodes the beneficiaries' entrepreneurial capacity and project ownership, triggering a negative cycle where the expectation of ongoing support permanently stifles local initiative and innovation.
Continuity of Technology Adoption Programs	Adequate external funding +			Continuity of Technology Adoption Programs +	Reinforcing loop – virtuous cycle Adequate funding enables successful technology adoption and institutionalization support, justifying and attracting further financial investment to sustain and continue future initiatives.
Silo or Kanya-Kanya Mindset	responsibility overlapping and duplication +	fragmented network +	open communication -	Silo or Kanya-Kanya Mindset -	Reinforcing loop – Vicious cycle "Kanya-kanya" mindset causes agencies to isolate themselves to meet individual targets, leading to fragmented networks and duplicated programs that eliminate opportunities for joint planning, which in turn reinforces organization-level silos and cripples collective regional innovation.
Continuity of Technology Adoption Programs		Number of community/ cooperative adopter+	Internal Conflict+	Continuity of Technology Adoption Programs -	Balancing Loop Increase in the number of cooperative adopters introduces divergent interests that trigger internal conflicts, creating a self-limiting mechanism that erodes group cohesion, undermines program sustainability, and ultimately halts further membership growth.
Dole-out system	understanding of entrepreneurial culture-	sustainability of technology adoption programs +	adequate external funding+	Prevalent Dole-out system+	Balancing Loop External funding relieves immediate resource constraints but simultaneously triggers a counteractive effect by weakening the beneficiaries' entrepreneurial drive and self-reliance, which ultimately pulls program sustainability back down once the funding ends.

SRQ 3.3. Intervention Points for CLD

The main interventions need to target the vicious cycles, especially the silo mentality, dole-out dependency, and weak sustainability loops, because these will just keep reproducing the same problems. In the silo or "*kanya-kanya"* loop, a practical intervention is to strengthen or create a shared regional innovation platform or regular interagency coordination forum where DOST, DTI, DA, LGUs, universities, and cooperatives jointly map projects, align deliverables, and agree on one common outcome to reduce duplication of services. This should be paired with shared performance indicators, cross-agency reporting, and incentives for collaboration so that agencies are rewarded for joint outputs rather than isolated accomplishments. Studies on silo reduction attest to this as they recommend common platforms, unified goals, and publicly rewarding cooperative behavior (OECD, 2025).

Intervention programs should also focus on the psychological conditioning to eliminate the adverse dependency mentality aimed at reducing the pervasive dole-out cycle by requiring reasonable counterpart contribution in terms of finances or resources, shared management responsibility arrangements, and well-established transition plans post-project implementation before the funding ends. Community groups and cooperatives should receive entrepreneurship training, business mentoring, leadership and management training, financial management, and market linkage so they can see the project as a livelihood system rather than an all-expense-paid program. Participants involved in implementing agencies for these programs admitted that they did not include behavioral, leadership, or financial literacy training in most of their science and technology programs, as they are more focused on value-adding and technology development leading to potential livelihood sources for beneficiaries. To overcome this, training on the human resource development aspect

could be developed and provided by partner institutions from the academe or industry who could provide experts or practitioners to conduct the training.

To strengthen the sustainable commercialization loop, value chain analysis training could be provided to the academe and industry to augment their understanding of market needs, making their developed technology more viable in the industry or market. Starting at the ideation stage, research institutions could embed value-chain analysis and user validation at the proposal and workplan stage of research. This requires active involvement of potential industry or technology adopters, as they will be part of demand or problem identification, prototype testing, and pilot implementation to ensure that technologies fit the demands of the market and overcome market instability.

For the internal conflict balancing loop, interventions could include training programs on leadership, financial management, values orientation, and team building among members of cooperatives who are frequently inundated by fights and conflicts. Management and governance skills are also needed to help them establish clear bylaws, transparent financial reporting, a conflict-resolution mechanism, and leadership capacity of their officers. Transparency of income is always the root cause of such conflict, so there is also a need to orient members on their shared responsibilities, revenue shares, and roles in the sustainability of their organization, as this could prevent fragmentation and eventual collapse of their organization after commercialization begins. Consistent communication, healthy relationships, and professional dealings with every member are a necessity in building trust and cooperation inside the organization. This will deter faction and rivalry from proliferating, avoiding potential disbandment of the cooperative.

To alleviate the risk aversion mentality of potential entrepreneurs from both community and industry, constant awareness and promotion campaigns could be aggressively introduced even in informal or small group events, making the interaction more direct, personal, and impactful. Success stories could be introduced during these campaigns as budding entrepreneurs could learn firsthand from actual practitioners who have visible success in business. Once they open up to technology transfer possibilities, technology demonstrations and gradual adoption could be implemented where communities would first learn the operation of the machinery and generate income ideas before they could launch complete adoption. This coincides with Rogers' (2003) principle of triability, where users have to test and evaluate the machine firsthand before it could be fully adopted. As investments are the most frequent constraints, co-investment schemes could be implemented where partial funding grants are provided by LGUs and the intended adopter pitches in their share, making them co-investors with shared ownership and responsibility for the project. This will offset the burden of early production costs, and the community will be motivated to expend effort just to make the business successful as they are co-owners who would share all the burdens, risks, and profit. Communities are now active equity participants, not just passive recipients waiting only for dole-out grants.

Among the academe, the primary incentive for engaging in the innovation system is the promise of promotion. However, several participants recalled that many faculty members are dissuaded because of the stiff promotion system that does not fairly compensate actual commercialization effort. Promotion guidelines could be embedded with commercialization milestones such as accomplished technology licensing with partner industries, spin-off establishment, or start-up co-founding formation. These milestones should carry more weight in the promotion system,

equivalent to indexed publications or IP filings because they are actual evidences of the applied social and economic impact of research outputs. A reformed promotion guideline is necessary because previous analysis using the Iceberg Model identifies institutional structures that proliferate the problems of low commercialization in the ecosystem. This indicates that the problem of low commercialization of research output is not caused by individual researchers, but by institutional mandates and conditions that refuse to acknowledge and incentivize commercialization efforts fairly. Faculty researchers perform their functions aligned with the existing reward system as their primary motivation. Denying them this compensation would just perpetuate the recurrence of this same problem. Additionally, entrepreneurship immersion programs could also be introduced to immerse faculty members in a business culture. They could learn from the mentorship of successful academic entrepreneurs, adapt calculated risk-taking behaviour toward business, and co-ideate with industry partners on possible income-generating initiatives.

In summary, identified intervention programs should target the breaking systemic silos through shared visions and collegial interaction, diminishing dependency by behavioral capacity building and ownership sharing, and reducing weak commercialization by strengthening market linkages and understanding, and value chain planning.

Answering the Main Research Question (MRQ): "How do key actors perceive the interactions, mental mindsets, and feedback structure shaping the dynamics within the regional innovation system of Western Visayas and what systemic patterns could be inferred from these analyses?"

Using a systems approach as its foundational theoretical framework, findings revealed that the prevalent actors' perceptions in the interaction among stakeholders in the RIS are exhibited as a government-academe-dominant network structure where collaborations are heavily attributed only to these two active sectors, influencing the skewed dynamics of the entire ecosystem. In the government sector, DOST is identified to have the highest eigenvector centrality, recognizing its central role as the supervising, implementing, and funding backbone of the system. LGUs are recognized as critical brokers in the system as they have the capacity to connect peripheral and isolated community sectors into the broader network fold. However, the dominance of government and academe network configuration critically isolates the private industry comprising startups and other commercialization entities, and marginalized communities, leaving them mostly at the periphery of all innovation activities. This suggests a structural imbalance in the RIS as most collaborations are geared only toward high research production but weak commercialization efforts.

From a theoretical perspective, this configuration suggests a structurally imbalanced Quadruple Helix model with functions comparable to an early-to-intermediate stage network where the ecosystem exhibits unequal resource and responsibility sharing, disproportionate collaboration, and unequal interaction and relationship efforts among the four core actors . These dynamics fell short in attaining the fully functioning Quadruple Helix Model described as a balanced network where four identified actors comprising the government, academe, industry, and community share overlapping and mutual relationships and function in their roles as active, equal innovation partners.

The study by Hakeem et al. (2023) also noted similar findings as they postulated that the stakeholders should eliminate the gap among the academe,

government, industry, and civil society toward an impartial and active collaboration as befit the description of a balanced Quadruple Helix Model and as evidenced in the relationship of the regional innovation system actors in Central Japan. Although these dynamics are not currently reflected in Western Visayas, continued perpetuation of this relationship and addressing of critical leverage points could potentially lead to a balanced Quadruple Helix Model in the near future.

To target identified weaknesses in the RIS, interventions have to delve deeper to address underlying mindsets, as these create behavioral patterns that ultimately affect the effectiveness of innovation diffusion. Using the Iceberg Model analysis framework, root causes of the visible problem symptoms were identified. Prevalent issues of weak commercialization outputs, low acceptance of technology, and mismatched research outputs to industry needs suggest a need to target underlying causes to prevent recurrence of these issues. Deeply ingrained risk aversion to entrepreneurial initiatives, siloed or “kanya-kanya” orientation among government line agencies, and persistent dole-out or dependency culture emerged as underlying causes of these visible symptoms.

Self-perpetuating cycles of these interactions and mindsets were inferred using Causal Loop Diagramming. Feedback structures identify reinforcing and balancing chains of events and actions that could amplify or stagnate innovation momentum of the RIS. Positive or virtuous loops that could accelerate innovation progress in the region are triggered by innovative and visionary leaders, aggressive dissemination of entrepreneurial success stories, cultivation of trust, collaboration and open communication, and promotion of risk-taking entrepreneurial culture. On the contrary, negative or vicious loops need immediate intervention as they could suspend progress in innovation and induce network fragmentation and a siloed mindset, which could

reduce systemic collaboration in the ecosystem. Balancing loops emerged as the frequent internal conflicts afflicting community-based cooperatives and overreliance on external funding causing a declining behavioral drive to initiate or expand their own enterprise.

Ultimately, findings suggest that there is a conducive ecosystem to generate localized success in innovation. However, support mechanisms to scaffold self-sustaining momentum of technology commercialization remain scarce, particularly in funding and behavioral conditioning programs. These findings reinforce the theoretical implication that mental and cognitive structures are equally critical factors as infrastructure allocations in driving and upscaling innovation in the region.

Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the synthesis and culmination of this research using a systems approach in analyzing the RIS of Western Visayas. This chapter serves the following purpose:

Firstly, this chapter summarizes the entire research process, including its key findings. This also discusses the conclusions drawn from the findings through its intensive and integrated detailed analytical tool. The last purpose is to provide sound and achievable recommendations for the proposed intervention in the RIS and direction of future studies.

Summary of the Study

The primary aim of this study is to examine and analyze the inherently unique, multifaceted, and complex dynamics of the regional innovation system (RIS) in Western Visayas through the actors' perceptions using a systems approach as its foundational theoretical framework. RIS has been pivotal in augmenting the economic growth of the country and further promises to catapult the country toward a global competitiveness ranking, thereby paving the way toward technological independence and self-sustaining progress.

Utilizing a qualitative multiple case study research design, a multi-level system approach data analysis tool was employed for empirical data collection method and analysis, including Social Network Analysis to identify actors' perceptions of their roles, functions, and manner of interaction and collaboration within the RIS; the Iceberg

Model to delve deeper into the institutional and cultural factors for prevailing factors identified by actors as barriers or drivers of innovation performance; and Causal Loop Diagram to analyze the causal linkages, and the reinforcing or balancing behaviors perceived by actors to influence the progress or decline of the innovation process. Guided by a systems approach framework, central stakeholders involving purposely selected 20 participants from universities, government, industry, and community, were identified to corroborate their perceptions, experiences, insights, and engagements regarding the innovation process of the RIS. Key informant interviews were conducted with all participants.

Summary of Key Findings

The data analysis uncovered several key findings based on the most prevailing themes in the study anchored on the three sub-research questions SRQs.

SRQ 1. Based on the examination of the perceptions of actors regarding their role and collaboration in the RIS, the study inferred that the regional innovation system is dominated by the government and academe as the two most active sectors in the ecosystem. Among the government line agencies, DOST and LGUs served critical roles as primary implementers, funders, brokers, coordinators, and enablers of innovation activities. On the other hand, state colleges and universities are the research arm and knowledge generator with main functions of research, technology development, and technology diffusion through extension or industry adoption. Industry has a critical but limited role and is often found at the periphery of network structure due to its distant or minimal connections with key implementers of projects, including the academe and government. This isolation confines the full deployment of

its role in the ecosystem, which is to provide market linkages, adopt technologies, and mass produce products at market scale. Community is identified as having the weakest and least connection among all actors despite its crucial role as an end-user and technology beneficiary. This peripheral connection limits its role as co-creators of innovation. This study further implies that network connections showed active collaboration and interaction but performed unevenly across sectors. Communications are found to be generally smooth and informal, and relationships are anchored in trust and collegial climate as perceived unanimously by participants. However, structural imbalances in the performance of roles permeate as industry and community remain peripheral rather than central actors in their collaborative contributions to the network, which highly diminishes broader innovation diffusion success. On a positive note, the evolving nature of the cooperatives, as it was able to shift from being end-users to becoming active industry partners once it achieves financial sustainability, was highlighted in this study. This proves the transitory and flexible nature of agency inclusion in each sector, as they can evolve and change roles to fit in one or two sectors if they assume multiple roles in the ecosystem.

SRQ 2. Commonly identified factors driving collaborations in the innovation system are: relationships embedded with trust and collaboration; visionary and innovative leadership; visible success stories to promote an entrepreneurial mindset; strengthening of value chain orientation to boost technology market viability; and shared vision and collaboration.

On the contrary, barriers obstructing the progress of the innovation system are attributed to: low commercialization of research output, weak academe-industry link, limited manufacturing and industrial plants in the region, rigid documentary and

financial requirements for technology transfer, and hesitance of the industry to adopt technology.

These visible and surface-level issues could be traced to a deeply ingrained mental mindset and beliefs permeating the ecosystem. Among the community, the overreliance and dependency on dole-outs or government provision exists; in the industry, risk aversion to new and unproven technology persists; and in the academe, the researcher mindset that excludes commercialization as one of its core functions persists. These barriers constrain all efforts to augment the RIS, making it difficult to achieve project goals, cultivate entrepreneurial culture, and ensure long-term adoption of technologies.

SRQ 3. Several reinforcing loops were derived from causal relationship analysis that could either strengthen or weaken initiatives in RIS. Positive reinforcing behaviors include having an innovative and visionary leader, competency in value chain analysis, adequate funding, and open communication and collaboration among the actors. These positive loops project a successful cycle that would eventually lead to sustainable technology adoption, better understanding of market needs, equitable collaboration among key institutions, and greater confidence in pursuing commercialization among most actors. Caution should be exercised in these negative-reinforcing loops, as they could lead to the detriment of all innovation efforts, limiting growth in the RIS, including dependency on external support, fragmentation, weak coordination, and internal conflict among cooperative members

Conclusions

The primary objective of this study was to examine the RIS through a systems approach as its theoretical framework to analyze actor perception regarding network collaboration, deeply ingrained mindsets permeating the system, and causal relationships of factors driving or hindering innovation direction. Moreover, it revealed persistent gaps requiring intervention to augment commercialization and long-term sustainability of technology adoption.

This conclusion is elaborated below according to the three sub-research questions (SRQs) that guided the inquiry.

Structure and Interactions of RIS

The dominant network structure prevailing in the regions is the government-academe-dominant interaction. Universities and government agencies are the most active sectors in implementing science, technology, and innovation initiatives. However, not all government agencies divest the same enthusiasm and cooperation in supporting these initiatives.

Among all government agencies, DOST VI emerged as the most active agency throughout the region, with its highest eigenvector centrality indicating that not only does it have many connections, but it is also well-connected to other influential sectors in the region. Its central function of spearheading and funding most science and technology initiatives and research and development programs hails it as the most influential and central core of the innovation system.

LGUs are another identified active actor in the government sector, serving as principal brokers as it connects several peripheral and disconnected actors to the central cluster. This role is crucial as LGUs maintain the inclusion of isolated sectors into the innovation fold, ensuring that S&T programs reach even those who are in the periphery. Despite varying levels of commitment and support toward S&T programs, most LGUs acknowledge the role of S&T in uplifting the livelihood and way of life of society.

Industry and community sectors have comparatively weak connections in the system. Industry connections fall mainly on economic, manufacturing, cooperatives, and market clusters as they are an integral component of the value chain in business. Industry forges strong connections with cooperatives as their source of raw materials, and with other industries for manufacturing, processing, promotion, and marketing of their product. They are less inclined to partner with academe and government as they are not viewed as an integral part of their business process chain.

Community is one unique cluster, as members can evolve in their role. Cooperatives and civil society organizations are not confined exclusively to the community cluster. Community members and cooperatives can become entrepreneurs and engage in business. Once they achieve financial stability, they could be considered part of the industry, contributing to the economic augmentation of the community. The case of one handloom weaving cooperative is a testament to this evolving role. Moving from a passive beneficiary of government grants, they were able to scale up into a direct industry link with growing international market demand, exhibiting the flexibility of their role in the system. However, this is still an isolated case, as most cooperatives and community bases enterprise struggle to take off financially toward sustainability.

In the academe, SUCs function as knowledge intermediaries and the research and development arm of several government agencies. They are the lead implementers of programs funded by the government, thus in charge of pooling resources, setting policy, and ensuring program delivery. SUCs admittedly do not have sufficient funding for institutional research despite the intended allocation of university budget toward research and development. For research requiring more funding, they rely on several government agencies, particularly DOST and its sectoral council for support.

In this cascade arrangement, SUCs are structurally and financially tied to external support as they channel R&D funding from agencies such as DOST. As a result, universities are positioned as intermediaries rather than equal partners with government, community, and industry. This network structure implies a structurally imbalanced Quadruple Helix Model arrangement. Although all sectors work collaboratively, the degree of their role and resource sharing vastly differs, leaving some actors underperforming.

Despite this structural imbalance, actors infer that innovative and visionary leadership, trust, open communication, and collegial relationships could help in overcoming performance weaknesses, as they are perceived to be primary drivers moving the RIS into further progress. On the contrary, low research output commercialization, weak academe-industry link, bureaucratic technology transfer requirements, risk aversion, and dole-out mentality set the RIS back from potential success. Iceberg Model Analysis provided an empirical framework to analyze the issues prevailing and treat them not as performance weaknesses of one actor but as symptoms of deep underlying institutional and cultural structures.

The low transition of research output into commercialization reflects a national phenomenon in the academic landscape, signifying that despite the high patent activity, knowledge capitalization and economic gains remain low. The mismatch between the technology produced and market needs echoes broader findings that the region's innovation system requires a proactive, risk-tolerant, and self-sufficiency mindset orientation parallel to that of businessmen. Industry and market ideas have to be injected at the earliest onset of the research and development stage. Through this, frequent modification of the technologies could be performed, making them market-ready and well-suited to the demands of the industry.

The identified drivers and barriers, both virtuous and vicious behaviors, shape the innovation landscape of the region. Positive or virtuous loops arise from visionary leadership, market-responsive research, and successful commercialization, while negative or vicious loops persist through dependency, fragmented coordination, and "kanya-kanya" or siloed behavior that slow innovation diffusion. The RIS does not lack success; it lacks a mechanism for converting localized success into systemic, self-sustaining momentum.

In summary, these findings converge on the conclusion that the Western Visayas RIS exhibits the characteristic of a Quadruple Helix system in an early-to-intermediate stage of institutionalization — structurally imbalanced, and not yet exhibiting the overlapping, mutually transformative relationships which Etzkowitz and Leydesdorff identify as the hallmark of a mature Quadruple Helix.

Implications of the Findings

Significant implications for both innovation theory and practice were derived from this study. These implications suggest that innovation performance is influenced not only by tangible resources and technical capabilities but also by social, cultural, and mental conditions of the actors in the system.

For Advancing Regional Innovation System Theory

The findings contribute to the existing body of knowledge on regional innovation by affirming that innovation performance is shaped not only by tangible resources, technical skills, and infrastructure but also by interactions, collaborations, culture, and mental models possessed by the actors. Most RIS literature emphasizes knowledge flow channeling through the four active actors. They also iterate visible symptoms of problems that are easily discernible even among non-researchers. This study employed an empirical and systematic framework integrating three systems thinking tools to analyze the system comprehensively as a whole ecosystem, not just the sum of all its parts. The identified “dole-out” dependency, “kanya-kanya” mindset, and risk-averse culture toward entrepreneurship extend the regional innovation theory by underscoring the significant role of informal and cognitive structures that affect innovation outcomes. This implication asserts that culture, beliefs, and assumptions are equally important determinants of innovation performance.

These integrated systems thinking data analysis tools provided a framework for examining and better understanding the recurring issues in the system despite repeated interventions. This method contributed to systems approach theory by providing a framework to use a multi-tier strategy in uncovering deeper assumptions of issues at hand.

For SUCs Governing Bodies

Findings imply a pressing need to reconsider the allotment of equitable points to commercialization criteria in the promotion and incentive systems of the university. If these promotion metrics persist, issues with high patent application which did not yield income returns through commercialization would continuously recur.

This result could serve as baseline data to recalibrate the research workflow in SUCs. Research and development workflow should not be a linear process with ideation mostly actuated by the researcher. Co-ideation involving users, producers, and local enterprises is a proven partnership that strengthens innovation performance. External agencies should not be considered as late-stage joiners, merely expecting to adopt whatever technology will be developed by the university.

Further implications suggest that local cooperatives could grow into active and stable economic actors when interventions focus on the development of their technical skills, interpersonal conduct, and behavioral conditioning. Strengthening both community and industry partners to become active co-ideation partners in research bridges the gap between technology development and commercialization.

For Government Agencies

The findings imply a need for a concerted effort among involved government line agencies to align their initiatives toward one common goal to reduce overlapping of responsibilities and duplication of effort. A common platform could reverse fragmentation and siloed mentality, prompting government agencies to act on ecosystem-strengthening strategies rather than prioritizing only their own institutions. Cross-sectoral consultation could strengthen this RIS collaboration as multiple actors advocate for long-term sustainability rather than short-term response to persisting

issues. This collaboration could map out the flow of the innovation process and identify actors responsible at each stage. As an example, the university, industry, and community could co-create technology; government could assume the next phase of intellectual property protection, industry could then mass produce technology for the market; and LGUs could promote adoption and monitoring of post-project implementation to ensure sustainability. Without this common platform, government actors' efforts will continue to produce project outputs that are not only adopted but also fully sustained by the end users.

For Local Government Units (LGUs)

Among cooperatives and government agency project implementers, LGUs are viewed as the most crucial agencies to sustain projects post-implementation and funding. Findings noted that LGUs are instrumental to successful technology adoption and product development programs if they assume monitoring responsibilities and provide funding, facilitation, and continuity support until cooperatives have a stable footing in their income generation. The result further implies that several cooperatives and small local enterprises fail not because their business ideas are weak but because support mechanisms did not fully extend up to their organizational stability. A further implication is that support mechanisms should be institutionalized through innovation policy, indicating that support should not cease post-project implementation and funding; it must also include post-project monitoring, shared financing, market access, and value-focused training.

Limitations of the Study

Academic transparency requires acknowledging limitations that only became transparent as the study unfolded – several of which diverged from what was originally anticipated during planning. Several constraints were encountered despite the achievement of the study objectives. These limitations were recognized as follows:

A key limitation is the response of the participants. The initial number of participants was 20, with 10 from government, 5 from academe, and 5 from industry. 5 more will then be added in case of emerging sectors for a probable maximum number of 25. However, only 20 participants responded, with one from government and another 1 from industry who never replied to the invitation. Nonetheless, an additional two from the community sector participated, completing the initial number of 20 participants. Despite this, twenty participants is within the range qualitative researchers consider adequate (Creswell, 2014; Bernard, 2016). The researcher ensured data saturation from each sector.

As with most qualitative research, results herein are not statistically generalizable. Insights and experiences might be different from other regions, although similarity may seem plausible, noting that other regions share the same programs and national funding architecture (DOST, DTI, and DA-funded programs). This study could not ascertain if social networks and causal loop relationships bear resemblance with other regions due to varying geographical factors such as manufacturing companies, governance capacity, or cultural context.

Another identified limitation is that this reality or phenomenon exists only at a certain specified time and condition, particularly during the conduct of the study. It does

not show how these relationships change over time, or if interventions and other unidentified factors are introduced.

Recommendations

Building on the conclusions and implications discussed, this section proposes the following recommendations.

Recommendations for Stakeholders

Stakeholders across the Regional Innovation System—including SUCs, industry, government agencies, and communities—are suggested to strengthen collaboration, trust-building, and open communication to overcome fragmented and kanya-kanya approaches. Universities could also consider aligning research with industry needs and recognize commercialization outcomes alongside academic outputs.

Key strategies suggested for SUCs and their governing boards could include:

- ***Revise faculty promotion and incentive systems to reward commercialization outcomes alongside publications and patents***. This could be suggested during the CHED consultation with SUCs on the DBM-CHED Joint Circular (JC) No. 3, s. 2022, which serves as the framework for the 9th Cycle NBC 461 and outlines the guidelines for the faculty reclassification and promotion system. Institutional Merit Promotion could also contain these criteria.
- ***Institutionalize industry participation in research planning.*** A policy to include industry at the earliest stage of the research cycle could be developed to

ensure that research outputs address actual market needs and have a higher likelihood of adoption and commercialization.

- ***Strengthen entrepreneurial capacity among researchers***. Capacity-building and mentorship programs could be conducted to include successful and notable entrepreneurs in the region. Capacity-building programs and mentorship from successful regional entrepreneurs could equip researchers with practical business skills, networks, and mindsets needed to transform their research into viable enterprises.

Key strategies suggested for government line agencies and LGUs could include:

- ***Strengthening coordination among agencies***. This way, they could better facilitate technology diffusion and commercialization. By serving as coordinators and facilitators, LGUs can help bridge gaps among stakeholders and promote an innovation and entrepreneurship culture at the local level. Doing so could reduce duplication of efforts, align priorities, and promote resource sharing
- ***Streamlining technology transfer and commercialization procedures.***

Streamlining the application processes could encourage budding entrepreneurs to participate in startup formation and focus more on developing and upgrading their product or technology rather than worrying more about business compliance.

- ***Institutionalize innovation and technology adoption initiatives within local development plans, policies, and ordinances to ensure continuity across political administrations (for LGUS).***

Innovation programs should be streamlined on a coordinated work plan where all cooperating members of the RIS could participate. Actors involved in each stage of research up to commercialization could be tapped to develop a collaborative research output based on the actual needs of the market. This could be strengthened through institutional policies to support strategic planning geared toward long-term sustainability and not be easily discarded despite leadership transitions.

Key strategies suggested for industry:

- ***Government and SUCs could encourage industry partners and MSMEs to become active partners in research and innovation activities rather than passive recipients of technology.***

Academe could initiate collaborations with industry partners and involve them at the earliest stage of research development. They could also incorporate value chain analysis before technology development so they could map out the feasible course of action in developing market-viable technology.

Key strategies suggested for community and cooperatives:

- ***Focus on developing entrepreneurial culture, leadership capacity, and project ownership among members.*** Implementing agencies could include behavioral conditioning, leadership training, financial literacy, business management capacity development, and team building alongside technical training. Programs and grants should be designed to gradually lead to eventual independence and ownership and administration by the beneficiaries.

For Future Research

Future studies may use longitudinal methods to study the trend, comparative designs to compare several RIS, mixed methods to include quantifiable variables, and other qualitative designs to use other frameworks in analyzing the RIS. Other variables could also be included to validate the findings, identify more factors, and deepen the understanding of the inherently unique RIS of Western Visayas.

Further research may also investigate the perspectives of underrepresented actors in the ecosystem such as cooperatives, inactive government line agencies, budding startup founders, technology brokers, and private manufacturing and processing companies.

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Appendices

APPENDIX A

Research Ethics Committee Approval

	UP OPEN UNIVERSITY Faculty of Management and Development Studies Research Ethics Committee		
	CERTIFICATE OF ETHICAL APPROVAL	REC Form No.	4(C)
		Version No:	01
		Date of Effectivity:	

15 April 2026

This is to certify that the following protocol and related documents have been granted approval by the Faculty of Management and Development Studies Research Ethics Committee (FMDS REC).

The FMDS REC is the body that implements the university policy of overseeing the ethical soundness of the institutional research produced, including any research conducted by faculty members, students, REPS, and staff at the faculty office level. All FMDS research proposals must undergo ethics review and shall gain certification clearance from the FMDS REC.

The committee operates according to Philippine Health Research Ethics Board (PHREB) guidelines and regulations.

REC Protocol No.	2026-001-GS-FMDS		
Principal Investigator(s)	Dr. Olive Joy G. Abing		
Title	A Systems Approach to Mapping a Philippine Regional Innovation System		
Document Type	Study Protocol		
Protocol Version No.	02	Version Date	19 March 2026
Other Documents	1. 2026-Abing_FREC Form 8(A) 1st Resubmission Form (version 1, 19 March 2026) 2. 2026-Abing_Full Protocol v02 (version 2, 19 March 2026) 3. 2026-Abing_Diagrammatic Workflow.pdf (version 1, 24 January 2026) 4. 2026-Abing_Endorsement Form.pdf (version 1, 24 January 2026) 5. 2026-Abing_Form 1(B) CV Form.pdf (version 1, 24 January 2026) 6. 2026-Abing_Form 4(E2) Non-Health-Related Assessment Form.pdf (version 1, 24 January 2026) 7. 2026-Abing_Form 6(A) Application Form_v01.pdf (version 1, 24 January 2026) 8. 2026-Abing_Form 6(A) Application Form_v02.pdf (version 2, 26 January 2026) 9. 2026-Abing_Form 6(D) Study Protocol Assessment Form.pdf (version 1, 24 January 2026) 10. 2026-Abing_Form 6(F) ICF Checklist.pdf (version 2, 26 January 2026) 11. 2026-Abing_Full Protocol_v01.docx (version 1, 24 January 2026) 12. 2026-Abing_ICF_English_v02.pdf (version 2, 26 January 2026) 13. 2026-Abing_Letter Request.pdf (version 1, 24 January 2026) 14. 2026-Abing_Proposal AI Report.pdf (version 1, 24 January 2026) 15. 2026-Abing_Proposal Rejoinder Form.pdf (version 1, 24 January 2026) 16. 2026-Abing_Proposal SI Report.pdf (version 1, 24 January 2026) 17. 2026-Abing_Questionnaire_v01.pdf (version 1, 24 January 2026) 18. 2026-Abing_Thesis Approval Sheet.pdf (version 1, 24 January 2026) 19. 2026-Abing_Training Certificate_BRET 1.pdf (version 1, 24 January 2026)		

Page 1 of 2

UP OPEN UNIVERSITY
Faculty of Management and Development Studies
Research Ethics Committee

CERTIFICATE OF ETHICAL APPROVAL

REC Form No.	4(C)
Version No:	01
Date of Effectivity	

	20. 2026-Abing_Training Certificate_BRET 2.png (version 1, 24 January 2026) 21. 2026-Abing_Training Certificate_GCP.pdf (version 1, 24 January 2026)		
Type of Review	☑ Expedited ☐ Full Board Meeting Date: N/A	Duration of Approval from Date to:	15 April 2026 to 15 April 2027

FMDS REC Chair	Signature	Date
ROSE NONETTE C. CAPADOSA	Rncapadosa	15 April 2026

APPENDIX B

Informed Consent Form for Regional Innovation Ecosystem (RIS)
Participants from University, Government, Industry and Other Sectors

Principal Investigator: **Olive Joy G. Abing**
Organization: **University of the Philippines Open University**
Sponsor: N/A
Project Name: **A Systems Approach to Mapping a Philippine Regional Innovation System**
Project Version: 1.0

PART I: INFORMATION SHEET

INTRODUCTION

Good day! I am Olive Joy G. Abing, a Master in Research and Development Management student of UP Open University. You are respectfully invited to participate in this research study with the main objective of analyzing the Regional Innovation System (RIS) in Western Visayas with the end goal of producing policy recommendations to strengthen the innovation process in the region. Your participation is entirely voluntary, and you may ask questions regarding any words or concepts that you do not understand at any time during the process. Please take your time to decide whether you wish to participate in this study.

PURPOSE OF THE RESEARCH

This study aims to understand and explore various stakeholders' experiences on their functions and connections with other stakeholders in the RIS. We are interested in knowing about your experiences and insights on the regional innovation process as these can be used to improve our regional innovation ecosystem. Specifically, we will be asking about your connections, role, and relationship with other stakeholders. We would also like to know about the prevailing challenges, cultural practices, and mindsets in your institution. We will also be asking about barriers and enablers in the RIS processes that you have encountered, as well as other factors associated with them.

TYPE OF RESEARCH INTERVENTION

As a participant, you will be asked to engage in a key informant interview discussing your experiences and insights related to the Regional Innovation System of Western Visayas. There are no physical treatments or medications involved in this study. As this research involves interviews, there is no random assignment. It is a systems approach study where all members from various sectors of government, university, industry, and other sectors are enjoined to participate. Data collection utilizes key informant interviews to gather qualitative data.

PARTICIPANT SELECTION

You have been specifically selected to participate in this study because of your extensive involvement and experience with the RIS. Your engagement in the RIS, whether you are from the university, government, industry, or other sector, will help achieve the objectives of

this study through this key informant interview. As a participant, you are expected to answer questions honestly and to the best of your knowledge.

VOLUNTARY PARTICIPATION

Your participation in this study is completely voluntary. You can choose to withdraw at any time without any penalty or loss. Choosing to participate or not will not have any bearing on your job or job-related evaluations. Whether you decide to participate or not will not affect your current or future relations with the researcher and the University of the Philippines Open University.

PROCEDURES

This is a qualitative multiple case study research design with the primary aim of exploring and understanding the inherently unique, multifaceted, and complex dynamics of the regional innovation system (RIS) in Western Visayas. Data collection will involve key informant interviews to gather qualitative data. Approximately 20-25 individuals from various locations across the region are expected to participate in this study. Twenty participants from the university, industry, government, and other sectors will be invited for the key informant interviews.

You will be asked semi-structured, open-ended questions regarding your experiences and insights into RIS dynamics. You are free to share your insights and experiences as they could be the basis for actionable strategies in enhancing the RIS. If some questions or discussions may be sensitive or potentially cause you discomfort or embarrassment, you could inform the interviewer about this and refuse to answer the question. If you feel that your participation will cause you inconvenience, you could withdraw your participation at any time, and you will still receive the food and token as a symbol of my gratitude. You can still opt out of the study even after the interview by requesting that your participation not be cited as part of the data.

Key Informant Interview

Your participation will involve a single interview session lasting approximately 60-90 minutes to be conducted by Ms. Abing, the proponent of the study. You may choose a face-to-face or online interview via Google Meet or Zoom. You could also suggest a different date or location should the scheduled date or venue not be amenable to you.

- Location: Interviews will be conducted at a location convenient for you or via an online platform.
- Process: Each interview will last approximately 60-90 minutes. You may choose not to answer any question you do not feel comfortable with. Only you and the interviewer will be present during the interview. However, you could invite someone to be present during the interview should you prefer. A small token of gratitude will be given for your time, whether you finish or not the duration of the interview.
- Recording. The interviews will be audio-recorded to ensure accuracy in data collection. Data collected will be kept confidential and in a secure digital storage accessible only by the researcher. All information collected during this study will be kept confidential to the extent permitted by law. Identifiable information will not be disclosed in any publications or presentations. Only the researcher will have access to the interview recordings, which will be coded with numbers instead of names to maintain privacy. These files will be deleted after 5 years.

DURATION
The research is estimated to be completed within 6 months to one year. Your participation will involve a single interview session lasting approximately 60-90 minutes. After the interview/discussion, we might contact you again for follow-up questions and fact-checking. Should any information become available that may influence your decision to continue participating in this study, you will be informed on time.

RISKS
As this study involves minimal risk and no physical treatments, no compensation or insurance is provided for study-related injuries. No financial compensation is provided for participating in this study. The interview may cause you inconvenience due to the time that you will expend, and some questions may make you feel uncomfortable. You do not have to answer any question or take part in the discussion or interview if you feel that the question(s) are too personal or if talking about them makes you uncomfortable.

BENEFITS
There are no direct benefits to you for participating in this study. Your participation is voluntary and may contribute to improved understanding and practices within Western Visayas RIS. The findings may provide insights that could contribute to the enhancement of WV RIS practices, potentially benefiting the universities, research consortia, government agencies, and partner industries in the region and contributing to scientific knowledge in business development and innovation management. A small token of appreciation will be provided for the KII participants. These will be provided whether the participants complete their interview or withdraw during the process. Refusal to participate or discontinuance will not involve any penalty or loss of benefits provided to all participants.

REIMBURSEMENTS
No financial compensation is provided for participating in this study. There are no anticipated expenses that you will incur by participating in this study. All expenses incurred in this study are shouldered by the researcher. There are no external sources of funding.

CONFIDENTIALITY
All information collected during this study will be kept confidential to the extent permitted by law. Identifiable information about the participants will not be disclosed in any publications or presentations. Only the researcher and the thesis adviser will have access to the interview recordings, transcripts, and other raw data, which will be coded with numbers instead of names to maintain privacy. Pseudonyms will be used in all written output.

Artificial Intelligence (AI) tools and applications may be used to record and accurately transcribe the data collected during interviews. This is to ensure the integrity and accuracy of the information provided. All data handled by AI will be subject to the same confidentiality and privacy protections as outlined in this consent form.

Data will be stored securely in electronic format and accessible only to the researcher. All electronic data will be stored securely and will be destroyed based on FMDS REC's data retention guidelines.

SHARING THE RESULTS

The results of this study will be used for scholarly purposes and may be published in academic journals or presented at conferences. However, no information that could personally identify you will be used.

You or your legally acceptable representative will be informed in a timely manner if information becomes available that may be relevant to the willingness of your participation. You will also have access to the results of the study once it is completed. The summary of the findings will be made available upon request. You may also have access to your own personal recordings. However, you do not have the right to access detailed research records, recordings of other participants, or notes beyond the summary of findings as provided. UPOU IREC/FMDS REC or relevant regulatory bodies may have access to the study records for audit purposes, while maintaining confidentiality.

RIGHT TO REFUSE OR WITHDRAW

Your participation in this study is completely voluntary. You can choose to withdraw at any time without any penalty or loss of benefit. You may withdraw from your participation anytime. You will have an opportunity to review your remarks in the interview and erase part or all of your recording or note.

Your participation may be terminated by the researcher if completing the interview becomes impractical or if you wish to withdraw due to foreseeable circumstances and reasons.

DATA MANAGEMENT

Data will be stored securely in electronic format and accessible only to the researcher. All electronic data will be stored securely and will be destroyed based on FMDS REC's data retention guidelines.

WHO TO CONTACT

For more information about the study or in the event of a study-related injury, please contact Dr. Olive Joy G. Abing at +639608585179 (mobile) or ogabing@up.edu.ph (email).

This study has been reviewed and approved by the UPOU Faculty of Management and Development Studies Research Ethics Committee. For questions about your rights as a participant or to report concerns or complaints, you can contact the UP Open University Faculty of Management and Development Studies Research Ethics Committee (FMDS REC), UP Open University, Los Baños, Laguna, Philippines, 403. Monday – Friday 8:00 AM – 5:00 PM PHT. Email address: fmds-ethics@upou.edu.ph.

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Print Name of Participant: _____
Signature of Participant: _____
Date: [MM/DD/YYYY]

If Illiterate

A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumbprint as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ Thumb print of participant:
Signature of witness _____
Date: [MM/DD/YYYY] _____

STATEMENT BY THE RESEARCHER OR PERSON TAKING CONSENT

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1.
2.
3.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to the participant.

Print Name of Researcher or person taking the consent _____
Signature of Researcher or person taking the consent _____
Date: <MM/DD/YYYY> _____

APPENDIX C

Semi-structured Interview Questionnaire

Participants: Government: Personnel from DOST, DTI, LGU, and DOST-led R&D consortia

Data Collection Integration: During key informant interviews, systematically ask relationship-mapping questions:

1. **Preliminaries:**

   1.1 What is the name of your agency?

   1.2 Where is your agency located?

   1.3 How many years have you been involved in RIS?

   1.4 Briefly describe the mission, vision, and goal of your agency.

2. **SNA Analysis**

   2.1 Could you describe the organizations that your institution collaborates with for innovation activities? How do their functions and roles align with your institutional objectives?

   2.2 How does the flow of knowledge or resources occur between your institution and partner agencies?

   2.3 In your experience, which institutions often act as active coordinators in most of your innovation activities? Who acts as brokers or supporting stakeholders?

   2.4 Beyond the government, university and industry sectors, are there any other institutions/people whom you work with aside from those in the government, industry or university? What unique roles do they play in the system?

2.5 *How would you rate the quality and strength of each relationship: strong, moderate, or weak collaboration?*

3. Iceberg Model

1.1 Events: Understanding the Surface Level

1.1.1 How is your relationship with other institutions in terms of collaboration, resource sharing, and communication?

1.1.2 What immediate issue or challenge have you experienced or observed within your innovation ecosystem recently? Who is directly affected by this event?

1.1.3 What immediate effects have you noticed following these challenging events, and how did it affect your dynamics?

1.2 Patterns: Identifying Recurring Trends

1.2.1 Based on these issues and challenges, what other recurring trends or incidents can be observed in your institution over a certain period of time?

1.2.2 Do these problems occur on any specific timeframes, seasons, or conditions? What are the other possible causes?

1.3 Structures: Examining Systemic Influences

1.3.1 Are there any institutional policies or mandates that influence these patterns so that they keep happening? What are these, and what are your thoughts about them?

1.3.2 How do organizational processes or cultural practices contribute to the recurrence of the issue?

1.4 Mental Models: Uncovering Underlying Assumptions

1.4.1 Did you notice any cultural or institutional mindsets that perpetuate the problem? How do they happen?

1.4.2 How might these mental models need to change to alter the structures and patterns?

2. Causal Loop Diagramming

2.1 Key variables /System Components

2.1.1 What do you see as the primary drivers that determine whether innovation processes succeed or fail in this region?

2.1.2 Conversely, what are the most persistent obstacles or barriers that prevent our local innovation potential from being fully realized?

2.1.3 What available resources—funding, talent, expertise —are critical for innovation in this region? How are these resources currently distributed in the region or province?

2.2 Causal Relationship

2.2.1 Can you describe how these factors affect each other or lead to changes within the system? How do these constraints operate?

2.2.2 When the region, province, or institution experiences innovation success, what consequences typically follow from that success? How about when it weakens?

2.3 Feedback Loops for reinforcing (amplifying) or balancing (stabilizing) feedback loops

2.3.1 Can you tell me a recent happening where innovation happened (or failed to happen) in this region? How did it happen and who was involved? What do you think caused it?

2.3.2 What are some delays or time lags you notice between causes and their effects in innovation activities?

2.3.3 Does your interaction/relationship with other institutions shape the overall behavior or outcomes of the regional innovation system over time? How?

APPENDIX D

Iceberg Model Analysis Thematic Analysis

ICEBERG MODEL ANALYSIS

Regional Innovation System — Western Visayas | ATLAS.ti Quotation Report Analysis

Iceberg Level	Category / Theme	Actor Group	Key Quotations / Evidence	Code
Level 1 Events (Visible)	Patents not commercialized	Academe	"we have patents that are not commercialized… you get a patent but it's not commercializable"	events
	Bureaucratic tech-transfer process (FOB, valuation)	Academe	"A major hurdle is the FOB requirement… It discourages private partners, especially when lawyers get involved."	events
	Projects collapse post-funding	Government	"Most of our projects with LGUs are not as successful as we'd like because they aren't sustained"	events
	Stakeholder Receptiveness to new technology	Industry	"Some stakeholders who weren't easy… they don't easily accept the technology."	events
	Equipment turnover Post-funding project	All actors	"If a technology is too complicated, the community will abandon it the moment the project funding ends."	events
	internal conflicts	community	"Some community-based groups struggle to take off commercially. Sa una, ang tanan gavolunteer pa kag ga-work together. Pero sang nagstart na sila kita, nag umpisa naman sila ilinaway. Amo to nga nadula nalang ang iban nga mga coop sa ulihi. Wala na masustain."	events
	Absence of S&T representation in LGUs	All sectors	One reason is the lack of representation in that area. Unlike other agencies (like social work or agriculture) that have offices within the LGUs, we are a Provincial Office under a National Government Agency. We only provide inputs if we are invited to their planning or budget deliberations. We sometimes miss opportunities to establish our presence in general LGU operations."	events
	raw material wastage	industry and community	We have to see how they process pineapple leaves and make sure that they remove all the residues. We are buying fibers per kilo so we want to make sure that the raw material is worth it or else, most would just go to waste."	events
	Management issues	community	Management issues. Ang iban nga beneficiaries, cooperatives kag associations nagka-internal conflicts kag wala na nagpadayun."	patterns and trends
Level 2 Patterns & Trends (Recurring)	Research–industry mismatch	Academe & Government	"We would develop technology only to find out it wasn't what the industry actually needed."	patterns and trends
	low start-up formation	Industry & Academe	"Sa tuod lang, we still lack private startups and spin-offs (in the region)."	patterns and trends
	reluctance of adopters in commercialization	Industry & Academe	the MSMEs and farmers are already taking a big financial risk in production. They don't have extra money to risk further by buying new technologies. That is one of the challenges."	patterns and trends
	commercialization is often treated as an extra burden	Academe	"additional naman na ya nga trabaho daw indi man sila gusto."	patterns and trends
	Dependency on external support	community & academe	"Ang iban daw pahapos na lang. They expect the government to keep giving them things for free without them putting in the effort to keep the business rolling."	patterns and trends
	innovations are developed but rarely commercialized	Academe	Research in the academe is often done just for compliance to SUC levelling, PBB, accreditation, or for a degree, rather than being translated into a commercial product."	patterns and trends
	undersupply and disregard to quality of raw materials	community	"There are many seeds in the raw materials (for yarn production)."	patterns and trends
	Dole-out dependency	Government & Cooperative	"In communities, there is often a 'dole-out' mentality—a dependency on the government."	patterns and trends
	weather-related disruption	all sectors	*"Typhoon and weather uncertainties affect our harvest yield."*	patterns and trends

Level 3 Underlying Structures (Systemic)	Misaligned NGA–LGU priorities	Government	"The problem is the gap between the National Government Agency and the Local Government Unit. Our priorities aren't always aligned."	underlying structure
	weak academe-industry link	Industry & Academe	"The researcher doesn't always know the actual problems of the industry. Also, the industry doesn't know how to communicate with our researchers and inventors."	underlying structure
	limited manufacturing capacity in the region	All sectors	"Indi gawa damo ang mga manufacturing company or industry diri sa region."	underlying structure
	Fragmented & exploitative supply chains	Industry	"If there are certain middlemen monopolizing things, we can't do anything because we don't have control over the prices."	patterns and trends
	Promotion system blocks tech transfer (JC, TT disincentives)	Academe	"they only seem to get motivated because of our JC… so they can get points. So it seems to stop there at filing."	underlying structure
	financial constraints among farmers and MSMEs	industry and community	"The investors and farmers are already taking a big financial risk. They don't have 'extra' money to gamble further by introducing new technologies."	underlying structure
	mismatch in between technology and needs of community	All sectors	The technology we introduce does not address their immediate daily needs."	underlying structure
	conflicts with livelihood imperatives	Community	The primary participants in barangay activities are mothers who have domestic responsibilities, like cooking and child care, or daily labor jobs. If a training session conflicts with their household duties or earning potential, they will naturally prioritize their family's survival over attending our research workshops. We must align our research schedules with their daily realities."	underlying structure
	institutionalized via rigid performance evaluation matrices	academe	"Ang mga faculty wala man compelling reason magcommercialize kay ang IP application is enough na for promotion. Mangabudlay pa gid sila commercialize? Wala man sure nga points? Damo pa paperworks?"	underlying structure
	Administrative discontinuity (political turnover)	Government	"The problem only arises when there is a change in administration and a lack of continuity."	underlying structure
	weak supply chain infrastructure	Industry	"Undeveloped supply chain" / "Local yarn manufacturing are slowly dying and closing."	underlying structure
Level 4 Mental Models (Deepest)	"Research ≠ business" — commercialisation outside faculty duty	Academe	"Oh, she's doing business now, that's not research anymore."	mental models
	Business-research mindset gap (speed vs. rigor)	Industry & Academe	"The businessman is often impatient; the researcher has a different pace and mindset."	mental models
	"Technology should be free" — entitlement mindset	Government & Cooperative	"They view product development as a risk. They are used to everything being free."	mental models
	afraid of change; Risk aversion — "This is how we've always done it"	All actors	"But the biggest hurdle is the mindset and culture. People are afraid of change."	mental models
	"dole-out mentality"	community	"Gusto nila mabaton na lang gid ya nga mabaton" ("They just want to keep receiving").	mental models
	"Kanya-kanya" — siloed territorial thinking	Government	"What I've observed is that everyone is doing their own thing—it's 'kanya-kanya.'"	mental models

Dominant themes

- **Low Commercialization of Research and Development Outputs**
- **Stakeholder's Receptiveness to New Technology**
- **Unsustainability of Technology Adoption Initiatives**

Causal Loop Diagramming Open Coding

Regional Innovation System — Western Visayas - ATLAS.ti Quotation Report Analysis

ID	Document Groups	Quotation Content	Codes
1:90	Academe	We need to move past just "promotion."	Driver leads to...
1:70	Academe	In ____, political support is actually quite good	Driver
1:71	Academe	Many municipalities are appreciative and provide space or funding.	Driver leads to...
1:73	Academe	DOST's leadership	Driver
1:74	Academe	We have many "Balik-Scientists" (returning scientists), especially in Iloilo. We are "at par" with other regions in terms of human expertise.	Driver leads to...
1:79	Academe	Time lags." In the University, we can't move without Board of Regents (BOR) approval, and they only meet quarterly. Then there is procurement.	delays effects
1:80	Academe	Time lags."	delays and time constraint
1:81	Academe	It's out of our control. We bid for items, and in the end, the supplier says the product is unavailable or the price has increased.	delays effects
1:82	Academe	time you get the parts, the technology is obsolete.	delays effects
1:83	Academe	Or the reagents for our research expire before the equipment even arrives. It creates a "ripple effect" of delays.	delays effects
1:84	Academe	Relationship-building is a huge factor.	Driver
1:85	Academe	we help each other. If one institution has a weakness, another fills the gap.	Driver leads to...
1:86	Academe	We no longer feel shy or intimidated to approach other universities for help with IP applications or troubleshooting. We treat the region as one organization working for the common good. We even share resources and benchmark from each other.	Driver leads to...
1:87	Academe	It must address a real need in the community	Driver
1:88	Academe	not a researcher's expertise.	obstacles
1:89	Academe	Currently, many of us at ___ research just for promotion or publication.	obstacle causes
1:91	Academe	We need "success stories" to inspire us.	Driver leads to...
1:92	Academe	For example, a researcher at ___ earned millions from an innovation involving beetle nut feeds. When people see that innovation brings prestige and money—not just a promotion—they become "internally motivated."	Driver leads to...
1:93	Academe	Once they see the success, they start initiating the proposals themselves.	Driver leads to...
1:94	Academe	It should come from within because they see the benefit to themselves and the community.	Driver leads to...
3:49	Government	The biggest influence is the leadership of the Regional Director	Driver
3:50	Government	The direction of the office depends on their vision.	Driver leads to...
3:51	Government	Right now, our Director is heavily focused on Artificial Intelligence (AI). Most of our current activities and staff trainings are geared toward becoming proficient in AI	Driver leads to...
3:52	Government	It all depends on the leader's direction.	Driver
3:53	Government	project fails, the community gets discouraged	obstacles
3:54	Government	creates a bad image for DOST	obstacle effects
3:55	Government	community loses trust in us.	obstacle effects
3:56	Government	Partnerships	Driver
3:57	Government	. Even without a massive budget, if all institutions are committed to a single vision, things get done.	Driver
3:58	Government	The biggest obstacle is the mindset of a leader.	obstacles
3:59	Government	If a Mayor or a Director is a visionary, there are no limits	Driver leads to...

3:60	Government	But if they have a "closed mindset" or are just comfortable with the status quo, the impact will be small.	obstacle effects
3:61	Government	we can't really compete yet.	competition with other region
3:63	Government	Procurement.	delays and time constraint
3:64	Government	Even with the new Procurement Act, it hasn't become faster. There are so many documentary requirements: market scoping, PPMP, PRs. It can delay equipment delivery by six months or more.	delays effects
4:28	Government	SUCs always tell us that their expertise is in R&D and product development, but marketing is their challenge. they need help to monetize their inventions.	obstacles
4:29	Government	There is a long-standing issue regarding overlaps.	obstacles
4:32	Government	Currently, there is an overlap in these stages that we are trying to address.	obstacles
4:33	Government	Startups sometimes get confused about which agency to approach.	obstacle effects
4:53	Government	investment.	Driver
4:54	Government	Investments coming into the region create jobs and employment.	Driver leads to...
4:55	Government	Leadership and direction-setting are huge factors. They have successfully built investor confidence. This has led to a boom in tourism, which increases demand for transportation, hotels, and food MSMEs.	Driver leads to...
4:56	Government	investment leads to better rankings, which leads to more local business opportunities.	Driver leads to...
4:57	Government	The services sector, which includes ITBPM, hotels, and tourism, has really raised our GDP.	Driver leads to...
4:58	Government	Losing investor confidence is a risk	obstacles
4:59	Government	little heavy manufacturing or industry in Region 6	obstacles
4:60	Government	It’s hard for manufacturing graduates to find work here; many go to Manila.	obstacle effects
4:61	Government	One major factor is the cost of power.	obstacle causes
4:62	Government	Plus, logistics is an issue. If raw materials are from Manila or imported, it’s expensive to transport them here.	obstacle causes
4:63	Government	Most LGUs won't risk allowing chemical plants now.	obstacle causes
4:64	Government	We have the talent—engineers and scientists—but the energy cost is a major deterrent.	obstacle causes
4:65	Government	They sustain my programs in the ITBPM sector.	obstacles
4:66	Government	The struggle is that the budget is consistent or even shrinking (cut by 5-10%), but the needs grow.	obstacle causes
4:67	Government	Last year, we handled a major activity by partnering with others for cost-sharing.	obstacle effects
6:28	Government	intervention covers the entire value chain: from production (long-line culture and single-oyster methods) to post-harvest (depuration technology) and processing. For the surplus mussels, we introduced vacuum-frying technology developed by the DOST-ITDI (Industrial Technology Development Institute) to add value. We deployed a vacuum fryer to ____ , which now serves as a processing hub for local cooperatives, MSMEs, and private individuals to develop new shelf-stable products.	Driver
6:29	Government	laboratory tests and project results in ____ have directly aided local policymaking	Driver leads to...
6:30	Government	The industry started experiencing "Loose Shell Syndrome," which severely hurt their export quality. The local producers approached us, and DOST funded an R&D project to identify the root cause.	Driver
6:31	Government	R&D isn't a one-time fix.	obstacles
6:32	Government	The first phase identified the specific pathogen causing the syndrome, but knowing the pathogen doesn't automatically solve the problem. Now, we need a follow-up management framework or treatment kit.	obstacle effects

6:39	Government	socio-cultural side regarding technology adoption. Many traditional farmers and fisherfolk are set in their ways	obstacles
6:43	Government	we've learned to give feedback to technology generators (like SEAFDEC or ___) to simplify their equipment designs.	obstacle effects
6:45	Government	We also focus heavily on mental conditioning before a project starts.	obstacle effects
6:46	Government	Another strategy we use is identifying a trusted local leader or "focal person" within the community or indigenous groups.	Driver
6:47	Government	If we present the technology directly, they might be skeptical. But if a trusted local leader takes ownership and demonstrates the actual economic returns, the rest of the community follows. They need to see it to believe it.	Driver leads to...
6:50	Government	the machinery just sits idle and reverts to government inventory.	obstacles
6:51	Government	That represents zero impact	obstacle effects
6:53	Government	Now, we explicitly map out sustainability and commercial viability with our partners before a single peso is spent.	obstacle effects
6:54	Government	collaboration and synergy	Driver
6:55	Government	The innovation ecosystem functions like a machine: the academe acts as the technology generator, DOST acts as the enabler and funding source, the LGUs handle localized policy and implementation, and other agencies like DTI, DOT, and DILG provide market access and institutional support. When all these pieces align toward a single direction, the impact on MSMEs and the community is massive.	Driver leads to... role or function of institution
6:58	Government	Funding is always a factor	obstacles
6:59	Government	Lack of focus and adaptability	obstacles
6:60	Government	If we spread our resources too thinly across too many small, unrelated projects, we won't create a measurable impact	obstacle causes
6:61	Government	We need to focus heavily on our competitive advantages—like aquaculture and smart agriculture in ___—and fully fund those value chains from end to end.	obstacle effects
6:62	Government	External uncertainties like political instability, global economic shifts, climate change, and emerging biological diseases	obstacles
6:63	Government	If our communities and MSMEs have a low readiness level to adapt to emerging technologies, they will get left behind by international competitors from countries like Taiwan, Korea, or Singapore, who are constantly innovating their aquaculture practices.	obstacle effects
6:64	Government	have a low readiness level to adapt to emerging technologies,	obstacles
6:65	Government	We need to continuously upgrade our local facilities, laboratories, and scientist networks to keep our local industries resilient.	Obstacle remedy or solution
6:66	Government	t innovation is a continuous learning process. We shouldn't comfortably sit on our past successes. We need to keep expanding our partnerships, stay open to emerging technologies, and maintain our passion for field work	Obstacle remedy or solution
8:31	Government	they have become independent and are helping others.	Driver
8:34	Government	organizational conflict	obstacles
8:36	Government	We partner with the LEDIP office or TSKI to educate them on bookkeeping and organizational development	Obstacle remedy or solution
8:37	Government	We have to address these human realities even if it's beyond our technical mandate.	Obstacle remedy or solution
8:40	Government	Bureaucracy	delays and time constraint
8:41	Government	Causes delays when contracts need a resolution from the Legislative Department for a Mayor or Governor to sign.	delays effects
8:45	Government	the researcher doesn't always know the actual problems of the industry. Conversely, the industry doesn't know how to communicate with our researchers and inventors	obstacle effects
8:50	Government	biggest gap: communication.	obstacles
8:57	Government	Probably just having more people in the office (hire).	obstacles
8:58	Government	Time management is hard; our time gets consumed just by attending meetings we are expected to participate in	obstacle effects

8:59	Government	We probably need an increase in the workforce. Currently, the number of personnel is standardized, but we only have ten people here. Out of those, six are permanent and four are project-based. If you look at the ratio for 44 areas, our engagement is huge.	obstacle causes
8:60	Government	When you have many projects but few permanent staff, the rest are project personnel or COS (Contract of Service). You have to manage the turnover because if they get a better offer elsewhere, they have to leave for professional growth and stability.	obstacle effects
8:67	Government	You really have to manage yourself to avoid burnout. We currently have a 10-hour, 4-day workweek, which is exhausting.	obstacle effects
8:68	Government	But it's good that there are wellness breaks and leaves now.	Obstacle remedy or solution
8:69	Government	with few people, implementation is hard	obstacles
8:70	Government	The challenge is managing different generations and avoiding misunderstandings.	obstacle effects
8:71	Government	We handle about 40 active projects every year.	obstacle causes
8:72	Government	Visionary leadership	Driver
8:73	Government	highly competent personnel	Driver
8:74	Government	Also, funding—it requires money to support ideas and solve problems through R&D.	Driver
8:75	Government	platforms where various stakeholders can meet to find relevant solutions so we don't just waste effort.	Driver
8:76	Government	Disruptions. Whether it's war or a pandemic, future uncertainties are the biggest challenge.	obstacles
8:77	Government	Because our economy is service-heavy, a pandemic where there are no visitors or OFWs are affected hits us hard.	obstacle causes
8:78	Government	We need to develop our own industries and manufacturing so we can be self-sufficient like Singapore, especially in terms of food.	Obstacle remedy or solution
8:79	Government	Also, we need a more collaborative attitude.	Driver
8:80	Government	offices are unwilling to share information.	obstacle causes
8:81	Government	We just lack the actual manufacturing.	obstacles
8:82	Government	Most of what we have are flour mills and feed mills, but they aren't that large.	obstacle causes
8:83	Government	In terms of talent, we can definitely compete	competition with other region
8:84	Government	We have plenty of talent in the innovation ecosystem, although many leave.	competition with other region
8:85	Government	You find partners who have more resources and leverage your strength—like writing the technical proposal. You find ways.	Obstacle remedy or solution
8:86	Government	trust. Without trust, no one will talk or collaborate	Driver
8:87	Government	Relationships and trust-building—doing what you promised and managing expectations—are essential for a strong ecosystem.	Driver leads to...
8:88	Government	Communication is the most important. Open communication and trust-building are the only ways to solve problems	Driver
9:17	Government	We've been reaching out to the Provincial Government for years, but it's only recently that the Governor has begun to appreciate our work	obstacles
9:18	Government	DOST projects (worth 1-2 million pesos) were considered "small-time" compared to massive DPWH projects.	obstacle causes
9:19	Government	Fortunately, the current head of the Office of the Provincial Agriculturist is a Philippine Science High School graduate, so there is now more support for science	Obstacle remedy or solution
9:31	Government	Market and innovation, these should be stitched together.	Driver leads to...
9:32	Government	There should be partnership and collaboration	Driver
9:38	Government	They are not open (LGU on change). We want to help improve tourism, even just the entry process into ____.	obstacles
9:40	Government	The tourists are the ones affected.	obstacle effects
9:41	Government	They aren't open to help; they want to do it themselves.	obstacle causes
9:51	Government	In cooperatives, the acceptance of innovation is very low.	obstacles

9:52	Government	They don't appreciate it because, as a group, they can't even work together.	obstacle causes
9:53	Government	Improvement is very slow.	obstacle effects
9:54	Government	Businesses are struggling, especially after COVID…. Now, we anticipate more problems because of the current global conflicts. The main market for our local MSMEs is ____.	obstacle effects
9:55	Government	In 2024-2025, the main tourists in ___. Many have shifted to Bohol and Palawan.	obstacle effects
9:56	Government	MSMEs here need to be resourceful and look beyond ____, but competing with ___ is hard because ___is already so advanced.	obstacle effects
9:57	Government	flagship model	Driver
9:58	Government	Increased employment.	Driver leads to...
9:59	Government	they hired more people because they adopted more DOST technologies.	Driver leads to...
9:60	Government	The key factor is the mindset of the President. He is pro-innovation. He understands it, applies it, and instills it in his employees.	Driver
9:61	Government	They don't just stop at bread; they are launching a beverage line now. They aren't afraid to take risks, even in this economy.	Driver leads to...
9:62	Government	procurement	delays and time constraint
9:63	Government	we actually help the clients write the proposals because they don't have the capacity. The delay happens on their end with documentation—Mayor's permits, BIR forms, etc. That's where the process gets stuck.	delays and time constraint
9:64	Government	silo mentality	obstacles
9:65	Government	silo mentality. People are afraid other agencies will take credit for their accomplishments. That's why innovation doesn't move forward in ___. Startup development isn't progressing. It's hard when only DOST is pushing for it.	obstacle effects
9:66	Government	I don't want to be discouraged, even if we've spent years giving our all at ___. We keep going.	Obstacle remedy or solution
9:67	Government	I hope they see our projects being successful elsewhere and try to duplicate them here, like what ____ are doing.	Obstacle remedy or solution
9:68	Government	If local executives just passed an ordinance to bring stakeholders together, agencies would have no choice but to collaborate	Obstacle remedy or solution
9:69	Government	If only there was no corruption in government—if we were honest and transparent—programs would be beautiful. If the public could appreciate what the government does for them, the Philippines could become a "Tiger of Asia" again.	Obstacle remedy or solution
10:22	Government	Sometimes their perception is that when we provide projects to LGUs, it's just "added work" for them, rather than seeing the potential impact on the community.	obstacles
10:23	Government	If an LGU sees the project as something that helps the community, they are the ones who implement quickly and are very easy to work with. But for LGUs that feel the project is a burden, it requires more follow-through meetings and more regular monitoring just to properly align with them and eventually help them realize the true intent of the project.	Obstacle remedy or solution
10:27	Government	The challenge was really matching the available technology from DOST and our partner institutions with the actual needs of the locals.	obstacles
10:32	Government	we "immerse" ourselves in the community. What happens is we invite not only the barangay LGU but different sectors of the community to really hear their strengths, weaknesses, opportunities, and the threats they face.	Obstacle remedy or solution
10:33	Government	We have representatives from senior citizens, the youth, professionals, MSMEs, the LGBTQIA+ community, and out-of-school youth. So basically, it's a community needs assessment.	Obstacle remedy or solution
10:34	Government	When the partner LGU gives feedback, they are really happy because a large percentage of what we discussed during the needs assessment has been addressed with interventions or assistance. So far, so good.	Obstacle remedy or solution

10:39	Government	There is a group of people who are very open to innovation. Particularly the managers or business owners in the younger range—the younger generation taking over their family businesses.	Driver
10:50	Government	Our established food processors, especially in mango processing, are already active. I think they have established many really good mango-based products. So far, the value-adding for mangoes is doing okay.	Driver
10:51	Government	the Guimaras mango in particular was awarded a GI (Geographical Indication) by IPOPHL (Intellectual Property Office of the Philippines).	Driver
10:52	Government	That's why the province is strengthening the farmers' compliance with the established "code of practices" for mango production—to ensure production is standardized so the GI can be maintained.	Driver leads to...
10:56	Government	The biggest challenge is sustainability	obstacles
10:57	Government	We've experienced cases where our assistance is just the acquisition of equipment awarded to the LGU. But when you go back months or years later, the project wasn't sustained.	obstacle causes
10:58	Government	The intent is for the LGU to eventually manage the project for long-term benefit.	obstacle effects
10:59	Government	Manpower. Projects used to have a personnel component where part of the funds was used to hire staff. Once the project is complete, that staff position is gone.	obstacle causes
10:60	Government	The project leader is usually a Municipal Planning Officer who is already overloaded with other LGU tasks.	obstacle causes
10:61	Government	management issues. Some beneficiaries are cooperatives or associations that later face internal conflicts and disband	obstacle causes
10:62	Government	The real challenge is management—officers change, or other business activities compromise the coop's financial position.	obstacle causes
10:63	Government	Based on the number of "Balik-Scientists" and researchers we have, I'd say we are in the upper half compared to other regional offices. We are competitive in R&D activities, budget allocation, and the quality of researchers.	competition with other region
10:64	Government	They are at the top, along with Region 3. We are likely next, along with Region 7. We aren't lagging; we are running after them. ___, specifically, is leading with many initiatives to strengthen the innovation ecosystem and startup activities	competition with other region
10:65	Government	Procurement	delays and time constraint
10:67	Government	That's the first thing that comes to mind. It's a challenge in ___ because of the lack of local suppliers for specialized technology. Finding the right players to speed up the process is hard.	delays effects
10:68	Government	With LGUs and government agencies as partners, papers go through so many signatories. If a document needs revision, it has to go through that long process all over again.	delays effects
10:70	Government	When introducing innovation, it doesn't necessarily have to be "advanced." What's important is practicality, ease of use, and addressing a local need. It's a waste of resources to develop technology that has no intended user. We must start with the needs of the community.	Driver
11:42	Academe	tedious paperwork and FOB requirement	obstacles
11:43	Academe	We guide them through the process.	Obstacle remedy or solution
11:44	Academe	Most of our technology requires a "middleman" producer because our outputs are often ingredients for other products rather than direct consumer goods.	obstacles
11:45	Academe	We assist spin-offs hands-on with their business plans to make sure they are acceptable to the FOB.	Obstacle remedy or solution
11:46	Academe	It's not just an industry problem; it's a researcher problem	obstacle causes
11:47	Academe	In the past, researchers weren't prepared for these requirements—they thought their job ended at filing the IP.	obstacle causes
11:48	Academe	Now, through our programs, we are changing the mindset of researchers to push for commercialization.	Obstacle remedy or solution

11:49	Academe	We have developed spin-off policies, tech transfer protocols, and IP policies. Research agencies like PCAARRD have guided us. We've incorporated these into our training so faculty members now see the business value of their research. Some are now aligning their research toward commercialization instead of just publication.	Obstacle remedy or solution
11:50	Academe	So, at least we have aligned our policies here at the university to serve as a guide or to help.	Obstacle remedy or solution
11:51	Academe	Our policy amendments, if implemented system-wide, go through the BOR (Board of Regents). But if it's just here for __, usually as long as we get approval from the ___ to implement it and show that it's aligned, they allow it. We also requested the __ to have focal persons per college so it wouldn't be difficult for us to cascade information since we are a small office.	Obstacle remedy or solution
11:52	Academe	this is done without violating RA 10055 or our IP Code in the Philippines.	Obstacle remedy or solution
11:65	Academe	Having government support for our innovation... especially on the promotion end, where they promote the idea that instead of exporting or importing technology, why not use what has been developed by our universities if it's available? Our needs can be addressed by our own research, and we should push for that instead of always importing from other countries. That's one of the biggest supports we need—support from the government showing they believe in the innovation we are doing here in the Philippines or here in our region.	Driver leads to...
11:66	Academe	Having government support for our innovation.	Driver
11:67	Academe	Regarding talent and expertise, Ma'am, there's no question. It's definitely there. In the entire country, Region 6 has one of the highest concentrations of talent and expertise for innovation.	competition with other region
11:68	Academe	Regarding funding, perhaps that's where we are falling short. We need large amounts of funding, but they don't seem to appreciate that yet because they expect technology to be easy...	competition with other region
11:69	Academe	even just funding to improve the "readiness" of our technology. We don't have specific funding for that. Our current level is often just laboratory scale. It's expected that when we upscale to industry... but it's difficult..	obstacles
11:70	Academe	if you do get funding, my goodness, your research is finished and you still haven't finished the procurement of what you need. That's another discouraging point on our side. For example, when we are on the pre-commercialization side and testing for mass production... we get delayed because it takes forever for our equipment to arrive, or we have to wait in line—for instance, our last one was a shelf-life study.	Driver leads to...
11:71	Academe	funding,	delays and time constraint
11:75	Academe	And that's why sometimes it fails and becomes frustrating because your project cycle is cut short; you're chasing time, trying to make the budget fit, and they are expecting so much. They tell you your output should be a commercialized product, but they only give you two years!	obstacle effects
11:77	Academe	Commercialization should be isolated as a separate project from R&D,	obstacles
11:78	Academe	There should be a focus on commercialization once it's been assessed as viable, and the only thing left is how to upscale it.	Obstacle remedy or solution
11:79	Academe	Phase 1 is basic. Phase 2 should be application since Phase 1 was basic; that's where they should start expecting a product. Then Phase 3 should be upscale production, where the end goal is that the industry can adopt it. Isn't that how it should be? Also, as I explained, we don't file for IP at the start of research.	Obstacle remedy or solution
12:15	Academe	budget that takes so long to arrive	delays and time constraint
12:16	Academe	there's no travel allowance yet, I pay for it myself because we have targets to hit.	delays effects
12:17	Academe	organized an innovators' group.	Driver
12:18	Academe	And money is always a problem because when we file, we don't have funds. We have ten items to file. I filed them myself; my credit card bill is high now.	obstacles
12:23	Academe	faculty and their lack of involvement—we probably have a problem there because they say they are already overloaded. In your policy, they are required to have 21 units, and it feels like we don't have time...	obstacle causes

12:24	Academe	budget for it. Like ours—we can say we are "institutionalized,"	Driver
12:25	Academe	having leaders who really push for it, like "____." He is a driver.	Driver
12:26	Academe	having a "navigator"—someone who champions the advocacy and provides the platform—is vital	Driver
12:27	Academe	If that person is gone, things weaken. Just like before "___" retires, he should put an "___" in place.	Driver leads to...
12:28	Academe	"circular"—from researcher to innovator to entrepreneur.	Driver
12:29	Academe	others are more on the entrepreneur side. You just pair them with a researcher to form a team.	Driver
12:30	Academe	Yes, I've seen that there is a bias in funding, especially towards the Tagalog region because they are situated there.	competition with other region
12:31	Academe	Sometimes we have to be careful because they move so fast, they might file before us. Even with an NDA (Non-Disclosure Agreement), I don't really believe in NDAs. Regarding my fruit wines, they kept asking questions, so eventually, I stopped talking. I stopped giving out information because they are clever. There are similarities.	obstacles
12:36	Academe	once they trust you, you have to do things correctly and liquidate the funds so that when the next project comes, it won't be a struggle.	Driver
12:37	Academe	accounting department.	delays and time constraint
12:38	Academe	accounting department. They don't understand "project life." No matter how many times you explain it, their brains are fixed on December.	delays effects
12:39	Academe	fund management and the processing.	obstacles
13:10	Industry	We don't use any chemicals. Except in our packaging procedures, we have... the polyethylene packs and plastics, right? So, we are introducing this to other clients. I am teaching them to reuse or recycle the plastic or plastic containers.	Driver
13:12	Industry	You shouldn't hold a grudge if there's something they don't like about the impression of the product	Obstacle remedy or solution
13:13	Industry	if there is negative criticism. You should take it as positive criticism	obstacles
13:14	Industry	You have to be professional when dealing with people, especially since this is research-based and the product is patented. So, he must understand its exclusivity to the innovator.	Obstacle remedy or solution
13:15	Industry	Because... procurement... you can't just get the equipment immediately... that you need for your work. Because you have a timeline. You need to report to... whoever. Because if not... you won't meet the output that you want to catch up on for the report.	obstacle effects
13:16	Industry	so we should be able to comply with what is expected after one or two quarters. Because we made a promise there, that my output for the second quarter is this. Then we don't even have... the... the equipment you requested. Right? We said we needed that... the calendar says it took a... a year... before it arrived. Oh, that's true. So, it's really hard to catch up.	obstacle effects
13:17	Industry	When his funds don't arrive from the university... yes... from the agency... you find a way. Out of pocket.	obstacles
13:19	Industry	For the ones that follow, I look at that, I shouldn't fail.	Driver
13:20	Industry	Because they are watching. So that's why... okay... I was looking at when... it went... when the technology was successful.	Driver leads to...
13:27	Industry	So, when there's an opportunity, we just tell our story so they can be more... so others can be motivated. Because if not, the younger generation will just settle for the concept without anything, right?	Obstacle remedy or solution
13:28	Industry	You should prove... even the prototype, show that it is working and after that, when you do it, it will really work and it will actually be used.	Obstacle remedy or solution
13:29	Industry	We need a wider market reach.	Driver
13:30	Industry	strengthen relationships for further collaborations	Driver leads to...
13:31	Industry	Partnerships	Driver
13:32	Industry	competitive	Driver

13:33	Industry	. Yes. In your logistics alone, Ma'am. That is one thing that should be looked at as one of the risks that should be considered. Because logistics Ma'am... actually that's what I'm thinking about until now. Oh yes. This logistics should be included because with the continued increase in the price of diesel	obstacles
13:35	Industry	That's why they asked, the business mindset should still be focused on the business. Not on research.	obstacles
13:36	Industry	legacy	Driver
13:37	Industry	We already have a marker there, the DOST one that's placed there... a mark of a startup	Driver leads to...
13:38	Industry	You give inspiration to others, Ma'am. I was happy, I said "Oh, I'm actually... something to people..." even if I don't know them anymore but they heard my name and I was able to touch people's hearts. Y	Driver leads to...
13:39	Industry	government procurement program because it has to be through bidding	delays and time constraint
13:40	Industry	nd until now, we've served the paste but there is no payment yet. Hmm.	delays effects
13:41	Industry	Patience is... to start... while working on the concept... everything should be planned	Driver
14:8	Industry	Inefficient manufacturing system	obstacles
14:9	Industry	Unreadiness of the academe in the demanding commercialization process	obstacles
14:10	Industry	delayed R&D process, implementation and paper works	obstacle effects
14:13	Industry	competitiveness starting in the R&D stage	Driver
16:5	Industry	Manufacturing raw materials	obstacles
16:6	Industry	Suppliers do not impose quality control over raw materials, quality of cotton is not pure and good, there are many seeds in the cotton.	obstacle causes
16:9	Industry	. Local yields of raw material is low leading to high wastage during the sifting and processing	obstacle effects
16:12	Industry	Not many farmers are into cotton or abaca	obstacle causes
16:14	Industry	Quality of raw materials	obstacles
16:16	Industry	Leading to the industry to look closely into the value chain process. Every aspect is being looked at. This is to prepare for risks in the future that might affect the supply of yarn.	Obstacle remedy or solution
16:18	Industry	Equipment upgrade, upgrade quality of material, power cost and supply cost, locality of supply, capacity of supplier, environmental impact in the processing of raw material	Obstacle remedy or solution
16:19	Industry	More manpower for large scale production	Obstacle remedy or solution
17:33	Academe	So I think that's where we need to strengthen the challenges, that the technologies we should develop or address should really address the need or the problem of the industry.	obstacles
17:34	Academe	we need to strengthen the challenges, that the technologies we should develop or address should really address the need or the problem of the industry.	Driver
17:35	Academe	Through that, your commercialization is easier compared to pushing it.	Driver leads to...
17:36	Academe	So it would really be better to have the industry as a partner in the research we are doing. That's what we need to strengthen, Ma'am.	Driver leads to...
17:50	Academe	value chain of products in research	Driver
17:60	Academe	harmonized policies like IP policy, tech transfer, and then our spin-off policies.	Driver
17:61	Academe	I think they are crafted to align with the tech transfer... with the laws in the Philippines, right	Driver leads to...
17:62	Academe	process-oriented,	Driver
17:63	Academe	h the policies, at the same time with the procedures, right? But people are really a big factor, Ma'am, on how to implement those policies,	Driver
17:64	Academe	support is from the top management	Driver
17:65	Academe	priorities	Driver leads to...
17:66	Academe	they will work too	Driver leads to...

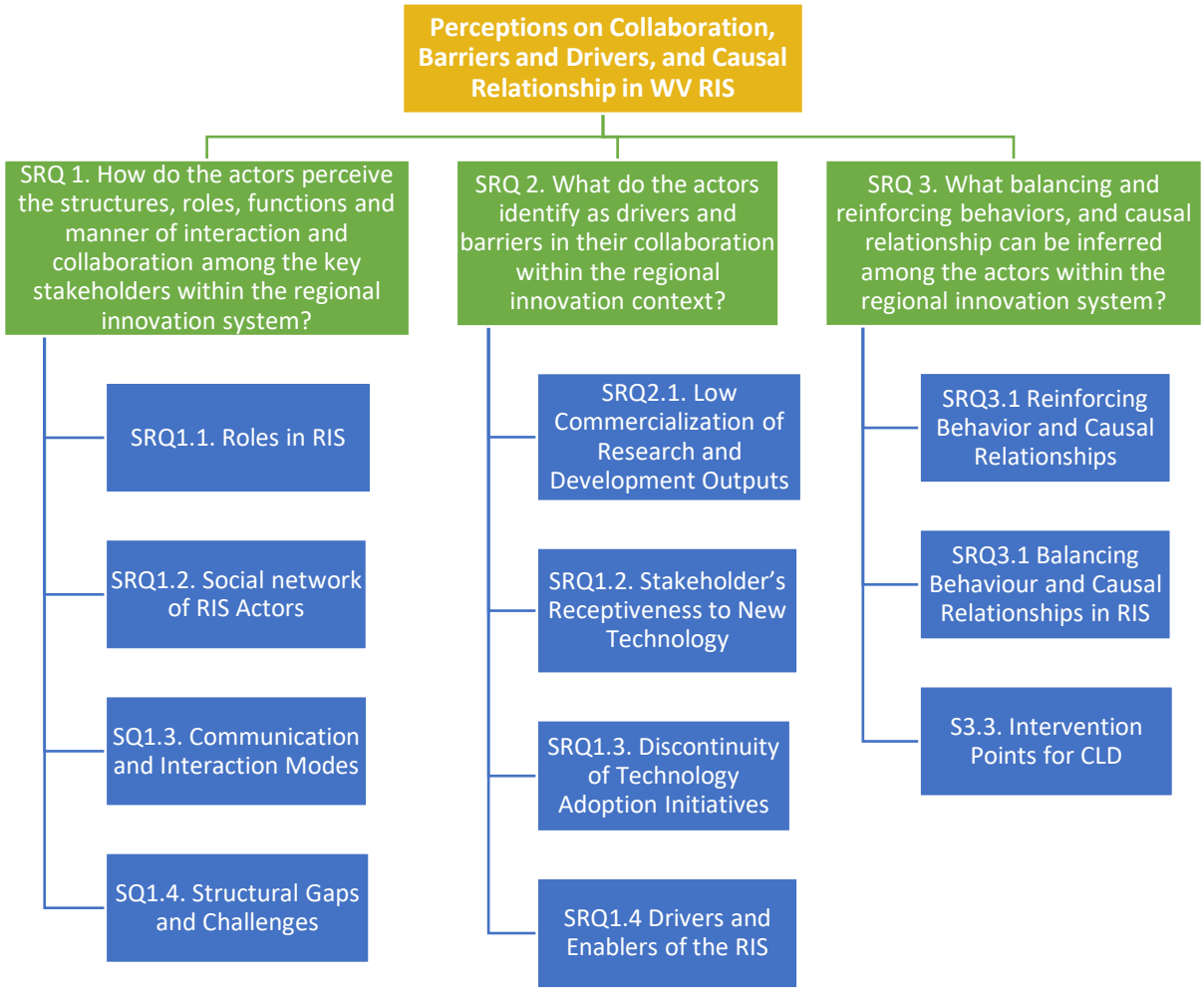
17:67	Academe	politics, Ma’am. It’s always part anyway of the system even here inside and outside. But I think what's nice to see there is they are very supportive of the school's activities,	Driver
17:68	Academe	When we conduct activities, they are okay with it, as long as it's for the university and for ___.	Driver leads to...
17:69	Academe	Our mayors are very supportive, for example, our municipalities, Ma’am, if it's ___, maybe because we are the only university here on the island, right?	Driver leads to...
17:70	Academe	establish the IP system here at ___ so that everyone understands.	obstacles
17:71	Academe	don't have, for example, what they call a unicorn? Oh yes, right? Because if you have a really big unicorn, they will approach you. Correct. Or if they see it's really working even just one...	obstacle causes
17:72	Academe	champion,	Driver
17:73	Academe	high school, the college students, innovation is being injected into them.	Driver
17:74	Academe	So I think that is much easier to get the innovation system into them compared	Driver leads to...
17:75	Academe	old	obstacles
17:76	Academe	then you tell them, you go to them, then they say "what is this?" "what is this?" "does it work?" "I've been..." "we've been successful already."	obstacle effects
17:77	Academe	They just want to invent. Business isn't maybe their forte.	obstacles
17:80	Academe	partnership with the industry, academe, and the agencies and the community.	Driver
17:81	Academe	biggest thing is awareness of the innovation system here in ___	Driver
17:82	Academe	so they know what that is and what they can get from it, right? And then, of course, they want to be sure ("siguradista"), Ma’am, in those kinds of things	Driver leads to...
17:83	Academe	funds, money,	Driver
17:84	Academe	innovation budget is quite small	obstacles
17:85	Academe	awareness, very limited.	obstacles
17:86	Academe	regarding the money, Ma’am, in accounting. The fund is delayed.	delays and time constraint
17:87	Academe	The fund is delayed, for example, when you buy equipment in bidding	delays effects
17:88	Academe	Bids and Awards Committee.	delays and time constraint
17:89	Academe	Our submission to BAC, procurement, procurement actually.	delays effects
17:91	Academe	So it's better to partner with the industry, and then conduct research within that, and then address the needs, the problem, the technical problem	Driver leads to...
17:92	Academe	So it's better to partner with the industry, and then conduct research within that, and then address the needs, the problem, the technical problem. And then everything will follow: IP protection, commercialization, will follow.	Driver leads to...
18:9	Academe	they have a TLA [Technology Licensing Agreement], but no FOB [Fairness Opinion Board], that's the only problem.	obstacles
18:28	Academe	commitment of our innovators. Yes, yes Ma’am, right? Because if we lack commitment or motivation,	obstacles
18:29	Academe	we have researches, even innovations that were extended but there was no sustainability. Correct. So after extension, it just stops right there.	obstacles
18:30	Academe	no one follows up with them.	obstacle causes
18:31	Academe	it seems we didn't monitor what the progress of our research was after we left it with them. Maybe it's in the monitoring of our... Yes.	obstacle effects
18:32	Academe	mindsets of the people in the community	obstacles
18:33	Academe	And if they don't really get anything back from it, they eventually lose interest. If they don't see a big use for it, sometimes they lose their drive to sustain what was left with them.	obstacle causes
18:34	Academe	needs assessment.	Driver
18:35	Academe	management is good	Driver
18:36	Academe	maybe their income is okay,	Driver leads to...

18:37	Academe	So most of the innovations here aren't funded by the school	obstacles
18:38	Academe	It's the initiative of the faculty if they want to push through with commercialization.	obstacle effects
18:40	Academe	but you have laboratories, research laboratories also? Ah, none. There are research... we have equipment but for example, it's just for classroom needs.	obstacles
19:7	Coop	Not enough space for weaving as traditional loom is too big in their houses	obstacles
19:8	Coop	No direct contact with big companies where they could supply products	obstacles
19:9	Coop	Too many orders but only few weavers left	obstacles
20:10	Coop	Market opportunity for food products such as chips, pickles, noodles and other seaweed products.	obstacles
20:11	Coop	Most of the beneficiaries' products are currently sold only within the local area and neighboring towns.	obstacle causes
20:12	Coop	Continuous programs and monitoring of beneficiaries.	Obstacle remedy or solution

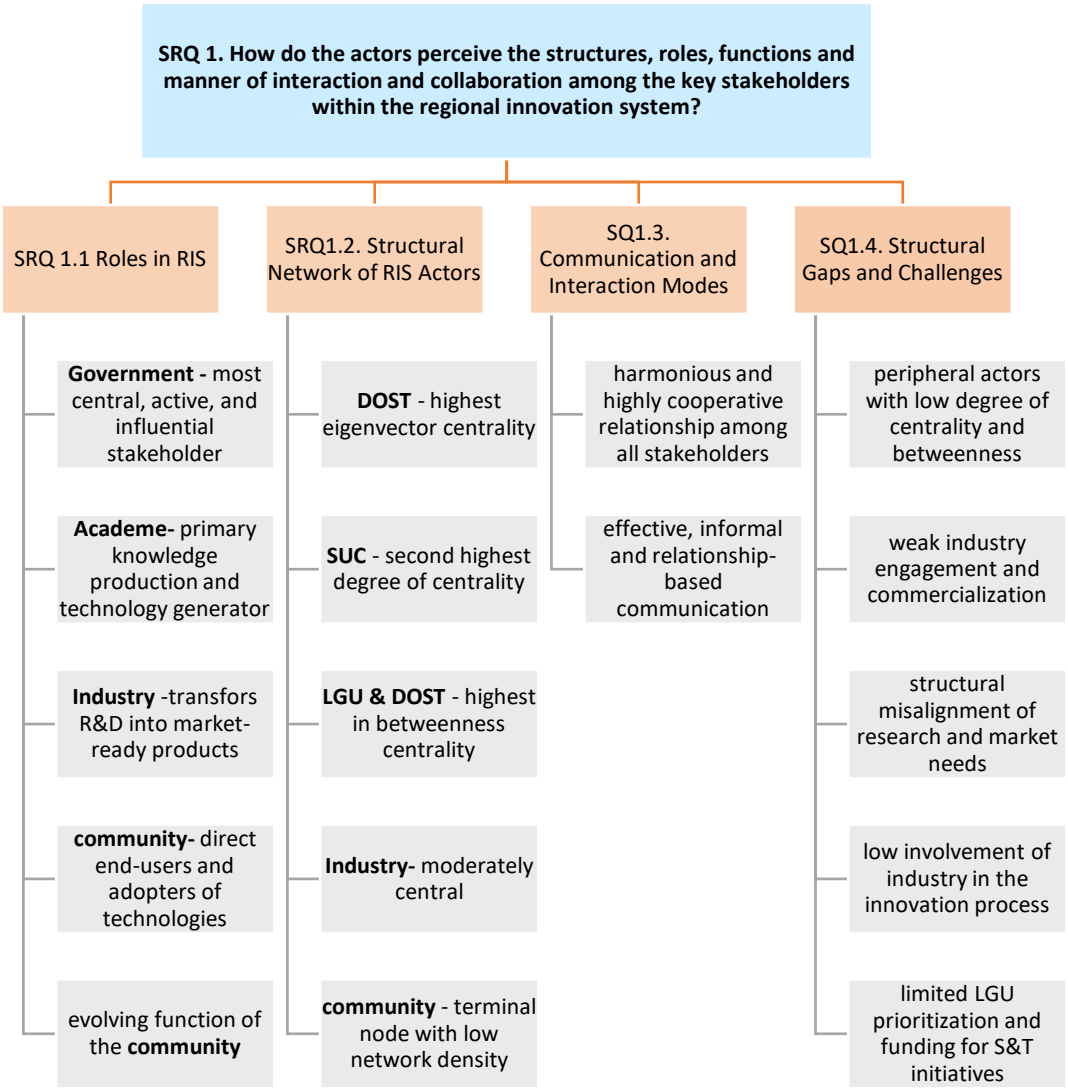
APPENDIX E

Mind Maps

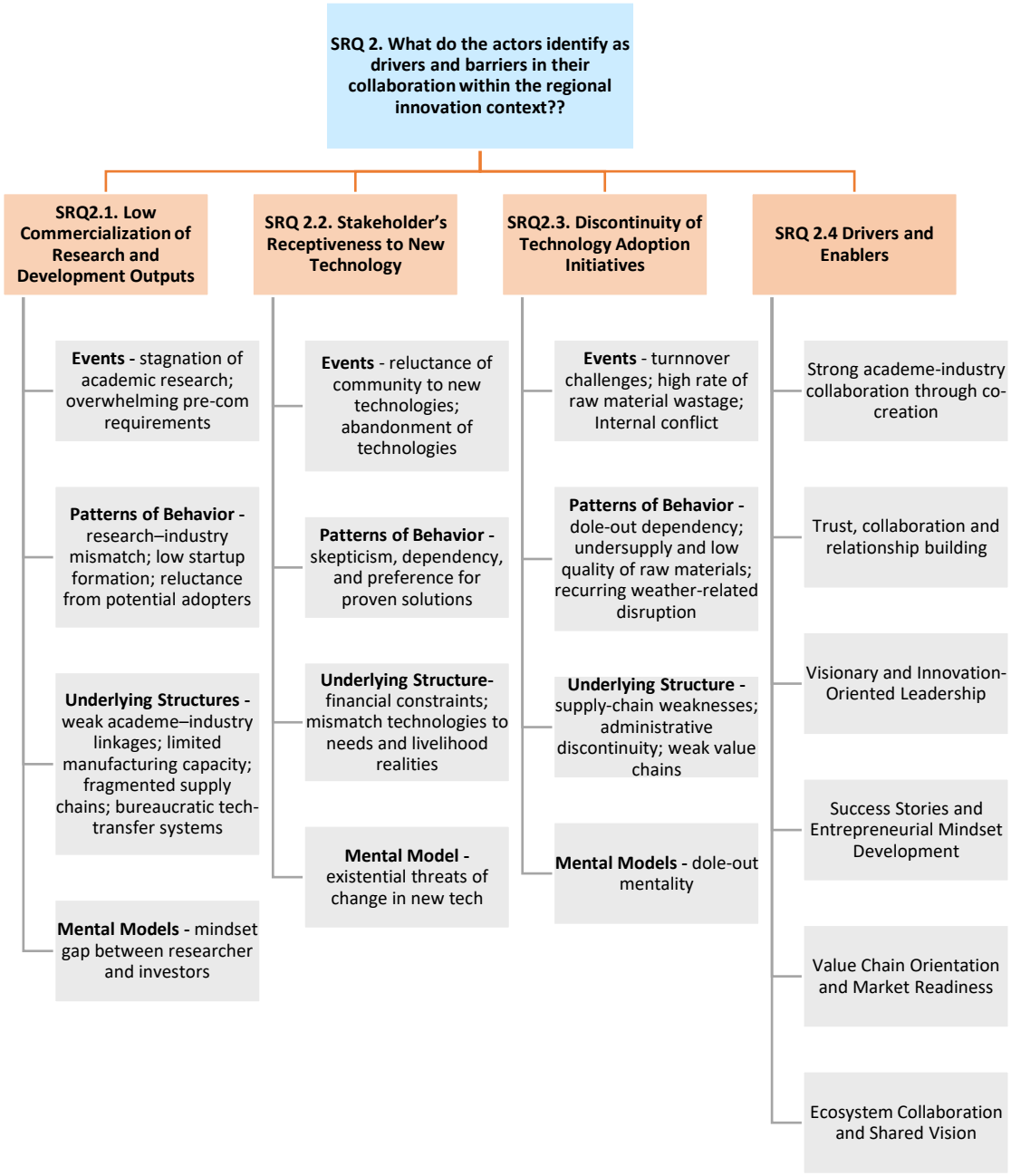
Central Idea: Collaboration, Barriers and Drivers, and Causal Relationship in WV RIS



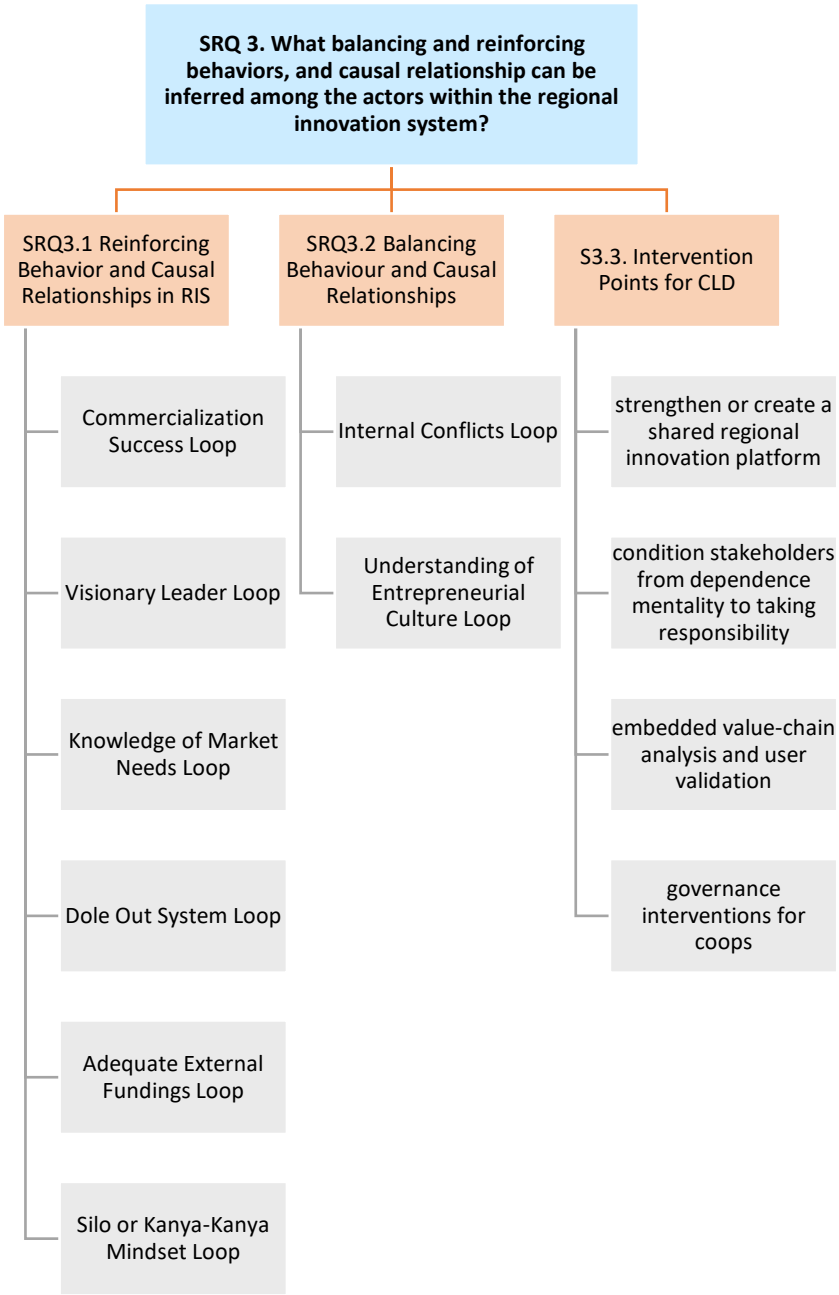
SRQ1 Mind Map: Central Idea > Themes > Categories



SRQ 2 Mind Map: Central Idea > Themes > Categories



SRQ 3 Mind Map: Central Idea > Themes > Categories



APPENDIX F

Timeline for Conduct of the Study

TARGET ACTIVITIES	TARGET ACCOMPLISHMENTS	Month									
		J	F	Mr	A	M	Jn	Jl	A	S	O
Revision of Proposal/Approval	Revised and approved thesis proposal by the panel	X									
Ethics Review	Submitted and approved by ERC	X	X								
Revision and Progress Report	Revised and approved study protocols and interview schedule		X								
Data gathering	Conduct of KII			X	X						
Coding and thematic analysis	Transcribed data and identified emerging themes					X					
Result and Discussion	Analysis of data for result and discussion					X	X				
Finalization of thesis	Finalized thesis in preparation for final defense						X				
Defense Presentation	Conduct of thesis defense							X	X		
Final Revision of thesis for approval	Finalized and approved thesis manuscript									X	X

APPENDIX G

Line Item Budget

Project Title: **A Systems Approach to Mapping a Philippine Regional Innovation System**

Project Implementation: **January to September 2026**

Total Budget: **Php 41,900.00**

	Total
Personnel Services	
Direct Cost	
Honoraria	
Student research assistant /encoder (25 days/3 hours per day)	3,000
Maintenance and Other Operating Expenses	
Traveling Expenses (data gathering)	20,000
Communication Expenses (online interview/calls)	2,000
Tokens for participants (300 for 25 pax)	7,500
Venue and foods for data encoders (400X 6 pax)	2,400
Venue and foods for expert validation and consultation of result (400 X10 pax)	4,000
Tokens for expert (300 for 10 pax)	3,000
TOTAL	**41,900**

Source of Fund: **Personal**

APPENDIX H

Declaration of Tools and Artificial Intelligence (AI) Use in Research

In the interest of complete methodological transparency and adherence to the principles of academic integrity, this appendix discloses the suite of digital tools and applications used to support the completion of this thesis. These tools were employed to augment the research process, from data collection and transcription to analysis and final manuscript preparation. The researcher maintained full intellectual ownership and responsibility for the critical analysis, theoretical development, and conclusions presented in this study.

A. AI-Powered Applications

This section details the tools that leverage Artificial Intelligence for specific tasks.

1. Meeting and Transcription Service

- AI Tool: Zoom Meeting and Transcription Services https://www.zoom.com
- Version: Workplace Pro Premium License 2025
- Purpose: To conduct and record the 20 remote key informant interviews. The platform's built-in AI transcription feature will be utilized to generate initial text documents from the interview audio recordings.
- Outcome: The tool could provide high-quality audio-visual recordings of all interviews and initial, time-stamped text transcripts that will form the basis of the raw data.
- Limitations and Researcher's Role: The AI-powered transcription feature demonstrated limitations in accurately transcribing conversations that mixed English and Hiligaynon. Consequently, the researcher will perform

a thorough manual review, comparison, and correction of all transcripts against the original audio to ensure complete accuracy before analysis. All data will be saved in the personal computer of the researcher and not uploaded in any cloud-based AI.

1. Large Language Models (LLMs)
    - AI Tool: Gemini 3 Flash AI https://gemini.google.com, Claude Sonnet 4.6 AI https://claude.ai/new, ChatGPT 5.5 by OpenAI https://chatgpt.com/c/6a37d9d6-7c68-83ec-9243-6ade4baf13cb
    - Version: Free, web-based services
    - Purpose: The LLMs will be used as "methodological partners" and writing assistants. They will be used as a comparative tool to provide alternative phrasing and structural suggestions. They will also help refine the researcher’s writings for clarity, flow, and academic tone.
    - Outcome: The LLMs will assist in transforming the researcher's primary analysis into a more polished, well-structured, and coherent academic narrative.
    - Limitations and Researcher's Role: Strict ethical boundaries will be maintained. The LLMs will not be provided with any raw, confidential interview transcripts. The researcher will perform all initial open coding and theme identification. The AIs' role will be strictly confined to that of a methodological partner working with the researcher's pre-analyzed and anonymized findings (e.g., lists of themes, drafted paragraphs). The researcher will retain the full intellectual responsibility for all final interpretations and conclusions.

B. Non-AI Research Management Software

This section details the software used to manually organize and manage the research process.

1. Qualitative Data Analysis Software (QDAS)
    - Tool: ATLAS.ti (Student License) https://atlasti.com/atlas-ti-web
    - Version: ATLAS.ti 2025
    - Purpose: The software will be used as a non-AI management tool to facilitate the manual analysis of the interview transcripts. Its function is to help organize the researcher's analytical work, including the creation and application of codes to text segments, and visualizing concept relationships.
    - Outcome: The tool will provide an organized and auditable structure for the researcher's manual coding process, resulting in open codes that will form the foundation of the analysis.
    - Limitations and Researcher's Role: The researcher will not use the software's automated AI features (e.g., automated coding). All interpretive and analytical work will be performed manually by the researcher, in line with the methodology. The software will serve solely as an organizational aid.
2. Mind Mapping Software
    - Tool: Gephi 0.11.12; Claude Sonnet 4.6 AI https://claude.ai/new,
    - Version: Trial versions
    - Purpose: These will be used for conceptual visualization during the data analysis phase. It will help the researcher visually organize the open codes into focused codes and map the relationships between

these categories to identify the emergent core themes particularly in the Social network Analysis.

- Outcome: This will produce visual mind maps that will serve as a blueprint for the thematic structure, facilitating the synthesis of data into theory.
- Limitations and Researcher's Role: Gephi and Claude Sonnet are manual visualization tools. It does not perform any automated analysis; it only provided a canvas to represent the analytical connections and structures created by the researcher.

3. Causal Loop Diagramming
    - Tool: Vensim PLE x64 software application
    - Version: Version **10.4.0**. Personal Learning Edition
    - Purpose: It helps define feedback structure and “circular” relationships between variables. Its primary purpose in Causal Loop Diagramming is to identify whether causal loops are reinforcing or balancing to verify the logic of a system.
    - Outcome: This will produce mental model to reveal feedback structures allowing the researcher to predict how a system will behave over time and to identify specific “leverage points” for possible policy intervention.
    - Limitations and Researcher's Role: Vensim lacks advance data connectivity. The researcher will primarily define the boundaries of the system by inputting raw data or themes to be processed by the application. The researcher will also ensure the accuracy of the causal relationship generated by the application.

APPENDIX I

Study Setting: Regional Profile of Western Visayas (Region VI)



Geographic and Administrative Profile

Western Visayas, officially designated as Region VI, occupies the western portion of the Visayas island group in the central Philippines. Following the transfer of Negros Occidental to the newly constituted Negros Island Region in 2024, the region's current composition consists of five provinces — Aklan, Antique, Capiz, Guimaras, and Iloilo — together with the highly urbanized city of Iloilo, which functions as the regional center (Philippine Statistics Authority [PSA], 2024). The region is anchored by the island of Panay, with Guimaras constituting a smaller, adjoining island province.

Topography

The physical landscape of Western Visayas is characterized by an interplay of coastal lowland and mountainous interior. Broad stretches of coastal plain give way to rugged hill systems further inland, underlain by volcanic soils that have historically supported the region's agricultural base. The highest elevation in the region is Mount Madja-as, located in the interior of Antique province, rising to 2,117 meters above sea level (PSA, 2024).

Economic Base and Local Products

Agriculture and fisheries remain the dominant economic sectors across the region, though production profiles vary by province. Recent PSA data indicate that sugarcane has retained its position as the region's leading crop even after the statistical separation of Negros Occidental from the region's figures (PSA Regional Statistical Services Office

[RSSO] VI, 2025). Beyond sugarcane, each province contributes a distinct agricultural or industrial specialization: Aklan is recognized for abaca and piña fiber production and is home to Boracay Island; Antique's economy centers on agriculture and fishing; Capiz, popularly termed the "Seafood Capital," sustains extensive fishing grounds; Guimaras is nationally associated with mango production; and Iloilo functions as both an agricultural center and a hub of trade, heritage, and commerce.

Sociolinguistic and Institutional Context

The region's population is linguistically diverse, with Hiligaynon, Kinaray-a, Aklanon, Capiznon, and Inati spoken alongside Tagalog and English (PSA, 2024). Labor force participation among the working-age population reached 62.2 percent as of July 2025, reflecting a 0.4 percentage-point increase from the previous year (PSA RSSO VI, 2026). This socioeconomic and institutional backdrop — marked by an agriculture-dependent economy, multilingual population, and a network of provincial and regional government offices — forms the immediate context within which the Regional Innovation System of Western Visayas, and the actor relationships central to this study, are situated.