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1. INTRODUCTION

Food insecurity remains a persistent global challenge. It refers to a condition in which individuals or households lack reliable physical and economic access to sufficient, safe, and nutritious food needed to maintain an active and healthy life. Hunger, malnutrition, and nutrient deficiencies are closely associated with food insecurity and disproportionately affect economically and socially vulnerable populations, particularly those living in rural communities (Fikre Tesfahun, 2022; Gomez et al., 2020).

Food insecurity is driven by interconnected economic, environmental, and social conditions. Poverty arising from economic instability, inequitable food prices, and the unequal distribution of income and productive resources limits people's capacity to obtain adequate and nutritious food (Ronaghi & Scorsone, 2023; Alade et al., 2023). These socioeconomic inequalities are especially consequential in rural areas, where households depend heavily on agriculture for their income and food supply.

Agricultural production is also highly sensitive to environmental conditions. Drought, unpredictable precipitation patterns, soil fertility, and agricultural management practices influence crop productivity, food quality, and the availability of agricultural products (Visse-Mansiaux et al., 2025; Zaporozhchenko et al., 2022; Li & Li, 2023; Verma, 2022). When climate-related shocks reduce agricultural output, local food systems and supply chains come under pressure, threatening the availability, affordability, and accessibility of food in rural communities.

The consequences extend beyond immediate hunger. Persistent food insecurity and malnutrition may adversely affect public health, educational achievement, labor

productivity, and long-term national development (Enge et al., 2024). Among children, inadequate nutrition can impair cognitive development, concentration, learning, and academic performance (Roberts et al., 2022). Ensuring reliable access to affordable and nutritious food is therefore essential to building healthy, educated, resilient, and economically productive communities.

Women play essential roles throughout agrifood systems as producers, processors, entrepreneurs, custodians of crop diversity, and managers of household food and nutrition. Their participation extends from agricultural production to processing, value addition, distribution, and trade, making their work vital to household food security, rural livelihoods, and local economic development (Nirmal Ravi Kumar et al., 2024). Recent FAO evidence similarly recognizes women's contributions across the agrifood value chain while showing that much of their labor remains undervalued or inadequately recognized.

As women become increasingly involved in agricultural processing and entrepreneurship, they contribute not only to household food availability but also to the development of micro, small, and medium enterprises. Through value-adding activities, women can transform surplus or underutilized agricultural commodities into marketable products, reduce postharvest losses, diversify household income, and generate employment within their communities.

Despite these contributions, women in agrifood systems continue to face structural barriers related to land, productive resources, technology, extension services, financing, training, and decision-making opportunities. They also carry a disproportionate burden of unpaid domestic and care work, which restricts the time and resources available for innovation and enterprise development. These disadvantages are reinforced by gender stereotypes, institutional practices, and social expectations that can limit women's participation in entrepreneurial and technological activities.

Addressing such gender disparities could produce broader economic and food-security benefits. Evidence indicates that women's empowerment and equitable access to productive resources can improve household welfare, strengthen rural economies, and enhance the resilience of agrifood systems. Consequently, gender-responsive financial assistance, technical training, access to technology, mentoring, and supportive institutional policies are increasingly recognized as necessary components of sustainable agricultural development.

1.1 Problem context

Cagayan Valley, or Region II, is one of the Philippines' major agricultural production areas. The region is a leading producer of corn and rice and supplies agricultural commodities to markets outside the region. This strong production base provides opportunities for agricultural processing, value addition, entrepreneurship, and the commercialization of locally developed agricultural technologies.

The region's innovation environment is supported by government agencies and higher-education institutions. For example, the collaboration between the Department of Science and Technology–Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development and Isabela State University has supported the establishment of an Agri-Aqua Technology Business Incubation Center, an agribusiness hub, and facilities for intellectual-property and technology management. These initiatives are intended to strengthen product development, technology transfer, and agricultural entrepreneurship in Cagayan Valley.

Within this environment, women innovators contribute to the transformation of agricultural production by processing crops, developing value-added products, and establishing agriculture-based enterprises. By converting raw or surplus commodities into products with greater market value, they can support household income, local employment, food availability, and regional economic development.

However, women innovators do not participate in this innovation ecosystem under equal conditions. Their entrepreneurial activities may be constrained by limited access to financing, land, technology, business networks, markets, training, and institutional support. These barriers may be further intensified by unpaid domestic responsibilities, gender stereotypes, family circumstances, socioeconomic position, geographical location, and other intersecting dimensions of inequality.

The resulting challenge is not merely a lack of entrepreneurial ability among women. Rather, it concerns the social, cultural, economic, and institutional conditions that influence whether women can translate their knowledge, resilience, and entrepreneurial capacities into sustainable innovation outcomes. Generic assistance for MSMEs may not adequately respond to these intersecting and gender-specific constraints.

1.2 Research gap

Many studies show that women contribute to farming and face barriers, but few explain how these barriers combine to affect women-led agricultural startups in Cagayan Valley, or how women's own stories can guide the design of support programs.

1.3 Research questions and objectives

To address the problem and achieve the objectives of this study, the following research question (RQ) has been formulated by the researcher

Main Research Question (MRQ): What are the intersectional barriers, experiences, and demographic factors that influence innovation of women in agricultural startups in Cagayan Valley?

Sub-research question (SRQ)

- **SRQ1** (Qualitative**)**. What are the experiences of women innovators in agricultural startups in Cagayan Valley navigating intersectional barriers to innovation?

- **SRQ2** (Quantitative). To what extent do demographic characteristics and intersectional barriers relate to and predict innovation productivity among women innovators in agricultural startups in the Cagayan Valley Region?

  SRQ2a. Does innovation productivity differ significantly by age, marital status, number of children and structural family status?

  SRQ2b. What is the extent of each intersectional barrier domain, and how is each related to innovation productivity?

  SRQ2c. To what extent do the intersectional barrier domains (financial and land access; time poverty and unpaid care work; social and institutional support; gender and institutional; regional and sociocultural; gender stereotypes and cultural norms; technology and machinery; intersectional identity; and overall support environment) jointly and uniquely predict innovation productivity?

1.4 Purpose and objectives

Using an **exploratory sequential mixed-methods design**, this study aims to investigate how the lived experiences and intersecting barriers encountered by women innovators shape the innovation productivity and outcomes of women-led agricultural startups in Cagayan Valley.

Specifically, the study seeks to:

1.To explore and describe the experiences of women innovators in agricultural startups in Cagayan Valley, focusing on how they articulate and navigate intersectional barriers to innovation.

2. To determine the extent to which demographic characteristics (age, marital status, number of children, and structural family status) and intersectional barriers (financial and land access; time poverty and unpaid care work; social and institutional support; gender and institutional; regional and sociocultural; gender stereotypes and cultural norms; technology and machinery; intersectional identity; and overall support environment) relate to and predict innovation productivity among women innovators in agricultural startups in the Cagayan Valley Region.

1.5 Expected contribution

The study argues that the innovation productivity of women-led agricultural startups is not determined solely by women's knowledge, entrepreneurial capacity, resilience, or social

networks. It is also shaped by the interaction of available resources, institutional arrangements, sociocultural norms, household responsibilities, and women's demographic and socioeconomic circumstances.

The findings are expected to provide an evidence base for designing support mechanisms that respond to the actual experiences of women innovators. These may include gender-responsive training, mentorship, technology access, market linkages, business-incubation services, grant programs, and collateral-free or alternative forms of financing.

The study may also contribute a context-specific understanding of women's agricultural innovation in Cagayan Valley. By integrating lived experiences with quantitative evidence, it can inform policies and programs developed by government agencies, academic institutions, technology business incubators, financial organizations, and other stakeholders. Ultimately, the study seeks to promote a more inclusive agricultural innovation ecosystem capable of supporting sustainable women-led enterprises, rural livelihoods, and community food security.

2. Theoretical background

2.1 Integrated theoretical lenses guiding the study

The primary theoretical framework used to interpret the results of this research is the Intersectionality Theory. It seeks to establish the extent to which women's innovations experiences are shaped by their social location which includes their socioeconomic, age, educational, agricultural enterprise, and locality backgrounds. The second theoretical framework that guides this research is Feminist Political Ecology. This theory seeks to establish the role of gender relations in determining women's access to agriculture related resources, knowledge, spaces for making decisions, and innovation processes.

This study integrates Feminist Political Ecology, Agricultural Innovation Systems, and Intersectionality Theory to examine women's agricultural innovation. It views innovation as a social process shaped by gendered power relations, access to resources and institutions, and women's diverse socioeconomic identities and local contexts. Together, these theories help explain the opportunities and barriers women innovators encounter in Cagayan Valley. Moreover, the Agriculture Innovation Systems framework have been relevant to this study as it explores the effect of the engagement of women innovators with different players in the agricultural innovation systems on their innovation efforts.

2.1.1 Intersectionality Theory

The Intersectionality theory was proposed by Kimberlé Crenshaw, an academic of law (Crenshaw, 1991)and studies the interaction between various social and political identities like gender, class, ethnicity, and geography that leads to overlapping of

disadvantages not captured in any one dimension alone. The theory has three separate analytical dimensions identified by Crenshaw in her work and have been discussed in the context of women innovators in Cagayan Valley**.**

Structural intersectionality involves the manner in which an individual's positioning in multiple identity categories creates a uniquely different experience of oppression from that of being in only one of those categories. In this study structural intersectionality is best exemplified in the intersecting identity barriers category, in which gender, age, location, ethnicity(Norris et al., 2024), and income all make for higher barriers than any one of them alone. Similarly, structural intersectionality forms the basis of the financial/land access barriers and time poverty/unpaid care work categories, because a rural innovating woman's challenge to access credit or attend conferences is multiplied, not simply added to, by her marital status and childrearing responsibilities.

This aspect of political intersectionality explains why attempts to address problems on the basis of a single issue, like the issues of gender or agriculture or rural development in isolation from each other, may end up excluding those individuals who find themselves at the convergence of the two or more axes. This aspect is clear from the lack of social and institutional recognition and gender and institutional constraints areas, wherein the various government initiatives (such as that of DA, DOST, and DTI), are premised on either "women's empowerment" or "agriculture development."

Intersectional representation looks at how cultural discourses and narratives create the stereotypical image of marginalized people, which affects the perception of their plight. This aspect is related to the gender stereotypes and cultural practices and socio-cultural barriers themes, which is because the women innovators continue to be stereotypically represented in public and domestic discourses as supporting laborers, and not as agricultural producers or innovators.(Rosser et al., 2024)

2.1.2 Theoretical Assumptions Underpinning Intersectionality Theory

Apart from the three dimensions of intersectionality theory, there are other assumptions that have been made about the theory that helps in analyzing how this research understands the theory. Firstly, intersectionality assumes that power relations are part of all social categories where one needs to understand not only the difference between social groups but also which social group wields structural power and which social group is systematically denied structural power. This assumption becomes evident on the notion that "men become the presumed farmers, innovators, and technologists, whereas women's knowledge is controlled through permission or dependency, or even ignored altogether". Secondly, intersectionality makes the assumption of context-dependency which means that whether gender, marital status, family size, or geographical position is more relevant and will depend on the particular rural, sociocultural, and institutional contexts. This makes the research on women innovators in the Cagayan Valley Region a context dependent inquiry in which the importance and impact of demographic factors become relative within the specific socio-cultural and geographical context of the region and not an absolute one that applies to other women

innovators in the rest of the Philippines. Third, the theory prioritizes centering the most marginalized, making its application particularly timely for this study, since women who serve as founders, co-founders, or key decision-makers in agricultural startups occupy a historically marginalized position within the sector and must navigate multiple, overlapping structural constraints simultaneously. This principle guides the study's approach to its participants: rather than treating "women innovators" as a homogenous category, the analysis attends to the specific, compounded constraints faced by women occupying leadership and decision-making roles within their enterprises.

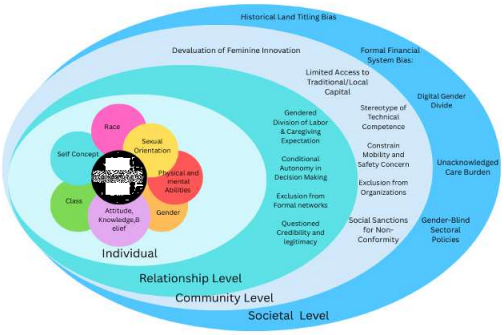

Figure 2.1 Intersectionality Framework
Note: Author's own Illustration (Languido 2026)

2.2 Feminist Political Ecology Theory

Feminist Political Ecology (FPE) framework, proposed by Rocheleau, Thomas-Slayter and Wangari (1996), analyzes the role of power relations associated with gender on the access to, control over and knowledge about natural resources, placing economic and environmental conditions within the context of intersecting gender, class and cultural structures(Sundberg, 2017) . Gender relations in this concept are viewed not as demographic variables, but as an important variable, which together with such factors as geography, ethnicity and socio-economic background determine access to and exclusion from agricultural and environmental resources. This theoretical framework can be applied in analyzing innovative women farmers of Cagayan Valley Region, their access to land, equipment, money and institutions which are influenced by gender structures inherent in rural agrarian society.

2.3 Agricultural Innovation System Theory

The Agricultural Innovation System framework describes innovation not as an isolated effort of one individual entrepreneur but as something which results from dynamic interaction among the different actors, institutions, and policies present in a particular agricultural and economic setting. According to the definition of the Tropical Agriculture Platform, an agricultural innovation system is "a network of organizations, enterprises,(Castella et al., 2022) and individuals involved in the creation, diffusion, adoption and utilization of new products, processes, and organizational forms, as well as the institutions and policies that influence their effectiveness". The framework is built around four interrelated components, namely, research and education, business and enterprises, bridging institutions, and enabling environment. The application of the concept of Agricultural Innovation System for analyzing the situation of women entrepreneurs in the Cagayan Valley changes the analysis perspective from individual incapability (for example, the fact that a woman "is not skilled enough") to the weaknesses of the innovation system around her.

2.3.1 Agricultural Innovation System's Role Within the Integrated Framework

The unique contribution of the Agricultural Innovation System theoretical framework to this research lies in its placing the barriers both individual and structural in relation to gender in the context of the general institutional setting of women's innovations, where systemic obstacles rather than gender themselves are considered an essential characteristic of the innovation environment. In the integrated theoretical framework, Agricultural Innovation System defines the systemic obstacles dimension that constitutes the institutional environment, previously created by the Gendered Resources and Power Context according to Feminist Political Ecology, and Intersectionality theory later examines how systemic and gendered obstacles interact in order to create intersectional obstacles that restrict productivity of women innovators. Importantly, the Agricultural Innovation System literature itself recognizes women as key players in innovation systems, stressing that "ignoring gender exacts a price on people's well-being and sustainable development.

2.4 Empirical Studies on Barriers to Women Innovators in Agricultural Startups

Empirical studies indicate that structural barriers significantly constrain the innovation productivity of women innovators in agricultural startups. These barriers span social, economic, policy, technological, and cultural dimensions. The literature attributes the gender productivity gap mainly to these barriers rather than to differences in women's efficiency.

2.4.1 Structural-institutional barriers.

Women are underrepresented among land-title recipients and face disparities in inputs, institutional credit, and extension (Chidiebere-Mark & Nwaebo, 2023; Guo & Akudugu, 2023; Araujo et al., 2025). Women contribute roughly 50% of agricultural production in East Asia and sub-Saharan Africa (Palacios-Lopez et al., 2017) and about 43% of the global agricultural labor force (Bhattacharyya et al., 2025), yet hold only about 20% of land globally (Singh et al., 2023). Women are underrepresented in startup leadership (Tonoyan et al., 2025), which limits capital and mentoring access.

2.4.2 Economic and policy barriers.

A gender capital gap driven by implicit investor bias (Nguyen, 2019; Xue et al., 2025) and lack of land collateral pushes women toward informal financing (Gupta, 2025) and necessity-driven ventures. Despite progressive frameworks such as the Magna Carta for Women, implementation is hindered by bureaucratic accreditation and certification procedures (Ezeugwa et al., 2024; Abbas & Liu, 2022) and by the absence of disaggregated regional data.

2.4.3 Sociocultural and care barriers.

Women may spend up to ten times more hours than men on unpaid care (J. Zhang & Zhang, 2022), producing time poverty that curtails networking, R&D, and enterprise growth (Gimenez-Nadal & Molina, 2022). Restrictive norms and stereotype threat shape who holds assets and leadership (Shohel et al., 2021; Dewantara et al., 2024) and divert effort toward proving competence (Luksyte et al., 2018).

2.4.4 Technological-market barriers.

Machinery and digital tools are often designed for male users (Mwiine et al., 2024), and unstable internet and costly devices produce digital exclusion (Nabizada et al., 2024; Perera et al., 2023), confining women to low-tech, low-scalability solutions.

2.4.5 Enabling mechanisms and outcomes.

Cooperatives, farmer-producer organizations, and DA/DOST/DTI programs offer training, market links, and mentoring (Piyumali & Balasooriya, 2023), but patriarchal norms and the lack of tailored assistance limit their effect. Inclusive finance, including flexible terms, FinTech, gender-lens investing, grants, and acceptance of non-land collateral, is considered critical (Elouardighi & Oubejja, 2023; Imam et al., 2022). Barriers depress business success through constrained capital, male-dominated networks, and credibility deficits (Lu et al., 2025), and reduce technology adoption and R&D efficiency (Staniscuaski et al., 2021). Resource-Based View and transaction cost perspectives explain these barriers as frictions on the innovation-to-outcome pathway (Hendi et al., 2022; Nguru et al., 2021).

2.5 Innovation Productivity and Business Outcomes

2.5.1 Business Success

Intersectional barriers have a causal impact on the success of female innovators in the Cagayan Valley because they significantly limit the innovation output as well as the market reach and financial results for agricultural startups. These obstacles directly diminish the innovation performance of women by reducing their startups' chances of success, as they arise from the intersecting influences of gender, geography, and industry. The essential resources needed for advanced research and development, hiring specialized staff, and scaling operations are limited as an effect of insufficient formal and informal financial capital as well as gender bias in lending and investment. Due to lower revenue growth and profit margins (Ivanyshyn et al., 2024), this essentially keeps the startup in a state of subsistence or slow growth and failure to secure additional funding. Lack of access to high-value, strategic networks, which are often dominated by men in the agriculture sector, also makes it more difficult to obtain the required follow-on investment, increases the cost of acquiring new clients, and slows down the process of obtaining critical partnerships or contracts. It becomes disproportionately difficult to achieve significant market penetration and influence market dynamics without these connections. The widespread lack of social and cultural credibility undermines the innovator's power(Lu et al., 2025) and makes farmers and partners doubt the technology's feasibility. This erodes confidence, slows end-user adoption, and postpones reaching the required revenue and market share goals that characterize successful business operations. As a compounded " cost of doing business," intersectional barriers essentially undermine business success metrics by limiting capital flow, raising operational friction, and impeding market acceptance.

2.5.2 Technological Adoption and Productivity

Technology adoption rates and innovation productivity are significantly impacted by intersectional barriers faced by women innovators in the Cagayan Valley. The main mechanisms of lower technology adoption by women innovators in the industry are mismatch(Martínez-Arteaga et al., 2023) and exclusion(Haase et al., 2021). Given that agricultural technologies are often oriented toward work traditionally carried out by men(Diiro et al., 2021), technologies for agricultural startups' innovations often lack features that cater to women's unique needs(Chouriya et al., 2025) labor burdens, or limited mobility. These factors, along with the gender tech gap and rural infrastructure deficiencies, are the root causes of lower technological adaptation and exclusion. Because of the perception on the high cost of innovation and still on the experimental stage adoption by end users particularly women farmers tend to be slow(Staniscuaski et al., 2021). Furthermore, women innovators are frequently denied access to established cooperatives largely controlled by male farmers and distribution channels due to social and cultural credibility barriers, which restricts the use of their technologies to small - scale, low leverage spaces and slows their diffusion. As a result, these innovations find it difficult to achieve the critical mass necessary for long-term sustainability and wider regional impact.

A significant misallocation and depletion of resources are linked to productivity. Research and development (R&D), networking, and intellectual property protection are

essential for high-growth startups, but women's time is severely limited due to the double burden of domestic and entrepreneurial responsibilities. Delays in product upgrades,(Cabero & Epifanio, 2021) slower internal R&D cycles, and decreased overall innovation efficiency are the outcomes(Staniscuaski et al., 2021) of this. Constrained access to resources, whether in the form of human capital or in the form of skilled technical co- founders or financial capital for the purchase of sophisticated machinery, simultaneously forces women innovators to rely on labor-intensive, less efficient processes.

2.6 Theoretical Framework

In order to bring clarity on the intricate dynamics influencing the productivity of female innovators in agricultural startups, this theoretical framework combines three important academic theories. The main components of the theoretical framework comprise the three primary phases of the model, core concepts, mediating and contextual factors, and the outcome. The theoretical lens is defined by the Core Concepts (Feminist Political Ecology, Intersectionality Theory, and Agricultural Innovation System Framework). The Gendered Resource and Power Context, informed by feminist political ecology, explains how gendered power relations shape control over resources, directly influencing innovation productivity and underpinning the emergence of intersectional barriers. Systemic Constraints, as defined by the Agricultural Innovation System Framework, are institutional flaws and inconsistencies that directly affect productivity and configure the overall institutional environment, which is already influenced by the Gendered Resource and Power Context. Intersectional barriers identified as the primary independent variable are created by the combination of these systemic constraints and the Gendered Resource and Power Context. Intersectionality Theory offers a lens through which these barriers are analyzed. The ability of women innovators to attain high levels of innovation productivity (the dependent variable) is consequently limited by these compounded barriers, demonstrating that low innovation performance results from a number of intersecting identity-based constraints embedded in a restrictive agricultural and gendered context rather than from a single factor.

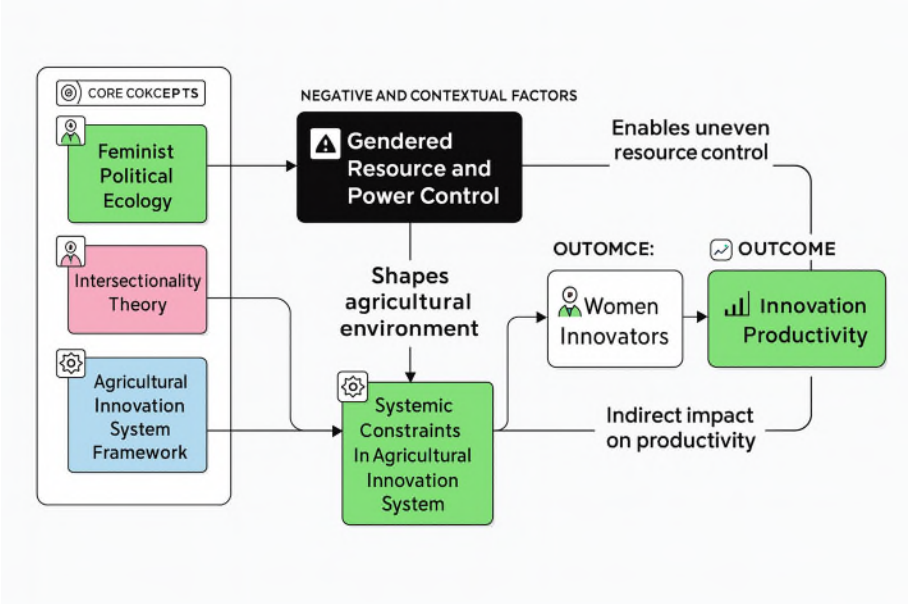

Figure 2.2 Theoretical Framework
Note: Author's own Illustration (Languido 2026)

3. METHODOLOGY

3.1 Design

This research explored and studied the intersectional barriers affecting the innovation productivity of women innovators in the agricultural startups in Region II. It employs an exploratory sequential design (QUAL - QUAN) to identify specific constraints and hindrances and, assess their overall impact on a larger sample (Kallon et al., 2024). The research design has two distinct sequential phases; first, there is the qualitative phase, which focuses on the exploration of the lived experiences of women innovators to capture the rich, contextual, and subjective reality experienced by women innovators through thematic analysis. An in-depth interview with six women innovators in the Cagayan Valley Region was conducted to fully understand and inductively define the lived experiences of these women. The second phase is the quantitative phase, which serves as an instrument to confirm the prevalence and intensity of the themes identified in phase 1 and to test their relationship and the correlation and prediction between themes and innovation outcomes through a survey questionnaire administered either via an online platform or in person. The research design ensures context specificity is integrated with generalizability and predictive power from the quantitative data for accurate data.

The use of the exploratory Sequential Mixed Method Design (QUAL-QUAN) as the research methodology for this study is due to the complex, context-specific nature of the intersectional barriers of women innovators in agricultural startups in Region II (Susitha et al., 2025). The initial qualitative(QUAL) phase (Interview) is vital for exploring, identifying, and defining(Gagnon et al., 2024) the unique, locally relevant barriers that existing theory may miss, generating key themes and variables from the innovators' lived experiences. These findings then directly informed the development of the context-

specific survey instrument for the subsequent quantitative (QUAN) phase(Capella-Peris et al., 2020). Administration of the tailored instrument to a larger sample in the study to statistically test the prevalence and the relationship between the identified barriers and innovation productivity enables generalization across sectors. By addressing the limitations in statistical rigor that often occur in studies that rely solely on qualitative data and single-method analysis, the two-phase, cyclical process provides a thorough and evidence-based solution.

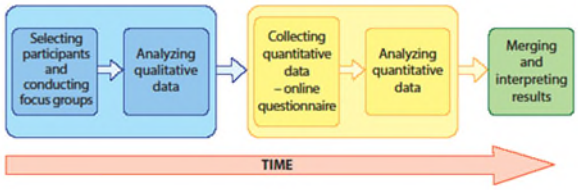

Figure 3.1. A visual model of the exploratory sequential design used in a mixed methods study (Source: Oven, 2016)

3.2 Phase 1: Qualitative

3.2.1 Sample & Procedure

For the qualitative phase, the study utilizes purposive sampling. Purposive sampling is a non-probability sampling technique that is used when a few representatives of a specific group can serve as participants. The researcher recruited six (Urcia, 2021)(Goman et al., 2020) (Lawal & Duma, 2023) women innovators in agricultural startups from different provinces of Region II. They shared their experiences of intersectional barriers in agricultural startups. Although the sample is small, the qualitative phase did not aim for statistical representation of all women innovators in the region. It aimed for an in-depth, interpretive understanding of how intersecting barriers are experienced. Sample adequacy was therefore judged by the information power model (Malterud et al., 2016), which holds that the more relevant information a sample holds for the study aim, the fewer participants are needed. To ensure methodological rigor, clear inclusion and exclusion criteria were established for consistency; participants were selected according to the following standards:1.Women innovators in agricultural startups and aquatic sectors of the regional technology startup ecosystem (RTSE). 2. Women with at least three years of experience in the agriculture field in the Philippine RTSE;3.Women working as support and managers in the agriculture sector.

This aligns with Creswell & Poth's (2018) emphasis on purposeful sampling to select participants with rich and diverse experiences for the reflexive thematic approach of the study (Creswell & Poth, 2018)

3.2.2 Data Gathering

For the qualitative phase, an individual interview with the participant, which took about 45 minutes to one hour, was conducted by the researcher face-to-face. Before the interview, the researcher facilitated orientation and rapport building to establish trust and confidence between the researcher and the participants. Also, an in-depth discussion on informed consent with the participants was carried out to enlighten them on the pros and cons of becoming a participant in this study, and their right to skip any survey question if they do not wish to answer. They may stop answering the survey at any time without penalty or loss of benefits. During the conduct of the interview, the conversations were audio recorded with the permission of the participants for easier data retrieval, while assuring the participants that all data and information were kept confidential, including their identity.

An individual interview was conducted using an open-ended semi-structured questionnaire to enable participants to articulate their experiences on intersectional barriers in agricultural startups. To encourage a detailed narrative, follow-up questions were used, such as " How are you feeling about this?" and "Can you share if there were challenges you encountered along the way?" These questions aimed to reveal the work and experiences of women in the agricultural startups while experiencing intersectional barriers in the industry.

3.2.3 Data Analysis

Data for the qualitative phase was analyzed through Braun and Clarke reflexive thematic analysis to identify patterns of meaning in participants' accounts of their lived experiences. Throughout the analytic process, the researcher maintained reflexive memos and engaged in reflexive to remain attentive to prior assumptions and to minimize their influence on the interpretation of the data.

Following repeated familiarization with the transcripts, meaningful excerpts were coded, and related codes were clustered into categories. These categories were subsequently developed into themes and subthemes that represented recurrent patterns in participants' experiences of intersectional barriers to innovation. The themes were supported by direct quotations and contextual details from the transcripts to preserve participants' voices and to demonstrate how the interpretations were grounded in the data.

The analysis produced a rich, contextualized description of how women innovators experienced and navigated intersectional barriers in agricultural startups. While attention was given to patterns shared across participants, the analysis also recognized the particular circumstances of each woman innovator. To enhance trustworthiness, the researcher maintained a reflective journal documenting analytic decisions, developing interpretations, reflections on researcher positionality and subjectivity, and methodological insights. This process supported a transparent and nuanced account of participants' lived experiences and informed the development of context-responsive policy and support recommendations for women innovators in agricultural startups.

3.2.4 Trustworthiness of the Qualitative Phase

To ensure the dependability and confirmability of the qualitative phase, the researcher maintained an audit trail across the study. The audit reflexive recorded major methodological and analytical decisions from participant recruitment to presentation of findings. These documents included qualitative sampling and recruitment , data generation, familiarization, initial coding, category development, theme development, building constructs, drafting items, content review, pilot testing, quantitative data collection and analysis and Integration.

The audit trail enabled the researcher to demonstrate a transparent connection between the participants' narratives, the generated codes, the developed themes, and the conclusions of the study. It also provided a record that may be reviewed by qualified reviewers to assess whether the findings were grounded in the data and whether the analytical process was logically and systematically conducted.

3.2.5 Instrument Development

For the quantitative phase of the study , the research tool was formulated to systematically measure the constructs, dimensions, and indicators identified within the study. The formulation of the tool was based on the objectives of the research, theoretical framework, and findings derived from the qualitative phase. The themes and categories that arose from the lived experiences, perspectives, and practices of the participants in relation to their lived experiences were transformed into the measurable variables and survey items.

Table 3.1 Representative survey items showing how qualitative themes informed the quantitative instrument.

Overarching Theme	Qualitative subtheme	Survey domain	Representative questionnaire items	Total Items
Machine incompatibility as a gendered design barrier	Women's bodily experiences of tools, machines, and farm work	Technology and machinery barriers	Agricultural machinery is too heavy or not suited to my physical strength	5
	Gendered norms and role expectations	Gender stereotypes and cultural norms	Design and cost of agricultural technologies tend to favor make users more than women.	6
Complex lives of women with multiple barriers	Survival-driven entrepreneurship under heavy care burdens	Time poverty and unpaid care work	I often feel too tired after household work to focus on innovation activities such as product development and networking.	5
		Overall support environment	My immediate family is highly supportive of my role as a startup innovator	4
	Empowerment discourse and lived realities	Gender and institutional barriers	. I have experience doubt from investors or stakeholders about my technical expertise	11
	Centrality of women's labor in farm production	Innovation productivity / support environment	Our innovation have resulted in significant improvement in efficiency or revenue.	4
Limited access to resources	Structural resource exclusion	Financial and land-access barriers	I experience barriers in obtaining initial startups funding or loans	6
	Gendered financial exclusion and institutional barriers	Low social and institutional support	Difficulty accessing strategic networks and partnerships slows down our startup growth.	5
		Intersectional identity barriers	I sometimes feel that many factors(gender, age, location, ethnicity, income) combine to create bigger barriers for me than others.	6

Note:Representative survey items are shown to demonstrate how qualitative themes informed the quantitative instrument.

The tool was formulated to systematically measure valid and reliable information concerning the characteristics, experiences, practices, perceptions, challenges, and outcomes of the respondents. All the items were formulated in accordance with the Operationalization Matrix of Variables in order to ensure that the questionnaire measured the identified variables and their indicators.

Before the use of the developed instruments, it had been evaluated by experts to measure the clarity, relevance, adequacy, and appropriateness of the contents. This questionnaire was also piloted on respondents whose characteristics matched those of the respondents that would be involved in the study.

3.3 Phase 2: Quantitative

3.3.1 Sample & Procedure

For the quantitative phase, simple random sampling was employed to select respondents from the identified population of 500 eligible women engaged in agricultural enterprises in the Cagayan Valley Region. The sampling frame was derived from the Department of Trade and Industry master list of women entrepreneurs and screened according to the study's inclusion and exclusion criteria.

The required sample size was determined using Cochran's formula with finite population correction, assuming a 95% confidence level, a 5% margin of error, and a population proportion of 0.50. This yielded a minimum sample size of approximately 218 respondents.

A unique identification number was assigned to each eligible individual in the sampling frame, and respondents were selected through a randomization procedure without replacement. This procedure gave each eligible individual an equal probability of selection. Selected respondents were then contacted and invited to participate in the survey, subject to informed consent and the study's eligibility requirements.

The quantitative data were analyzed using descriptive statistics, analysis of variance, Pearson product-moment correlation, and multiple linear regression, as appropriate to the research questions and measurement characteristics of the variables.

3.3.2 Variables and Operational Definition

Based on the themes and categories derived from the qualitative phase of the study, the current quantitative phase operationalized the constructs into variables and indicators. With this, the researcher was able to determine the degree, pattern, and relationship of the findings in the qualitative part among a wider pool of respondents. Below is the Operationalization Matrix of Variables for the Quantitative Phase, which contains the concept and operational definition of the variable, its dimension, indicator, questionnaire item, response scale, and statistical treatment.

Table 3.2

Operationalization Matrix of Variables for the Quantitative Phase

Variable	Type	Operational definition	Measurement	Analysis
Intersectional barriers	Independent variable	The combined barriers experienced by women innovators, including gender stereotypes, resource constraints, unpaid care work, institutional constraints, and market/technology-access limitation	Composite score from Likert-scale items	Correlation and multiple regression
Gender stereotypes	Independent-variable dimension	Perceived restrictive norms, discrimination, and reduced recognition of women's leadership and innovation capacity	Likert-scale subscale	Correlation and regression
Financial/material resource constraints	Independent-variable dimension	Limited access to capital, credit, land, equipment, inputs, and advanced technologies	Likert-scale subscale	Correlation and regression
Unpaid domestic and care-work burden	Independent-variable dimension	The extent to which domestic work and caregiving limit time for innovation, networking, R&D, and business expansion	Likert-scale subscale	Correlation and regression
Institutional constraints	Independent-variable dimension	Barriers related to policies, permits, extension services, training,	Likert-scale subscale	Correlation and regression

	organizational access, and government support

3.3.3 Content Validation of the Survey Instrument

The survey questionnaire was designed to measure the demographic characteristics, intersectional barriers, support conditions, and innovation productivity of women innovators in agricultural startups in the Cagayan Valley Region. Its items were developed based on emerging themes from qualitative phase of the study, relevant literature, study objectives and theoretical lenses of Feminist Political Ecology, Agricultural Innovation Systems and Intersectionality Theory.

The draft instrument was content validated by six panel of experts (Polit & Beck 2006), Polit et al., 2007)with relevant expertise in agricultural innovation and entrepreneurship, gender and development, research methodology, and survey or measurement development to ensure that the questionnaire adequately represented the constructs under investigation. Validators assessed each item for relevance, clarity, representativeness, appropriateness and consistency with the study aims and the local context of women-led agricultural startups.

Where applicable, content validity of each item was quantified using the item-level content validity index (I-CVI) and overall content validity of the survey scales was assessed using the scale-level content validity index, average method (S-CVI/Ave). The I-CVI was computed as the proportion of experts who rated each item as relevant or highly relevant. The S-CVI/Ave was computed by averaging the I-CVI values of all retained items within each scale and across the entire instrument. The instrument obtained an overall content validity index of 0.9883 (98.83%), which indicates **excellent** content validity.

Table 3.3

Results of the Content Validation of the Research Instrument and Their Interpretation

Component	**Result**	**Interpretation**
No. of Experts	6	
Initial Number of Items	57	
Number of Agreements	53	Excellent (Scale level of Validity)
Number of Items >.78	57	Excellent
S-CVI/Ave.	0.9883 (98.83%)	Excellent (Overall Content Validity)

3.3.4 Data Gathering

In the quantitative phase, the instruments were developed based on the thematic findings derived from the qualitative inquiry. The identified themes were translated into a survey questionnaire and distributed for the quantitative part of the study. During the survey, questionnaires were administered in two ways: the online platform (Google Form) and a face-to-face modality. The Google Forms were directly uploaded to the respondents' social media accounts. A two-week window was allotted to fill out the Google Form, after which an initial assessment commenced to gather initial data on the number of respondents who participated in the survey. Result of the initial assessment shows that only 37.61% (82/218) of the invited respondents responded via the Google Form, as an intervention, individual interviews were conducted to 62.38% (136/218) respondents who were not able to participate via Google form based on the master list provided by the provincial and or municipal coordinators anticipating factors affecting their non-participation on the online platform such as internet connectivity problems, lack of time, and needing guidance to fill up the form to complete the total number of respondents (218). Before the interviews, the researcher coordinated with the Local Chief Executive (LCE) of the area, the DTI municipal coordinator, and the Municipal Agriculturist's office. Also, before answering online, participants were asked to confirm that they are in a safe and private space. During the interview, the researcher monitored for any signs of distress among the participants and may opt to stop or break the interview if needed.

3.3.5 Data Analysis

In order to generate a quantifiable lived experience of women innovators for validation, generalization, and the identification of correlations between variables through statistical testing, the second phase of the study was a quantitative phase that entailed turning the emerging themes into quantifiable variables and data, guiding the development of survey questions. Pilot testing was conducted among the selected participants to test and ensure the reliability of the instruments. Twenty-two female innovators from the agricultural startups within Region II participated in the pilot testing to evaluate the instruments' efficacy and reliability. The internal consistency was assessed using Cronbach's alpha coefficient; collated data from the respondents were interpreted using a five-point Likert scale that enabled the respondents to rate their agreement or disagreement with the statements, thus supporting more nuanced responses and comprehensive data gathering.

Quantitative data were analyzed using frequency counts and percentages to describe the barriers. Mean scores were interpreted as follows: 4.21-5.00 = very high, 3.41-4.20 = high, 2.61-3.40 = moderate, 1.81-2.60 = low, and 1.00-1.80 = very low. One-way analysis of variance was used to test differences in innovation productivity according to age, marital status, number of children, and structural family status. Welch's ANOVA and the Games-Howell post hoc test were applied when the homogeneity-of-variance assumption was violated. Pearson product-moment correlation was used to examine the relationships between intersectional barriers and innovation productivity, while multiple linear regression determined the unique and combined contributions of the barrier

domains to innovation productivity. Effect sizes and 95% confidence intervals were reported where applicable, and statistical significance was
evaluated at the .05 level.

3.3.6 Inclusion / Exclusion Criteria

The study was conducted within the geographic context of the Cagayan Valley Region, Philippines. For the qualitative phase, participants were chosen by through purposive sampling to ensure the relevance and consistency of their lived experiences to the research agenda. Participants were a woman innovator/farmer/entrepreneur in agricultural startups, with or without parental obligations. For the quantitative phase, selection of respondents was guided by broader inclusion criteria from the qualitative findings, with the intention to quantify the connectivity or the pattern of occurrence of the significant themes.

This would exclude women innovators in non-agricultural startup sectors and those women innovators outside region 02, limiting the breadth of experience captured but ensuring depth and alignment of experiences within the target group. The methods employed in this study are strictly confined to philosophical guidelines and underpinnings of mixed methods, specifically exploratory sequential design (QUAL-Quan). Consequently, the validity of the quantitative phase (the survey and statistical testing) is directly dependent and anchored on the themes generated from the initial interview of the qualitative phase. Moreover, the study does not necessarily cover all possible barriers that may impact women innovators in the region, but it touches on the most prevalent ones.

3.3.7 Research Ethics
Ethical Consideration

This study adhered to established ethical standards for research involving human participants, with the aim of protecting participants' rights, privacy and welfare. The research protocol was reviewed and approved by the Faculty Research Ethics Committee (FREC) of the University of the Philippines Open University (UPOU) on May 28, 2026. The committee issued Certificate of Approval No. 2026-003-GS-FMDS. All procedures followed UPOU's ethical guidelines for research involving human subjects. Data collection began only after ethical clearance was granted.

Informed Consent

Before participating, all participants in both phases were informed about the study’s purpose, procedure risks, and benefits. Participation was voluntary, and participants may withdraw at any time without penalty. If distress occurs, the researcher will pause the interview, check on the participant’s comfort, and, if needed, provide a referral to MSWDO, Women’s Desks, GAD offices, or a licensed counselor or mental health professional.

Confidentiality and Privacy

The confidentiality and privacy of participants were strictly protected. Only the researcher has secure access to all interview and survey data. To maintain anonymity, identifying information was eliminated, and results were presented using pseudonyms to protect the identity of the participants.

Data Management

To protect the security and integrity of all collected data, strong data management procedures were put in place. The physical documents were kept in a locked, secured storage area, while the digital files were stored on password-protected devices with two-factor authentication, and access to the data is restricted and granted solely at the researcher's discretion. To reduce the possibility of data loss, regular data backups will be carried out by the researcher.

3.4 Mixed Methods

3.4.1 Integration and Reporting

The last phase combines quantitative findings and qualitative insights, integrating observations to drive both theoretical advances and practical policy recommendations for future studies. Visual joint displays and structured synthesis illustrate how qualitative themes and quantitative measurements reinforce one another to provide a clear path for strategies on policy recommendations and innovations. This comprehensive integration ensures that the conclusions and recommendations address the complexity of women's innovation experiences and can inform targeted support.

RESULTS AND DISCUSSION

4.Qualitative Results and Discussion

The six participants were women aged 49–68 years, all married with two to three children, and each had worked in the agriculture sector for 8 to 35 years. WI-01, from Cagayan, worked in fish and seaweed processing. WI-02, from Quirino, was a food processor specializing in banana and root crop products. WI-03, from Nueva Vizcaya, ran an integrated farm focused on organic vegetables and coffee. WI-04, from Isabela, was a poultry and livestock producer. WI-05, also from Isabela, was a seasoned rice farmer, and WI-06, likewise from Isabela, was a corn farmer. Most held college degrees or had

completed some college units, and one had finished high school. Their education and experience supported practical knowledge and strong networks, consistent with Wangithi et al. (2021) and Uhunamure et al. (2021). Their roles across production, processing, and marketing show that women are principal actors in agriculture rather than marginal helpers. Three theme clusters emerged from the interviews (quotations translated from Filipino).

Table 4.1

List of study participants and demographics

No.	Pseudonyms	Age	Participants Location	Subsector of Agri-startups	Civil Status	Highest Educational Attainment	No. of Children	Years in the Industry
1.	WI-01	*62*	Cagayan	Fish Processing	Married	College Graduate	*2*	*14 Years*
2.	WI-02	*49*	Quirino	Crop processing	Married	College Level	*3*	*25 Years*
3.	WI-03	*52*	Nueva Vizcaya	Organic Agriculture	Married	College Graduate	*3*	10 Years
4.	WI-04	*53*	Isabela	Livestock	Married	College Level	*2*	*8 Years*
5.	WI-05	*64*	Isabela	*Rice Production*	Married	College Graduate	*3*	*20 Years*
6.	WI-06	*68*	Isabela	*Corn production*	Married	*High School Graduate*	*2*	*35 Years*

4.1 Emergent Themes in Response to the Research Questions

The ensuing section was organized based on the thematic categories emerging from data analysis. These themes have been generated through the process of coding and constant comparative analysis. The thematic categories capture the major ideas that emerged from the data analysis, which represent some of the most significant patterns articulated by the participants. Every theme provides an important analytical perspective on the lives of female innovators. This section will respond to sub-research question 1:
SRQ1. What are the lived experiences of women innovators in agricultural startups in Cagayan Valley navigating intersectional barriers to innovation?

Table 4.2

Theme clusters and their corresponding theme

Theme Cluster	Themes
1. Machine Incompatibility- Gendered Design Barrier	1.1. Women's bodily experiences of tools, machines, and farm work 1.2. Bodily demands and gendered labor status 1.3. Gendered norms and role expectations
2. The complex lives of Women with Multiple Burden	1.1. Survival-driven entrepreneurship under heavy care and burdens 1.2. Negotiating identities, roles and relational positioning in agrarian life 1.3. Empowerment discourse and lived realities 1.4. Centrality of women's labor in farm production
3.Limited Access to Resources	3.1. Structural resource exclusion 3.2. Environmental constraints and insecure risk protection in women's production 3.4. Gendered financial exclusion and institutional barrier

4.1.1 Theme 1. Machine Incompatibility- Gendered Design Barrier

Incompatibilities that arise due to the use of machines by women farmers reveal the machine incompatibility along with the existing gender discrimination. This is because agricultural tools and equipment have not always been designed to meet the needs and physical dimensions of women workers(van Remmen et al., 2026). This often causes uneasiness, tiredness, and exhaustion, thus suggesting that there is a lack of anthropometric suitability of machinery to women(Liu et al., 2022). In situations where machinery is incompatible for the female operators, it results in a slower pace of work, the help of others, and even non-use of the equipment(Fargnoli et al., 2022). These experiences highlight how gendered design barriers can constrain women's productivity, safety, and full participation in agricultural and technical work.

1.Women's bodily experiences of tools, machines, and farm work

The use of farm equipment and machinery by women working in the agriculture sector may require both physical effort and adaptation. Due to the heavy structure of farm machinery and inflexibility, women have to adapt to the tools that do not completely fit their physique or physical ability, resulting in more difficult and uncomfortable farm operations in the field. Due to incompatibility issues experienced by these women, they tend to perform farmwork manually and are relegated to the "support roles, which are more tedious, tiring, and time-consuming(Capodaglio et al., 2024). This shows how women do not completely adapt to the farm tools and machinery and are not entirely comfortable in using them.

WI-04, an empowered woman with a strong focused of innovation in livestock production, a digital marketing advocate, and a dedicated community servant, shared her experiences operating Tractor:

Tagalog : *Nung una kong sinakyan yang tractor na yan, yung farm tractor, iba yung bigat. Talagang kumpara mo sa size mo bilang isang babae, hindi sila—talagang hindi sila angkop.*

English*: When I first drove that tractor, that farm tractor, it felt different in terms of heaviness. If you compare it to your size as a woman, they really—they're really not suitable.*

For this woman, the act of operating the tractor was strenuous and did not suit her body size; the equipment seemed heavy for her to operate. This statement shows an actual embodiment of the struggle and discomfort that the woman faces in operating the farm machinery.

WI-06, a long-time Magsasaka Sientista (Corn) and a farmer-led extensionist (FLE) in rice, narrated her experiences of operating machinery:

Tagalog: *Hilahin ka niya kapag umandar na.*

English: *The machine pulls you when it starts moving*.

It is an embodiment of her real experience of physical exertion and the difficulty she has maneuvering the tools that feel too bulky and difficult for a woman to handle. It illustrates how the perception of physical capability and strength based on gender influence her relationship with farming tools.

WI-05, a national awardee recognized as an outstanding rural woman and an empowered woman in the field of rice production, described her experiences operating small and big machineries:

Tagalog: *Uh, yung ginagamit ko kasi, as of now, yung maliit lang, pero okay naman siya. Nagagampanan ko din, at hindi rin ako, kampante kapag malaki.*

English: *Uh, what I use right now is only the small one, but it's okay. I can manage it too, and I'm also not comfortable with the big one.*

Her feeling comfortable and confident using smaller equipment, while hesitant and uncomfortable around bigger equipment, is a statement of embodiment of her capabilities based on physical limitations and perceived risks, illustrating how her knowledge and awareness affect her use of various types of farm machinery.

2. Bodily demands and gendered labor status

Women employed within the agricultural sector are usually marginalized and given jobs that are physically exhausting, such as planting, weeding, and harvesting. Women are always assigned physically exhaustive tasks that require endurance, strength, and hard work, thus adding more layers to the many responsibilities that women have in general, particularly those that concern reproduction and domestic work.

WI-05, recounts her struggles fulfilling her duties with multiple burdens:

Tagalog: *Yun nga, ma'am, eh, parang hindi na ako natutulog. Wala nang tulog.*

English: *Exactly, ma'am, it's like I don't sleep anymore. No more sleep*.

Inadequate sleep by the woman is an indicator of the enormous pressure associated with juggling many roles, resulting in immense physical and psychological fatigue. This situation shows the impact of overlapping roles with minimal chances of rest.WI-04 narrated how she allocates her time for each task throughout the day to ensure everything is completed.

Tagalog:*Kung may eight hours ka na gugugulin sa isang araw, i-divide mo yan sa mga category na dinadaanan mo para sa ganun, is hindi sila magkabuhol-buhol*.

English: *If you have eight hours to spend in a day, divide that into the categories you go through, so they don't get all tangled up.*

The strategy of careful time management amid multiple demands conveys the effort of maintaining order and balance while handling multiple roles at the same time,

demonstrating how she organizes tasks efficiently to meet both productive and caregiving responsibilities within limited time and resources.

WI-06 explains how her body compensates with the day-to-day activities on the farm:

Tagalog: *Kasi kung sa maghapon, ma'am, na nagtatrabaho ka, talagang sa hapon maam, talaga hapong-hapo ka sa—yung katawan mo talaga, sa tanda kong ito, ma'am, eh, syempre manghihina ang katawan .*

English: *Working the whole day, ma'am, you really feel exhausted at the end of the day; your body really gets tired. Given my age, ma'am, it is expected that my body gets weaker*.

The lived experience of physical fatigue and bodily weakness after a full day of work displays that long hours of labor leave the body tired, which cannot be easily recovered, highlighting the cumulative strain of continuous work and its impact on overall health and well-being.

3. Gendered norms and role expectations

Gender roles and norms are the cultural constructs that depict the expected behavior, functioning, and interactions of men and women. Typically, it is believed that men are assigned the roles of providers and leaders, while women are expected to be nurturing and preoccupied with the domestic sphere. Gender norms and roles can restrict individual options, reproduce stereotypes, and perpetuate inequality, but can also evolve.

WI-01, a retired government employee, fish and seaweed processor, and chairwoman of the fisherfolk cooperative, shares her insights on seaweed culturing.

Tagalog*: So yung nature talaga ng culture ng seaweed ay pang-lalaki.*

English: *Seaweed farming is generally seen as men's work.*

This reflects a lived sense of being located in a male- dominated occupation, where farm work is shaped by social expectation; gendered norms structure the participant's understanding of seaweed farming and her place within it, influencing both her participation and the ways she navigates acceptance, capability, and recognition in the field.

WI-06 shares her work in the field, which led to her recognition as a women farmer:

Tagalog: *Yung sa pagdadamo sa palayan, yung sa paglilinis ng mga dikes (tambak), ako ang gumagawa.*
English: *I'm the one who does the weeding in the rice fields and cleans the dikes (embankments*).

The hands–on agricultural care and maintenance displays her enthusiasm for sustaining the rice field through labor-intensive farm maintenance, reflecting her commitment to ensuring productivity and long-term livelihood despite the physical demands of the work.

WI-04 describes her experiences of discrimination while operating machinery in her community:

Tagalog: *Pero kung yung mga machineries na ganyan, bihira talaga yung makikita nila na mga babae na nandiyan, nakuliglig, nakasakay sa mga kulong-kulong, ganyan, nagda-drive. Yung parang, ano ba yung tawag nila, yung makapal ang mukha, yung parang nagpapapansin, ganyan, Ma'am.*

English: *But with those kinds of machineries, it's really rare for them to see women there—riding on the kuliglig, sitting on the tractors, driving, like that. It's like, what do they call it, someone who has no shame, someone who likes to show off, like that, Ma'am.*

The experience is being visibly out of place in a male-coded space, where simply performing machinery work exposes a woman to ridicule and moral judgment. It conveys how gender norms make women's participation in mechanized farming socially risky, even when they are capable.

4.1.2 Theme 2. The Complex Lives of Women with Multiple Barriers

Women facing multiple barriers experience a combination of different barriers to development, which might be poverty, lack of education, discrimination, employment barriers, and family duties. Such a combination can have an impact on women's ability to change their situation in life.

Generally, the roles that women play in their societies involve working at home and generating income from the informal sector. Sometimes women suffer from additional limitations due to cultural expectations and stereotypes. These expectations can include restrictions related to mobility and the right to exercise leadership, as well as engagement in certain occupations.

Consequences of having multiple barriers are not limited to poor economic opportunities. These women can be depressed, undervalued, or excluded from the decision-making process in many spheres. At the same time, these women manage to survive and make contributions to their societies despite these difficulties.
It is important to understand how the lives of such women are complex. Women facing multiple barriers cannot be viewed as vulnerable but as active and hard-working members of society.

1. Survival-driven entrepreneurship under heavy care and burdens

The concept of survival entrepreneurship amid care and burdens describes a scenario whereby an entrepreneur establishes and manages a small business primarily in order to satisfy basic survival needs in situations where he/she has many responsibilities at home and within the family setup. Entrepreneurship in this case does not necessarily mean expansion and profitability but rather means surviving for the sake of taking care of children, parents, or any other dependents.

Entrepreneurial activities for many women go hand in hand with the provision of care, including cooking, cleaning, taking care of children and sick people, among others. Due to the numerous responsibilities, they face a number of constraints, including a lack of enough time, money, and energy to develop their businesses, but still, they are determined to continue running their ventures through innovation and persistence.

The concept clearly demonstrates struggle and resilience as well. Showing how women juggle many activities at once without any help, while continuously adapting to limited resources and sustaining both their households and caregiving roles despite persistent challenges.

WI-02 reveals her motivation in doing agricultural processing besides her domestic responsibility:

Tagalog: *Kasi kung si Mama, nandun lang talaga sa bahay, walang pera. Kailangan ko may pakain sa anak ko, wala kang pambili*

English : *Because if the mother stays at home, there would really be no money. I needed to feed my child, but I had no money to buy food.*

This represents the real-life experience of the struggle of motherhood during times of economic hardship, in which WI-02 felt the need to work since staying at home without pay does not guarantee that food will be available to sustain the family.

WI-05 explained that her duties(provide) and responsibilities were fulfilled due to farming.

Tagalog: *Dahil sa pagfa-farming ko, nagawa ko at nagampanan ko bilang isang ina nila.*

English: *Because of my farming activity, I was able to fulfill my role as their mother.*

The feeling of satisfaction conveyed how farming becomes not only a livelihood but also a way of providing for and fulfilling her role as mother, reinforcing her sense of purpose and affirming her contribution to the family's survival and well-being.

WI-06 narrates her struggle to earn money to provide food for her family.

Tagalog: *Makabenta ako ng 500, puhunan ko naman 150, may 350 akong neto, bilhan ko naman si byanan ko ng smoke fish pang ulam nila taz iuwi ko na din yung anak ko, ganun, ma'am.*

English: *I have a total sales of 500, and my capital was 150, so I had a net income of 350. Then I bought smoked fish for my mother-in-law's viand, and then I brought my child home too, ma'am.*

It is an indication of how incomes are utilized in order to meet both household and caregiving requirements. This is a demonstration of the continuous process of converting farm incomes to sustenance through the everyday processes of resource management and provision for the household's well-being.

WI-03 explained her priorities as a mother above all responsibilities for the day:

Tagalog*: So anuhin mo naman yung pamilya kung wala ka namang ipakain, di ba ganun?*

English*: So how can you provide for your family if you have nothing to feed them, right?*

The lived experience depicts maternal helplessness under economic scarcity, where not having food becomes not just a practical problem but a threat to the woman's sense of responsibility and caregiving, intensifying emotional distress and undermining her perceived ability to fulfill her role as a provider and nurturer.

2 Negotiating identities, roles and relational positioning in agrarian life

In the agrarian society, women assume many roles at one time, such as being a farmer, a caregiver, a laborer, and a member involved in family decision-making. Social identity is formed as a result of social pressures, duties, and interaction with others

Identity negotiation involves changes in the way an individual and others view the individual. Relational positioning is the positioning of individuals within the context of the family, farm, or wider community as helpers, leaders, and experts.

WI-05 described her day-to-day work schedule, performing multiple roles:

Tagalog: Yes. *Um, ganito po kasi yun. Since ako yung nag-iisa, sa integrated farming po ito, so tuwing umaga, at 4 o'clock, gising na ako niyan. Lahat, nandun na ako sa mga, kumbaga, magpakain ng baboy, magpakain ng manok, lahat mga small ruminants, yun muna yung uunahin ko. And then after that, pupunta na ako sa field.*

English: *Yes. This is how it is. Since I'm the only one operating this integrated farming, I wake up at 4 o'clock every morning. First, I feed the pigs, the chickens, and all the small ruminants. After that, I go to the field*

This shows an experience of embodied routine and uninterrupted farm responsibilities where the day begins before dawn and is structured around caring for livestock and crops in sequence, conveying the physical and mental load of being the sole operator.

WI-04 described that she transformed from being a mother, farm manager, and public servant.

Taglog: *Uh, ang role ko po dito sa farm ay siyempre, ako yung nanay, nag-iisip kung ano yung makakain ng aking pamilya, at ano yung pwedeng ilagay dito sa farm na sarili naming produce. At siyempre, ako rin yung taga-isip kung paano ako makakatulong sa community bilang isang public servant, at kung ano yung mga kaalaman ko is kung paano ko ito mai-share sa aking mga kapwa kababaihan, lalo na yung mga walang trabaho.*

English: My role here on the farm is, of course, as a mother—I think about what my family will eat and what we can produce here on the farm from our own produce. And of course, I also think about how I can help the community as a public servant, and how I can share my knowledge with my fellow women, especially those who are unemployed.

The situation brings out various overlapping roles, where she has to juggle family duties, production activities, and service to the community all at once, highlighting how complex her life is and the strength needed to handle competing obligations.

WI-06 shared her experience in domestic responsibilities and as a provider at the same time.

Tagalog: Lahat kasi syempre ginawa mo: paglilinis, pagpapakain, tapos ikaw pa yung nag-iisip kung saan mo kukunin yung pambili.

English: *Everything is on you, of course: cleaning, feeding, and then you're still the one thinking about where to get the money to buy things.*

The combination of double burden and financial stress in which the routine tasks of home are inherently linked to the stress of providing for family is indicative of the challenges that women face when they have to balance caregiving and economic security.

3. Empowerment discourse and lived realities

While empowerment talk involves discussion on the need to grant women voice, power, and opportunity, empowerment realities refer to the actual issues that women have to deal with every day. These may be very far apart because women might continue being poor and carrying out care work despite being referred to as "empowered."

WI-05 shared her experience of discrimination as she encouraged women to be productive in a Brgy. assembly.

Tagalog :*Sa meeting namin sabi nung mama sa akin, uh, " Babae lang yan" , nagsasabi ba ng totoo yan?*

English*: At our meeting, the man said to me, "She's just a woman," is that true?*

This is an experience of being marginalized and excluded through sexist language, where womanhood is used to question authority and competence, reinforcing gender-based biases that undermine her credibility and participation in the field and limiting her opportunities to assert expertise and be recognized as an equal contributor.

WI -03 expressed her feeling of dismay as she experienced discrimination.

Tagalog: *Kasi dini-discriminate na yung pagkatao mo, eh. Most of the time, ang Pilipino, mahilig mag-discriminate sa personality niya .*

English: Because your personhood is already being discriminated against. Most of the time, Filipinos tend to discriminate based on a person's personality.

This represents an encounter with judgment**,** where discrimination is directed at her personhood. It conveys how negative social attitudes can make a person feel dismissed, misunderstood, or treated as less worthy because of who they are.

WI-06 explained their encounter of rejection as their product did not meet the standard of the industry:

Tagalog: *Tuloy pa rin yung project nila. Pero sa amin, nag -stop na kami kasi sa—Manila, ma'am, rinereject yung gawa namin.*

English: *Their project is still ongoing. But for us, we already stopped because in Manila, ma'am, our work was rejected.*

This illustrates the lived situation, where the participants' work is judged as not meeting required standards and therefore cannot move forward. It shows how external approval systems can interrupt effort, limit opportunity, and create a sense of failure or discouragement.

4. Centrality of women's labor in farm production

Women's productive contribution to agricultural production is vital because it helps ensure the achievement of many routine tasks necessary to sustain agricultural activity. Farm activities such as planting, weeding, harvesting, processing, feeding of animals, and other farm-related tasks are often performed by women. In addition, in many farming households, they prepare meals and take care of other routine tasks, making it possible for the household to continue farm work.

Thus, one should acknowledge that women do not play a mere auxiliary role in agriculture, being also active producers.

WI-06 described their extensive work in the agricultural sector:

Tagalog: *Yung mga trabaho sa agrikultura, gaya ng mga pag bunot ng seedling at pag transplant (raip, pag sikka), ako na lang maam ang gumagawa.*

English: *The agricultural tasks in rice production , such as pulling seedlings and transplanting, I'm the one who does them, ma'am.*

This conveys active participation in the bodily work of rice farming, where the farmer is closely engaged in the demanding process of establishing the crop. It also suggests a gendered agricultural role in which women commonly perform careful, labor-intensive rice tasks such as seedling pulling and transplanting.

WI-03 explained the sequence of agricultural activities involved in converting products to cash:

Tagalog: *So, uh, nagtanim ka, dapat maghanap ka ng paraan na maibenta mo.*

English: *Look for a way to sell your products*

This shows an experience of market struggle and entrepreneurial initiative, where the women must find avenues to sell products because production alone does not secure livelihood. It demonstrates persistence in the face of market barriers, with selling becoming a necessary part of sustaining farm work and household income.

WI-01 shares her insights and perception that processing is a female-dominated work:

Tagalog: *So usually, pag mga ganitong processing, mga babae talaga ang members na magtutulong.*

English: *So usually, for this kind of processing, the members who help are really women*.

This reflects the lived reality of women's collective labor in processing, where women are the main workers in supporting the activity. It conveys how processing work is organized through gendered expectations and women's practical involvement in sustaining the group's work.

4.1.3 Theme 3. Limited Access to Resources

In many rural communities, women contribute significantly to farming, yet they do not enjoy the same recognition and benefits as men get. They experienced of lack access resources such as land, loans, machinery, and other sources of information about agriculture.

Because of the inequality these women face, they often work hard but earn little. Their harvests remain meager, and they have little to no chance of expanding their ventures due to inadequate resources.

The lack of resources also undermines the self-confidence and independence of women farmers. Without easy access to credit and training, they find it difficult to make decisions and adopt new farming methods

1. Structural resource exclusion

Female innovators endure structural exclusion because they are often excluded from opportunities that are designed and conceptualize inconsideration to male innovators. Such exclusion includes lack of funding, lack of networks, and being part of systems which tend to ignore female ideas and view them as high-risk. Such exclusion tends to affect the innovation process of these female innovators by preventing them from accessing training, technology, and markets necessary for turning their innovations into

reality. Structural resource exclusion undermines their positionality, resulting in low confidence that affects the future success of such female innovators.

WI-02 expressed her willingness to expand her activities and identified the availability of land as a barrier:

Tagalog: *Wala na akong lupain. Mahal na po ang lupa*

English: *I no longer have any land. Land is already expensive*.

This illustrates a lived situation where the inability to own or buy land limits farming possibilities and livelihood security. The rising land price intensifies the barrier to participation in agriculture, further constraining long-term stability and access to productive resources.

WI-06 described their experience applying for additional capital to a financial institution :

Tagalog: *Medyo mahirap kasi, ma'am, sa papel, marami akong kinonvince dito noon, ma'am, pero walang nakapasa sa papel*.

English: *It's somewhat difficult, ma'am, because of paper, I convinced many farmer here before, ma'am, but none of them passed the paperwork*.

The interaction led to bureaucratic exclusion and frustration whereby the bureaucracy acts as an obstacle that denies the farmers access to possibilities, showing how the formal procedures can be an obstruction to inclusion.

WI-03 identified one of the challenges for small farmers :

Tagalog: *Ang challenges talaga, mm, sa aming mga small farmer is yung mag-loan ka sa government na isang katutak na requirements.*

English*: The real challenge for us small farmers is that when you apply for a government loan, there are so many requirements*.

This experience shows that access to loans is not straightforward, but filtered through procedures that small farmers must struggle to meet, revealing how institutional requirements create additional barriers that limit their ability to secure financial support for their livelihood

2. Environmental constraints and insecure risk protection in women's production

Female farmers may largely rely on natural resources to produce food and feed their families. The instability of the environment complicates the process for women farmers and reduces their output. In case of drought or low levels of precipitation, it will be difficult for women to cultivate any crops or raise livestock. Without irrigation, credit, or insurance, one bad year can bring serious losses to them. Such challenges put women under pressure and make them insecure. Women will have to walk farther to fetch water or cultivate lower-quality land.

WI-05 recalled her experience with the agricultural product harvested during the storm:

Tagalog:*Since kasagsagan ng bagyo noon, so medyo nabulok siya. Pero yungnabulok na yun, still na-harvest, naani ko pa din. So ang ginawa ko, binenta ko sa, uh, somewhere else in, like in Ilagan City. At kasi dito sa amin sa San Mariano, ayaw na nilang bibilhin yun. So naitravel ko siya at nabenta naman, okay naman. At least na yung manlang puhunan niya naibalik.*

English*: Since it was at the height of the storm back then, my harvest got rotted a bit. But even though it had rotted, I was still able to harvest it. So what I did was sell it somewhere else, like in Ilagan City. Because here in San Mariano, they no longer wanted to buy it. So I brought it there and was able to sell it, and it went well. At least the capital was recovered.*

This represents the encounter of a woman adapting to post-disaster market loss from crop damage by seeking alternative buyers and turning a setback into partial recovery. It conveys the effort to preserve value, avoid total loss, and restore capital despite weather-related damage and local rejection

WI-06 narrated her encountered loss due to adverse weather conditions (Drought):

Tagalog:*Maraming challenge, lalo na sa pagmamais ngayon, ma'am. Drought. 300,000 yung puhunan ko, tapos more than 100,000 lang yung bumalik.*

English*: Here are many challenges, especially in corn farming now, ma'am. Drought. I invested 300,000, but only a little over 100,000 came back*

This is an experience of economic setback under climatic stress**,** where drought undermines the return on investment and threatens livelihood stability. It conveys the pain of putting in substantial capital yet receiving only a fraction back, forcing the farmer to absorb the loss.

WI-04 explained their facility to conquer drought*:*

Tagalog: *Then may mga ano naman kami, may mga impounding areas kami na doon nag-iipon kami ng tubig pag may malakas na ulan, pero hindi pa rin sapat.*

English*: Then we also have impounding areas, where we collect water when there is heavy rain, but it is still not enough*.

This is an experience of resource limitation despite adaptation, where impounding water during heavy rain becomes a practical response to scarcity, but not a complete solution. It presents the struggle of depending on variable rainfall and the continuing anxiety that even collected water cannot fully sustain farming activities.

3. Gendered financial exclusion and institutional barriers

Institutional barriers are the practices of the banks and the government and other formal institutions which consciously or unconsciously discriminate against women. This includes demands for collateral that most women do not have, documentation papers that are difficult to acquire, spousal consent, or the design of financial products based on wrong assumptions about men.

Additionally, discrimination in employment hiring, poor access to education that enhances financial literacy skills, low access to formal employment, and inability to develop credit histories are some of the other factors that can limit access by women even where financial services are present.

WI-06 explains how she settled as a woman farmer:

Tagalog: *Eh, Wala naman—akong ibang income kasi hindi naman ako nakapagtapos ng pag-aaral.*

English: *I have no other source of income, ma'am. I don't have any other income because I didn't finish schooling*

This is the lived reality of constrained livelihood due to interrupted education**,** where the inability to finish schooling limits employment options and leaves farming or similar work as the only source of survival*,* reinforcing cycles of economic vulnerability and restricted upward mobility.

WI-04 described their experience of skipping meals due to poverty as an effect of resource constraints (land) :

Tagalog: *Dahil nung bata ako, naranasan ko talaga ang hindi kumain dahil nga wala kaming lupa.*

English*: When I was a child, I really experienced not being able to eat because we had no land….*

This is an experience of growing up with food insecurity rooted in the absence of land, where lack of access to farmland meant lack of food and daily hardship shaping early experiences of deprivation and influencing long-term livelihood choices and resilience strategies

WI-03 explains her observation on the bureaucratic systems within the community that hinder the acquisition of services:

Tagalog: *Minsan, isa yun, ah, hindi ka talaga makapasok-pasok sa malaking industry kasi sa dami ng requirements ng binibigay ng government*.

English: *You really cannot enter big industry because of the many requirements the government gives… even the requirements alone are very taxing*.

This is an experience of institutional barriers limiting economic mobility, where complex requirements create stress and discourage entry into larger-scale industry. It conveys the burden of paperwork and compliance as a major obstacle that makes growth feel out of reach

This section offers an exceptional glimpse into the stories of innovative women who show resilience and persistence when facing difficulties and challenges. This chapter is focused on analyzing how these traits allowed them to overcome certain barriers and to innovate. There were three main themes revealed through the qualitative phase of the research: incompatibility of machines with the design of women, multiple loads for women, and scarce resources.

1.Machine Incompatibility- Gendered Design Barrier

The first overarching theme identifies the experiences of the women innovators concerning machine incompatibility as a gendered design problem, which further adds a layer to challenges faced by women in terms of innovation efficiency in the agricultural industry. Analyzing the problem of machine incompatibility from a feminist point of view, the matter transcends mere incompatibility between the woman and the machine to become a design problem(Open et al., 2023), owing to the situated knowledge of women innovators in agriculture**.** According to the feminist standpoint theory, all knowledge stems from experiences, and in this particular situation, women encounter machines that are too heavy for their bodies, out of proportion, hard to start, and that are coded for men.

The machine's incompatibility becomes evident in the physical and social burdens women bear simultaneously. Joshi et al., (2024)points out that machines are not usually designed in an ergonomic way for women, for they lack access to the training and technical assistance required to operate the equipment; also, social restrictions limit women's involvement in the spaces of mechanization(Guo & Akudugu, 2023); thus, even if the technology is there, usability decreases. Here, the obstacle lies not just in the machine itself, but in the entire innovation context design, service, credit, and gender norms defining the operator.

In the context of a feminist perspective, women as innovators are uniquely valuable in terms of being knowers because they are capable of seeing design problems that innovation processes neglected to acknowledge. Their familiarity with the machine gives them insights into how the machine is functioning in reality, such as hopper height, starting effort, weight of the machine, its tendency to be unstable, portability, fuel consumption, safety, and preservation of byproducts such as corn. van Remmen et al. (2026) reveal that when machines have not been designed considering the ergonomics of women, they could be marginalized and made peripheral in the process of production and processing.

This gender-based constraint in design also reflects inequalities of power within the innovation process itself. According to feminist political ecology theory, agricultural innovations are produced through household dynamics, community culture, and political-economic arrangements, making it clear that innovation is not value-free.

From a feminist standpoint perspective, machine incompatibility may be understood as epistemic injustice when women farmers' embodied knowledge and lived experiences are excluded from the design, evaluation, and extension of agricultural machinery. Women innovators can only participate fully after standardization of the machine; thus, the needs of women are viewed as 'add-ons' as opposed to participating in the design process. It is important to adopt a just system that includes participatory design, testing by women, localization of machines, and extension services that view women as creators.

Machine incompatibility should therefore be viewed as a gendered structural issue, and feminist standpoint enables us to realize the power of embodied experience of women innovators in developing agricultural technologies.

Finally, the case of women in agriculture shows how development and modernization may fail to bring about equality without the lens of gender. Mechanization, adaptation to climate change, and use of modern farming technologies will not help decrease the load of women unless these measures are used in ways that do not increase women's burden. In fact, mechanization and modernization of agriculture may worsen the situation for women when women remain responsible for weeding and post-harvesting activities. In such a situation, the change brings benefits only to male workers and may actually widen the gendered gap between men and women workers in agriculture.

2.The Complex Lives of Women with Multiple Burdens

Secondly, the complex lives of women with multiple burdens is another major theme that shows the interconnectedness of roles and interrelated responsibilities that are characteristic of women working in agriculture. Applying an intersectional approach, one can say that the life experiences of women engaged in agriculture are formed not

only through gender but also through their social location, which includes marital and caretaking responsibilities, economic situation, employment conditions, ownership of resources and land, and other factors.

The experiences of women in agriculture highlight the very nature of gendered inequalities wherein productive labor, reproductive

labor, and social role merge together in order to generate a plurality of burdens. Rural women not only perform agricultural activities but are also crucial for maintaining households and communities and reproducing themselves and their family members. From a Feminist Political Ecology perspective, such roles of women highlight how gendered relations of power determine the ways in which rural women interact with agricultural resources, labor, and the environment. The involvement of women in food production, household tasks, childcare, and resource management is critical for rural survival, but it is often seen as natural, taken-for-granted, and less economically rewarding. Many rural communities involve women in various tasks throughout the day.

Women contribute to agriculture in many ways; however, these contributions are often perceived in society as auxiliary labor instead of productive labor. In addition, women participate in such activities as planting, transplanting, weeding, harvesting, threshing, producing, and marketing products, while men participate in land preparations, plowing, and spraying. Such division of tasks not only places women in performing more tedious and laborious activities but also makes their contributions secondary and unpaid or auxiliary within household chores and agricultural production systems (Gërxhani et al., 2022). However, from the point of view of an intersectional perspective, the intensity of the burden of such gender division of labor can be different for various women. Women who have low income, precarious employment, no lands, dependent children, old family members, or lack of technology for reducing the labor intensity may perform such tasks more burdensome compared to women with more resources.

The interplay between productive and reproductive activities has been a core element of women's lived experiences. Besides engaging in farming, women are typically required to perform activities such as cooking, cleaning, caring for children and older persons, and collecting water and fuel. Feminist Political Ecology helps explain that these reproductive tasks are closely linked to women's management of natural and household resources, yet they are frequently excluded from formal understandings of agricultural work and rural development. Women's multiple tasks contribute to the phenomenon of time poverty (Carmichael et al., 2024), as they must constantly alternate between farm tasks and household chores. Their engagement in agricultural activities is therefore determined not only by willingness and competence but also by the restrictions imposed by gendered social roles, unequal distribution of care work, and limited access to resources and support.

All these responsibilities are important in relation to the well-being of women. Repeated exposure to physically demanding activities, movements, and chemical substances can make women feel tired, suffer from pain in muscles, weakness, and illness (Barneo-Alcántara et al., 2021). The majority of women do not have an option of reducing their number of responsibilities since they depend on them for survival of their families, efficient operation of farms, and taking care of children. They keep on performing their duties despite feeling tired or ill. Intersectionality Theory states that those women who are economically disadvantaged, do not have access to health care services, are

engaged in informal jobs, and have no influence on decision-making in their households and farms may be particularly vulnerable to these dangers.

The invisibility of the work done by women is yet another recurring element in the case of women in agriculture. The nature of women's work, which occurs between agricultural production and household work, might render the contributions of women invisible in terms of labor data and policies and development programs in agriculture. It is in Feminist Political Ecology that the issue of invisibility in terms of women's contribution to agriculture is highlighted. In fact, the exclusion of women's knowledge, labor, and contributions from agricultural decisions leads to adverse results because if the needs of women are ignored in labor policies, agricultural extension, mechanization, climate adaptation, and rural development, the marginalization of women in agriculture is bound to persist (Botreau & Cohen, 2020).

Insecurity in labor markets is another problem faced by women farmers. Many of these women farmers work seasonally or in an informal way, receive poor compensation, and have no security of employment, which makes them vulnerable to exploitation, harassment, and financial instability as they still have to perform their household and care-giving roles (Handal et al., 2025). When viewed from an intersectional perspective, the issue of labor market insecurity will not affect all women in the same way, as it might particularly affect poor women, landless women, single mothers, women belonging to marginalized groups, women who do not have any education and institutional backing. Women farmers thus are required to take risks in the labor market and at home, as well. In this regard, the plight of women farmers involves more than just gender inequality; rather, it involves a combination of economic insecurity, care burden, resource deprivation, and unequal power relations in agriculture and rural settings.

3.Limited Resources

Productive resource access represents another crucial factor in women's life experiences while they participate in agricultural production processes. In spite of women's active participation in agriculture, they are discriminated against in terms of land access, financing, inputs, technology, training and extension services. Productive resource access for women matters greatly because of the impact it has on their productivity, autonomy, livelihoods and ability to capitalize on their efforts. Within the framework of intersectionality theory, the factors which restrict productive resource access are not experienced equally by all women. Resource access for women may depend on such factors as their income level, marital status, age, education, position in the family, ownership of land, ethnicity, caregiving role and geographic isolation.

Land ownership is one of the most basic issues. Women do not have more secure rights to land than men. They might own land either by inheritance or by virtue of their relationships with men; yet, such ownership is informal and less secure than the one of men. In Feminist Political Ecology, land is considered not only a means of production but a tool for gaining power, independence, security, and authority in agricultural and environmental decision-making. If women have insecure land ownership, they do not have an opportunity to make decisions about what to grow, what technologies to employ, how to manage agricultural resources, and the distribution of benefits obtained from agriculture. Women's inequality is aggravated by their poor access to credit, technology, information about agriculture, and involvement in farm and household decision-making.

All of these things prevent women from becoming more productive and using agricultural technologies (Guo & Akudugu, 2023).

In addition, the absence of security of tenure impacts women's access to credit and institution. Since land is normally used as collateral, women who do not have rights to land cannot access loans or purchase inputs to invest in farming activities. They end up in a situation of low-input and low-output agriculture (Mando et al., 2020). The perspective of agricultural innovation systems also provides an understanding that innovation is not based on whether or not an individual farmer decides to take up the process. In the case of innovation, innovation takes place through interaction between farmers, extension agents, government departments, credit agencies, input firms, cooperatives, markets, research agencies, and other actors in agriculture. Women are therefore denied access to innovation because of their inability to access the network or have the resources for participation in such networks.

Also, insufficient resources make it difficult for women to respond effectively to shocks and changes. In times of drought, price fluctuations, and crop failure, women who lack stable access to land, capital, technology, and institutions will find it impossible to alter their agricultural activities, develop alternative sources of livelihood, and rebuild after loss. This means that vulnerability is not just an economic challenge (Glazebrook & Opoku, 2020), but also an environmental one. In line with Feminist Political Ecology, gender inequality in access to land, capital, technology, and natural resources renders women more vulnerable to environmental shocks. In some cases, the consequences of these shocks can be exacerbated by various factors such as poverty, low mobility, care obligations, illiteracy, and lack of membership in farmer associations or local institutions.

The aforementioned limitations are not only caused by poverty but rather by the structure of society and the way institutions function to ensure that men have more opportunities and rights related to property and agricultural decisions. Although there are laws guaranteeing gender equality, there are customs, imbalances in the distribution of household power, discriminatory practices, and weak enforcement of protective measures that prevent women from gaining access to land and economic resources. It means that women's resource limitations are structural rather than personal constraints (Najjar et al., 2023). This claim is supported by the Agricultural Innovation Systems approach, which proves that exclusion can take place in the course of functioning of institutions and connections that facilitate innovations. In case the extension services, financial services, input providers, farmer organizations, and markets are not involved in overcoming gender barriers, they can unintentionally exclude women from innovation processes in agriculture.

From the above theme, one can see that the lives of women engaged in agriculture face a contradiction: although these women are involved in production, most of them lack the means or institutional framework to control their activities and derive full benefits from them. Through the Intersectionality Theory, one can see that the lives of women facing different forms of disadvantage become more difficult. The Feminist Political Ecology shows how the gender relations lead to the unequal access to land, resources, and environmental decisions, while the Agricultural Innovation Systems show how important it is to have inclusive relationships, institutions, services, and networks through which women can engage in innovations. Hence, solving the problem of women agricultural realities involves not just engaging women, but also securing their land rights, access to

credit, inputs, technology, and gender-sensitive extension services. This also involves ensuring that the marginalized women are incorporated in the processes of organizing farmers, agricultural training, research, technology development, networking, and decision making in agriculture.

5.Quantitative Results and Discussion

This section presents and discusses the quantitative results and findings of the study in relation to the sub-research question No. 2, which sought to determine the extent of demographic differences in age, family status, marital status, and family size) and intersectional barriers that statistically affect innovation productivity among women innovators in agricultural startups in Cagayan Valley Region.

The data presented in this section were derived from a statistical analysis of responses gathered from 218 respondents via a survey questionnaire, processed using frequency counts and percentages to describe the barriers. Mean scores were interpreted as follows: 4.21-5.00 = very high, 3.41-4.20 = high,2.61-3.40 = moderate, 1.81-2.60 = low, and 1.00-1.80 = very low. One-way analysis of variance was used to test differences in innovation productivity according to age, marital status, number of children, and structural family status. Welch's ANOVA and the Games-Howell post hoc test were applied when the homogeneity-of-variance assumption was violated. Pearson product-moment correlation was used to examine the relationships between intersectional barriers and innovation productivity. At the same time, multiple linear regression determined the unique and combined contributions of the barrier domains to innovation productivity. Effect sizes and 95% confidence intervals were reported where applicable, and statistical significance was evaluated at the .05 level.

Each finding was interpreted in light of the study's theoretical framework and existing literature, allowing for a deeper understanding of how the quantitative results answer the specific inquiry posed by this research question. This approach ensures that the numerical data are not merely reported but are meaningfully connected to the broader objectives and hypotheses of the study.

> **SRQ2** (Quantitative). To what extent do demographic differences(age, family status, marital status, and family size) and intersectional barriers statistically affect innovation productivity among women innovators in agricultural startups in the Cagayan Valley Region?

5.1 Demographic Profile of the Respondents

The demographic profile of the respondents provides an important background for understanding the characteristics of the study participants. It includes key variables such as age, sex, civil status, educational attainment, and other relevant socio-demographic information that may help explain differences in responses and perspectives. To clearly visualize the demographic profile see Table 4.3 which provides an overview of the

demographic characteristics and startup attributes of the 218 women innovators in the quantitative phase of the research. Most of the respondents were mature women, with 39.4 percent falling between ages 45 and 54 and 32.1 percent aged 55 years and above, implying that 71.5 percent are at least 45 years old. Most of the respondents were married (81.7 percent), have one to four children (80.7 percent), and are in nuclear family structures (63.3 percent). About half of them had completed college education (44 percent), while 77.1 percent considered themselves the founders or chief executives of their firms. Around half (47.7 percent) of the respondents have more than 10 years of experience in agriculture. Most of the respondents were from Isabela (50.5 percent) and Cagayan (34.9 percent), while their businesses mainly focused on post-harvest technology/processing (46.8 percent) and crop production (35.3 percent).

Overall, the sample reflects women entrepreneurs who are experienced in agriculture and hold primary management roles in their ventures. Nevertheless, this does not imply that all these women face similar opportunities or challenges. Instead, the characteristics in Table 4.3 represent them in diverse and unequal social, household, institutional, and geographical contexts which can affect their innovation productivity.

Table 4.3
Demographic and Startup Characteristics of the Respondents

Characteristic	Category	n	%
Age group	18–24 years	1	0.5
	25–34 years	16	7.3
	35–44 years	45	20.6
	45–54 years	86	39.4
	55 years and above	70	32.1
Marital status	Single	19	8.7
	Married	178	81.7
	Widowed	20	9.2
	Separated	1	0.5
Number of children	None	12	5.5
	1–2	90	41.3
	3–4	86	39.4
	5 or more	30	13.8
Structural family status	Nuclear family	138	63.3
	Extended family	57	26.1
	Single parent	13	6.0
	Childless	5	2.3
Educational attainment	Elementary graduate	27	12.4
	High school graduate	68	31.2
	Vocational/technical certificate	12	5.5
	College degree	96	44.0

	Postgraduate degree	14	6.4
Primary startup role	Founder/CEO	168	77.1
	Co-founder/CTO/COO	25	11.5
	Head of R&D/Innovation	5	2.3
	Other role	17	7.8
Agricultural experience	Less than 1 year	4	1.8
	1–3 years	41	18.8
	4–6 years	36	16.5
	7–10 years	30	13.8
	More than 10 years	104	47.7
Startup province	Cagayan	76	34.9
	Isabela	110	50.5
	Nueva Vizcaya	20	9.2
	Quirino	11	5.0
Innovation focus	Crop production	77	35.3
	Livestock/Aquaculture	19	8.7
	Post-harvest technology/Processing	102	46.8
	Agri-Fintech/Marketplace	13	6.0
	Sustainable Agriculture/Climate Technology	3	1.4

Note. $N = 217$. Percentages may not total 100 because of missing responses and rounding.

5.2 Innovation Productivity of Women-Led Agricultural Startup

Women-led agricultural startups reported high innovation productivity (M = 3.540, SD = 0.567), but their protection of intellectual property (IP) was only moderate (M = 2.780, SD = 1.063).

In the context of productivity of women innovator the highest-rated indicator was that innovations increased startup efficiency or income (M = 3.977, SD = 0.589). Launching new products, services, or technologies (M = 3.787, SD = 0.709) and meeting innovation-development deadlines (M = 3.608, SD = 0.719) also rated high. Together these show that the women generated ideas and also developed and implemented them, drawing on agricultural knowledge, experience, leadership, opportunity recognition, and resource integration (Nade et al., 2021). The relatively low IP score (M = 2.780, SD = 1.063) points to a gap between the ability to innovate and the ability to secure and benefit from the innovation. Securing IP requires money, legal and technical knowledge, registration know-how, guidance, and time for paperwork.

Analyzing the data at the intersectionality aspect, the moderate IP score is not read as a lack of interest or capacity. It more likely reflects the interaction of gender roles with household duties, funds, education, digital skills, location, business size, legal knowledge, networks, and market position. Women are not an undifferentiated group, so a rural,

married mother with little collateral, poor internet, and no institutional mentorship follows a very different path from an educated woman with extended-family support, urban market access, and ties to DTI, DOST, DA, and universities. High productivity can therefore coexist with unequal ownership of innovation and its gains (Girollet, 2024). Unprotected innovations can be imitated or appropriated, which weakens bargaining power and limits investment and commercialization. Barriers do not stop women from innovating. They shape the nature, extent, timing, ownership, and profitability of innovation (Baines et al., 2022). Women innovators in the region focused on survival, production, family income, and care may not invest in costly, paperwork-heavy legal processes.

From the perspective of Feminist Political Ecology IP is a matter of power and control over resources, not only a legal or technical issue. Protecting an innovation depends on women's time, money, information, mobility, decision-making power, and institutional support. The high operational scores show women as agents of innovation (Thomas, 2024), while the low IP score suggests their innovation labor may go unrecognized, undocumented, and economically unprotected (Ramalho & Porto, 2021). This matches the qualitative findings on limited funding, gendered technology, weak institutions, care duties, rural infrastructure, and resource inequality, which favor small, incremental innovations over complex, costly protection and scaling.

While in Agricultural Innovation Systems**,** innovation depends on interactions among entrepreneurs, government agencies, universities, incubators, extension systems, financial institutions, lawyers, markets, cooperatives, and digital providers (Yuliana et al., 2023). The weaker IP outcome signals a deficit in the regional ecosystem, with inadequate links to IP offices, legal counselors, incubators, affordable registration, technology transfer offices, and mentors. Efforts should therefore strengthen the pathway to protect and scale innovations, not only motivate women to innovate.

Table 4.4

Innovation Productivity of Women-Led Agricultural Startups

Indicator	n	*M*	*SD*	*Level*
Innovations improved startup efficiency or revenue	217	3.977	0.589	High
Successfully launched new products, services, or technologies	216	3.787	0.709	High
Met innovation-development deadlines	217	3.608	0.719	High
Secured intellectual-property protection	218	2.780	1.063	Moderate
Overall innovation productivity	215	3.540	0.567	High

Note. Responses were measured on a five-point scale, with higher scores indicating greater innovation productivity.

5.3 Extent of Intersectional Barriers Experienced by Women Innovators

Table 4.5 shows that women innovators in Cagayan Valley face intersectional barriers at a moderate level in every domain. This suggests the barriers act together, not separately, to affect innovation through technological, economic, household, institutional, sociocultural, and identity-related factors.

Highest barriers. Technology and machinery (M = 3.250, SD = 0.453), time poverty and unpaid care work (M = 3.217, SD = 0.714), and financial and land access (M = 3.201, SD = 0.766) were the most significant. They imply difficulty accessing and using machinery and digital technology for production, processing, and expansion. They also point to a lack of funds, land tenure, and productive resources for investment.

Institutional and sociocultural barriers. Gender and institutional barriers (M = 3.008, SD = 0.527) suggest that gendered processes and institutional structures can restrict access to training, extension, finance, programs, business contacts, and decision-making. Regional and sociocultural barriers (M = 2.901, SD = 0.607) and gender stereotypes and cultural norms (M = 2.785, SD = 0.599) suggest that women innovate within a context that expects them to focus on domestic work, take support rather than leadership roles, and limit their mobility and participation in male-dominated agricultural networks.

Identity barriers. Intersectional identity barriers (M = 2.722, SD = 0.498) scored lower than the technology, time, and money domains, but remain important. The effect of gender varies with age, marital status, family structure, number of children, education, enterprise role, location, and assets. A rural, married woman with young children, limited finances, and a remote location faces constraints very different from those of a better-qualified woman with more assets.

Support environment. Low overall support environment (M = 2.430, SD = 0.518) and low social and institutional support (M = 2.223, SD = 0.517) had the lowest means. Because support items were reverse-scored, these figures must be read cautiously. They reflect a low perception of barriers rather than high support, so women reported a low level of these barriers relative to other categories, not a well-supported environment.

Women innovators face the intersection of gender, care work, capital and land scarcity, rural setting, technology, and institutional constraints at once, and together these likely affect productivity more than any single barrier (Rossi et al., 2023). For example, lack of finance prevents the purchase of machines, unsuitable machines raise labor intensity, high labor intensity causes time poverty, and time poverty reduces access to learning, networks, markets, and innovation. Poor support services then leave women with no means of resolving these linked problems. The relatively low score on intersectional identity barriers does not make intersectionality less relevant, because identity-related inequality runs through the other domains, as in economic inequality tied to family structure, class, geography, and resource access.

This compounding of barriers becomes clearer when viewed through Feminist Political Ecology, which links women's constraints to unequal power and control over resources.

Land, for instance, is more than a means of production: it serves as collateral, raises negotiating power and creditworthiness, and supports autonomy in business decisions (Yang et al., 2024). Limited land rights therefore block formal credit, investment in machinery and inputs, and business growth. Time poverty similarly reflects the gendered distribution of labor: when women carry both paid work and unpaid care, they have less time for learning, travel, experimentation, adoption, networking, registration, and market transactions.

Beyond individual access to resources, the findings also show how women are positioned within the wider network of institutions that support innovation. From the Agricultural Innovation Systems perspective, innovation is an institutional process involving entrepreneurs, government agencies, extension services, universities, incubators, banks, input suppliers, market intermediaries, farmer groups, cooperatives, and policy bodies. Women may lack fair access to these actors and services (Adebimpe Oluwabukade Adefila et al., 2024). This indicates an innovation-system gap: women have ideas, experience, and skills, but not equal access to the resources, networks, services, and institutions that successful innovation requires, and this limits their innovation productivity.

Table 4.5

Extent of Intersectional Barriers Experienced by Women Innovators

Barrier domain	n	*M*	*SD*	*Extent*
Technology and machinery barriers	217	3.250	0.453	Moderate
Time poverty and unpaid care work	216	3.217	0.714	Moderate
Financial and land-access barriers	218	3.201	0.766	Moderate
Gender and institutional barriers	217	3.008	0.527	Moderate
Regional and sociocultural barriers	216	2.901	0.607	Moderate
Gender stereotypes and cultural norms	218	2.785	0.599	Moderate
Intersectional identity barriers	214	2.722	0.498	Moderate
Low overall support environment	211	2.430	0.518	Low
Low social and institutional support	217	2.223	0.517	Low

Note. Higher means indicate greater barriers or lower support. Positively worded support and resource items were reverse-scored when included in barrier-oriented composite scores.

5.4 Differences in Innovation Productivity According to Demographic Characteristics

Innovation productivity did not differ by age, marital status, or number of children, but it did differ by structural family status.

Non-significant variables. Age ($\eta^2 = .016$; $F(3,211) = 1.160$, $p = .326$), marital status ($\eta^2 = .012$; $F(2,212) = 1.261$, $p = .285$), and number of children ($\eta^2 = .021$; $F(3,211) = 1.512$,

p = .212) had very small effect sizes. Any differences could have arisen by chance in this sample. Mean productivity fell from M = 3.792 for women without children to M = 3.431 for those with five or more, but this was not significant.

The variable Structural family status produced a significant difference, Welch's F(2, 38.625) = 3.868, p = .029, η^2 = .050, so it explained about 5% of the variance, a small but significant contribution. Women from extended families (M = 3.689, SD = 0.680) and single-parent or childless women (M = 3.778, SD = 0.870) scored higher than women from nuclear families (M = 3.452, SD = 0.431). Games-Howell post hoc tests were used to locate the specific group differences.

Household structure shapes how care work, chores, finances, farming, decision-making, social support, business labor, and informal networks are divided. Extended families may share childcare, eldercare, housework, farming, transport, and market work, giving women more time and flexibility for product development, training, networking, marketing, and management. They can also offer pooled capital, intergenerational knowledge, informal credit, and market contacts. Women in nuclear families may carry more of the care and household load, especially where social expectations assign this work to women.

Cautions. An extended family does not automatically raise innovation productivity, because it can also bring more domestic pressure, competing interests, and less freedom for women. The single-parent or childless group had the highest mean but only 18 respondents and a large SD (0.870), so it should be read carefully. Feminist Political Ecology warns against idealizing extended families, since their effect depends on gender power relations: who controls income, business decisions, and land or assets, who does unpaid work, and whether women's enterprises are seen as legitimate. The mechanisms behind the family-structure effect are therefore difficult to specify.

Interpreted through the lens of Intersectionality Theory, the data show that women's experiences are shaped by overlapping social locations (gender, family composition, marital status, age, caregiving responsibilities, household wealth, education, place, and institutional affiliations) rather than by any single demographic characteristic. Two married women with the same number of children can face very different conditions depending on household, economic, and support circumstances. Women entrepreneurs therefore should not be treated as one uniform group, and productivity may depend on how social reproduction (unpaid childcare, eldercare, and household work) is organized. From the Agricultural Innovation Systems view, productivity also depends on access to networks, resources, knowledge, markets, institutions, technology, and support services. Women with strong family support can more easily use training, extension, cooperatives, DTI/DA/DOST/LGU programs, buyers, digital tools, market travel, and incubation. Women with heavy care burdens may struggle to reach these actors even when services exist.

Policy implication. Innovation support should not assume equal access to training, financing, extension, digital tools, or market links. Services need flexibility,

decentralization, childcare arrangements, remote access, and family-friendly design that address constraints on women's time and mobility.

Table 4.6

Differences in Innovation Productivity According to Demographic Characteristics

Demographic variable	Group	n	*M*	*SD*	Test statistic	*p*	η²
Age group	18–34 years	17	3.353	0.619	$F(3, 211) = 1.160$	.326	.016
	35–44 years	44	3.557	0.626			
	45–54 years	86	3.506	0.533			
	55 years and above	68	3.618	0.556			
Marital status	Single/Separated	20	3.588	0.446	$F(2, 212) = 1.261$	.285	.012
	Married	175	3.556	0.582			
	Widowed	20	3.350	0.528			
Number of children	None	12	3.792	0.601	$F(3, 211) = 1.512$	.212	.021
	1–2	90	3.583	0.571			
	3–4	84	3.494	0.602			
	5 or more	29	3.431	0.395			
Structural family status	Nuclear family	135	3.452	0.431	Welch's $F(2, 38.625) = 3.868^{*}$	.029	.050
	Extended family	57	3.689	0.680			
	Single-parent/Childless	18	3.778	0.870			

Note. Welch's ANOVA was used for structural family status because the homogeneity-of-variance assumption was violated.

5.5 Games–Howell Post Hoc Comparisons for Structural Family Status

Table 4.7 shows that women from extended families reported significantly higher innovation productivity than those from nuclear families, with a mean difference of 0.237, $p = .046$. No significant differences were found between the nuclear-family and single-parent/childless groups or between the extended-family and single-parent/childless groups. The finding suggests that extended-family arrangements may provide additional assistance in caregiving, household responsibilities, agricultural work, or startup operations that supports women's innovation productivity.

Table 4.7

Games–Howell Post Hoc Comparisons for Structural Family Status

Comparison	Mean difference	*SE*	*p*	95% CI
Nuclear family vs. extended family	−0.237*	0.097	.046	[−0.470, −0.004]
Nuclear family vs. single-parent/childless	−0.326	0.208	.286	[−0.857, 0.205]
Extended family vs. single-parent/childless	−0.089	0.224	.917	[−0.649, 0.470]

5.6 Relationships Between Intersectional Barriers and Innovation Productivity

Table 4.8 indicates that innovation productivity was significantly lower among women who reported a less supportive overall environment ($r = -.409$, $p < .001$); greater financial and land-access barriers ($r = -.376$, $p < .001$); and lower social and institutional support ($r = -.376$, $p < .001$). Time poverty and unpaid care work and technology and machinery barriers also had weak but significant negative relationships with productivity. Regional and sociocultural barriers showed a weak positive relationship with productivity ($r = .157$, $p = .022$) whereas gender and institutional barriers, gender stereotypes, and intersectional identity barriers were not significantly related to productivity. Overall, access to resources and support was more closely associated with innovation productivity than identity- or stereotype-based barriers alone.

Intersectionality does not require every barrier to be significant on its own, and the pattern shows reinforcing conditions. Limited land means less collateral and finance, which blocks machinery, materials, and certification. Missing machinery increases labor and time poverty, which limits training, networking, and innovation, and weak institutional support then removes mentoring, financial referrals, market links, and legal help. Feminist Political Ecology treats time poverty and machinery design as products of gendered power over who has time, mobility, energy, and authority to reach resources. Agricultural Innovation Systems reads the support, finance, and institutional correlations as weak links between women and the wider innovation system. Women therefore need coordinated help from DTI, DA, DOST, LGUs, universities, incubators, cooperatives, financial institutions, extension services, and digital providers. A gender-responsive system should offer affordable collateral-free loans, land access and asset building, appropriate technology, mentoring, flexible training, digital infrastructure, market linkage, and programs that account for unpaid care.

Table 4.8

Relationships Between Intersectional Barriers and Innovation Productivity

Barrier domain	*n*	*r*	*p*
Gender and institutional barriers	214	−.028*	.689
Regional and sociocultural barriers	213	.157*	.022

Low overall support environment	208	−.409***	<.001
Time poverty and unpaid care work	213	−.173*	.012
Gender stereotypes and cultural norms	215	.020	.776
Financial and land-access barriers	215	−.376***	<.001
Technology and machinery barriers	214	−.140*	.041
Low social and institutional support	214	−.376***	<.001
Intersectional identity barriers	211	.005	.948

Note. Pearson product-moment correlations were used. Tests were two-tailed.

5.7 Multiple Regression Analysis Predicting Innovation Productivity

Table 4.9 shows that the regression model significantly predicted innovation productivity, $F(9, 189) = 11.423$, $p < .001$, explaining 35.2% of its variance. Low social and institutional support was the strongest negative predictor ($\beta = -.284$, $p < .001$) followed by financial and land-access barriers ($\beta = -.234$, $p = .004$) and low overall support ($\beta = -.223$, $p = .003$). This indicates that women's innovation productivity declined when access to institutional assistance, entrepreneurial networks, financing, land, family support, and an enabling startup environment was limited. The positive coefficients for regional and sociocultural barriers and gender stereotypes should be interpreted cautiously because they may reflect suppression effects rather than beneficial effects of those barriers.

Under Feminist Political Ecology, the significant effect of financial and land-access barriers shows that women's control over land, collateral, and capital shapes what they can innovate. The non-significant time-poverty and machinery coefficients do not show that these barriers are unimportant. Both were negatively correlated with productivity on their own, so their effects likely pass through resource access, because gendered care work and male-oriented machinery reduce the time, mobility, and money available. Under the Agricultural Innovation Systems framework, the strongest predictor was social and institutional support. This suggests that mentoring, market linkage, training, and responsive services matter most. Innovation depends on the links among women, DTI, DA, DOST, LGUs, universities, incubators, banks, and cooperatives, not on individual effort alone, so weak links, not weak ability, appear to hold back productivity. Intersectionality Theory ties these points together: gender, age, marital and family status, care duties, rurality, and enterprise position combine into barriers that differ from one woman to another. The ANOVA result supports this, since women in extended families scored higher (M = 3.689) than women in nuclear families (M = 3.452). That gap suggests household structure changes how much institutional and financial barriers matter. The positive coefficients for regional and sociocultural barriers and for gender stereotypes are consistent with norms working upstream through finance, care, and mobility. Women who have adapted, or who are more visible in markets, may also be more aware of these barriers and so report them more. This explanation is speculative until tested with interaction or mediation analyses.

Table 4.9

Multiple Regression Analysis Predicting Innovation Productivity

Predictor	*B*	*SE*	β	*t*	*p*	95% CI for *B*
Constant	4.693	0.333	—	14.112	<.001	[4.037, 5.349]
Gender and institutional barriers	−0.003	0.083	−.002	−0.031	.975	[−0.166, 0.160]
Regional and sociocultural barriers	0.172	0.074	.181	2.333	.021	[0.027, 0.317]
Low overall support environment	−0.244	0.080	−.223	−3.055	.003	[−0.401, −0.086]
Time poverty and unpaid care work	−0.072	0.055	−.091	−1.300	.195	[−0.180, 0.037]
Gender stereotypes and cultural norms	0.153	0.063	.165	2.440	.016	[0.029, 0.277]
Financial and land-access barriers	−0.172	0.059	−.234	−2.937	.004	[−0.288, −0.057]
Technology and machinery barriers	−0.024	0.086	−.019	−0.283	.777	[−0.194, 0.145]
Low social and institutional support	−0.308	0.071	−.284	−4.331	<.001	[−0.448, −0.168]
Intersectional identity barriers	0.019	0.074	.017	0.252	.801	[−0.128, 0.165]

Note. $R = .594$, $R^2 = .352$, adjusted $R^2 = .321$, $F(9, 189) = 11.423$, $p < .001$; $N = 199$.

6.Integrated phase

In this study, both qualitative and quantitative data were used to provide an in-depth analysis of the way intersectional barriers impact the innovative output of women entrepreneurs running agricultural businesses in the Cagayan Valley. Intersectionality Theory formed the basis of this research, according to which all women are not homogenous and their opportunities, challenges, and innovation results depend on the way gender interacts with social location, household position, care-giving function, access to land and capital, geographic location, education, technology, institutions, and sociocultural factors. Therefore, the current study does not consider gender, poverty, rurality, family duties, institutional discrimination, and technological barriers in isolation but investigates how these factors intersect and reinforce each other in the process of innovative activities of women.

Integration took place during the process of data interpretation and presentation via analysis of the convergence, complementarity, expansion and disjuncture between the two sets of data. The qualitative data helped to establish the social and institutional contexts of the statistical data, illustrating how the barriers of heavy machinery, unpaid labor, small capital, lack of land, poor institutional support, gender discrimination and uncertain environment are manifested in the daily work of women's businesses. Quantitative data allowed the researcher to determine the degree of the barriers' prevalence and importance and those factors that have a high correlation with the innovation productivity. The integrated analysis led to making meta-inferences about women's innovation as an outcome of the interaction between gendered household setting, uneven resource distribution, institutional system, technological setting and rural economic circumstances.

It emerges that women innovators are innovative and productive innovators even when encountering multiple barriers. From the survey, high innovation productivity was attained M=3.540 SD = 0.567, which is seen from the increased efficiency and income of the business, successful launching of innovation ideas, and meeting innovation development deadlines. But there was moderate intellectual property protection M = 2.780. This trend has significant theoretical implications. It reveals that women have practical skills, creativity, agricultural experience, and the ability to act as entrepreneurs in order to innovate at the production/business level, but not to protect and profit from the innovations.

In terms of Intersectionality Theory, the fact that women have a relatively low intellectual property index does not necessarily mean that they are not ambitious, knowledgeable or innovative. On the contrary, for the formal protection of innovations, it is necessary to spend much time, mobility, money, to know the law and technology, to have a proper Internet connection, to document innovations, to get instructions, as well as access to offices and professional networks. Thus, women, who at the same time engage in unpaid care activities, live far from the institution of support, do not have any collateral and money, as well as being outside the formal networks, are capable of developing new products and improving production technologies but cannot register, patent, trademark, certify and scale them. Hence, high innovation productivity and low formal ownership can exist together.

The results can be used to justify another theory known as Feminist Political Ecology, which stresses that access to productive assets, technology, labor, knowledge, and decision-making powers are defined by gender-based power relations. In the context of the current research, women's problems with land, credit, mechanization, time, and access to different institutions cannot be viewed only as problems of a technical or business nature. Rather, they have much more to do with unequal asset ownership, unequal division of household labor, and unequal access to agricultural and entrepreneurship systems. According to the Agricultural Innovation Systems Framework, innovation does not occur in isolation from other actors. On the contrary, it is influenced by the relationships with banks and financial institutions, extension services, universities, technology providers, government agencies, incubators, markets, cooperatives, ICT-service providers, and other institutions of law or intellectual property.

Table 4.10

Joint Display of Integrated Findings (Side by side statistics)

Integrated issue	Quantitative finding	Qualitative finding	Relationship	Meta-inference
Gendered machinery barriers	Technology and machinery barriers were moderate overall ($M = 3.250$). "Agricultural machinery is too heavy or unsuitable" was highly rated ($M = 3.673$).	Participants described tractors and other machinery as heavy, physically demanding, and poorly fitted to women's body size. Some preferred smaller equipment or needed assistance in operating machinery.	Convergence	Agricultural machinery is not gender-neutral. Its design and use may limit women's independent participation, safety, efficiency, and access to mechanized innovation.
Time poverty and unpaid care work	Time poverty and unpaid care work showed a significant negative relationship with innovation productivity ($r = -.173$, $p = .012$). Household-work fatigue ($M = 3.433$) and primary caregiving responsibility ($M = 3.413$) were highly rated barriers.	Women described waking early, managing livestock and crops, completing household chores, caring for children and family members, and working despite exhaustion.	Convergence and complementarity	Unpaid care work reduces the time, energy, and cognitive resources available for experimentation, learning, networking, and commercialization of innovations.
Financial and land-access barriers	Financial and land-access barriers were moderately experienced ($M = 3.201$) and significantly predicted lower innovation productivity	Participants described expensive or unavailable land, excessive loan requirements,	Convergence	Women's innovation productivity is constrained by unequal access to productive resources. Land

	($\beta = -.234$, $p = .004$). Difficulty obtaining startup funds or loans was the highest-rated barrier ($M = 3.731$).	lack of capital, and difficulty complying with documentary requirements for formal credit.		insecurity, inaccessible credit, and bureaucratic requirements reduce their ability to invest in, expand, and sustain innovations.
Social and institutional support	Low social and institutional support was the strongest negative predictor of innovation productivity ($\beta = -.284$, $p < .001$). Low overall support environment also significantly predicted lower productivity ($\beta = -.223$, $p = .003$).	Participants recounted product rejection, exclusion from larger markets, discriminatory treatment, limited institutional assistance, and difficulty meeting government or industry requirements.	Convergence	Innovation is not solely an individual capability; it depends on responsive institutions, accessible services, supportive networks, and inclusive market systems.
Gender stereotypes and sociocultural barriers	Gender stereotypes and cultural norms, as well as regional and sociocultural barriers, had unexpected positive regression coefficients after controlling for other barriers.	Participants reported being questioned, ridiculed, or treated as out of place when operating machinery, leading enterprises, or entering male-dominated agricultural spaces.	Divergence requiring explanation	Gender norms remain restrictive in women's lived experiences. The positive statistical coefficients should not be interpreted as beneficial effects; they may reflect suppression effects, resilience among already successful innovators, or unmeasured enabling factors.
Family structure and	Structural family status was significantly	Women described	Complementarity	Extended-family arrangements

innovation productivity	associated with innovation productivity, Welch's $F(2, 38.625) = 3.868$, $p = .029$. Women in extended families reported higher productivity than those in nuclear families.	relying on family members for caregiving, farm work, household management, and livelihood support, while others carried responsibilities alone.		may provide practical support that reduces work–family strain and enables women to devote more time and resources to innovation activities.
Environmental risks and limited protection	The survey showed moderate financial, technological, and support-related barriers, which can weaken women's capacity to manage innovation risks.	Participants described drought, storm damage, crop spoilage, insufficient water storage, market rejection, and efforts to recover capital by finding alternative buyers.	Expansion	Climate and production shocks interact with limited credit, land, technology, and institutional support. Women's innovation should therefore be understood as adaptive work undertaken under conditions of environmental and economic uncertain

Note: Only the subthemes directly relevant to the integrated qualitative and quantitative findings were included in the joint display

6.1 Report of the Joint Findings

The integration of findings in the joint display provides an explanation of the impact of intersectional barriers on the innovation productivity of women innovators among agricultural startup businesses in Cagayan Valley. The integrated findings reveal that the innovation activities of women innovators are impacted by the intersection of technological, care, financial, institutional, socio-cultural, family, and environmental factors. Generally, the findings suggest that the innovation productivity of women is not dependent upon individual abilities and motivations but rather on gender-sensitive technologies, productive inputs, family support, and institutions.

6.1.1 Gendered machinery barriers

This alignment between quantitative and qualitative results shows that agricultural machinery is gender-specific. The survey reveals that technology and machinery barriers were at the moderate level, and the machinery that was heavy or inappropriate for women was among the most highly ranked barriers. These findings are supported by the qualitative data that illustrates the fact that women face equipment tailored to their male counterparts' bodily characteristics.

The Intersectionality Theory supports this conclusion as the impact of inappropriate machinery differs across women. A woman who has money, family labor, transportation, knowledge, and connections will manage to rent the machinery, use other people's labor force, or buy smaller machinery. In turn, a woman without money, single parenthood, poor transportation, and living far from the town will have to use only manual labor or ask men to help her with this issue. Thus, the constraints of machinery become an intersection of class, family organization, geography, financing, and gender.

6.1.2 Time Poverty and Unpaid Care Work

In relation to innovation productivity, there was a statistically significant negative relationship between time poverty and unpaid care work. The high score in household/work fatigue and primary caregiving duties was backed up by qualitative observations that women get up early, take care of their children and other household members, attend to household activities, tend to the crops/livestock, and work on their enterprises despite being exhausted.

The integrated finding does not mean “women have less time.” Rather, it suggests that unpaid care work is a structural channel for gender inequality within the innovation process. A woman who has to manage her agricultural enterprises together with her household chores, childcare, eldercare, food preparation, and housekeeping will have fewer hours available to her, she will have lower energy levels, fewer opportunities for movement, and fewer cognitive abilities to engage in experimentation, learning, networking, product development, digital marketing, record-keeping, market trips, and registration procedures. Unpaid care work also correlates with financial factors: when women cannot afford labor services, child care, transportation, innovations, or help from a farm worker, their unpaid work burden increases.

The Gendered Political Ecology of Feminism looks at this burden in terms of the gender division of labor both productive and reproductive. Therefore, the agricultural innovation process cannot be considered to take place solely on farms, in processing facilities, or even in the market place. This process is influenced by what happens in the home, as the allocation of care activities and labor dictates who has time to access innovation. The Agricultural Innovation Systems Framework proposes that the support system for innovations needs to adapt by providing training on flexible timetables, decentralized or mobile extension, and assistance through online resources where possible.

6.1.3 Financial and Land Access Barriers

There is an observable convergence in the findings from both the quantitative and qualitative data. The barriers of financing and accessing land were experienced

moderately and predicted lower productivity in terms of innovation, whereas the barrier of difficulty in securing start-up funding or loans was ranked the most severe. Qualitative respondents noted expensive or inaccessible land, inadequate capital, loan terms and conditions, and difficulties in fulfilling the documentation requirements of borrowing formally.

It is clear in an intersectional perspective that finance is more than just an economic problem. Finance intersects with land ownership and use, property rights, family and household decision-making, marital and family arrangements, location, institutional knowledge, mobility, and networks. For instance, a woman who does not have a land title or control over any assets may not be able to provide collateral for a loan. The inability to access credit makes it difficult for such women to purchase relevant equipment, inputs, packing materials, technology, irrigation, transportation, certification, or intellectual property protection.

This forms a self-reinforcing circle where limited land/assets mean less collateral, which means less access to formal finance, which limits technology and productive investments, which means more labor-intensive work, which means time poverty, which results in limited access to education, institutions, markets, and innovation networks. The study thus reveals that the low productivity of innovation by women has nothing to do with any lack of entrepreneurial spirit but is caused by their unequal access to the resources needed for innovation.

6.1.4 Social and Institutional Support

The survey revealed that lack of social and institutional support is the most significant negative predictor of innovation productivity, and low overall support environment significantly predicted lower productivity. The qualitative data provides an explanation of the underlying process: the respondents encountered product rejection, lack of inclusion into bigger markets, discrimination, lack of institutional help, and difficulties in complying with governmental or industrial standards.

Intersectionality Theory shows that institutional exclusion does not impact all female innovators in the same way. Highly educated women with well-developed networks living in urban areas, having Internet access, owning land, transportation, family support, and understanding of government procedures are likely to have better chances to get access to training, grants, loans, extension, certification, incubators, and market access. In turn, poor rural women who take care of dependents, who do not know about institutional procedures, and do not belong to influential business networks can encounter multiple exclusions at once.

The Agricultural Innovation Systems Approach is especially pertinent since it considers innovation to be an institutional activity. Not only are the skills of the women important for their productivity, but it is also crucial whether these women can network with the Department of Agriculture, Department of Trade and Industry, Department of Science and Technology, LGUs, universities, cooperatives, financiers, extension agencies, technology providers, marketing agents, and business advisers. Therefore, it appears that there is an innovation system deficiency: while the women possess innovation potential, the innovation systems through which financing, technology, mentorship, certification, intellectual property protection, and commercialization can be achieved are not within reach.

6.1.5 Gender stereotypes and sociocultural barriers

The regression analysis revealed positive coefficient values for gender stereotyping, cultural norms, and regional/sociocultural barriers, while taking into account the other barrier categories. Yet, the qualitative findings reveal that there was ridicule, questioning, and exclusion in relation to women working with machinery, running enterprises, and being engaged in the traditionally male-dominated space of agriculture. This contradiction does not indicate that there is an improvement of innovation productivity through the presence of gender stereotypes and sociocultural barriers.

Rather, this might be explained through various mechanisms such as suppression effect, multicollinearity, selection effects, or differences in women's exposure to gender barriers. For instance, women who are more visible, active, and successful in their enterprises will also be more exposed to male-dominated markets, institutions, machinery systems, or leadership spaces, where they will encounter discriminatory behavior. Their increased productivity is not necessarily caused by gender stereotyping but can co-exist with it. Also, those women who have managed to survive in difficult situations are more likely to demonstrate innovation activity and awareness of sociocultural barriers.

Theory of Intersectionality plays a very important role in such situations, as it ensures that a coefficient will not be interpreted in isolation. Gender roles might influence innovation not directly but via access by women to credit, land, training, technology, networks, mobility, family decision-making, and allocation of unpaid labor. As a result, their role in hindering innovation might be played indirectly through financial, technological, time and institutional constraints rather than a direct negative coefficient in a multivariate regression.

6.1.6 Family structure and innovation productivity

The quantitative analysis showed that there was a significant relationship between structural family status and innovation productivity such that women from extended family backgrounds reported higher innovation productivity compared to women from nuclear family backgrounds. The qualitative findings further support this in demonstrating that family members may provide care, agricultural labor, domestic chores, transportation, emotional support, livelihood support, and business support.

Interjectionally, one would caution against interpreting the notion of extended family status as being inherently good. It is not the size of the household that makes a difference, rather it is the distribution of labor, care, income, assets, mobility, decision-making capacity and entrepreneurial capacity within the family that make the difference. It is through the distribution of these resources that an extended family can support innovation when care-giving, farming, transport, marketing or household chores are shared among relatives. On the other hand, it can be difficult for an extended family due to domestic responsibilities and pressure, lack of freedom among women or lack of control over enterprise income and assets.

This finding confirms the concept of Intersectionality Theory since it shows that demographic variables alone, such as age, marital status, and number of children, do not account for the innovation productivity of women. This is because women's lives are formed through the intersection of their family structure, care giving practices, economic

situation, power dynamics within the family, geographical location, and access to institutions.

6.1.7 Environmental risks and limited protection

Qualitative narratives enriched the quantitative research findings through the identification of drought, crop damage due to storm, crop spoilage, poor water storage facilities, rejection from markets, and efforts to recover capital through alternate buyers. These stories illustrate that women entrepreneurs face both environmental and production risks along with financial, technological, institutional, and care-based barriers highlighted in the survey.

In an intersectional view, environmental risks do not impact all women entrepreneurs the same way. A woman who has savings, clear land ownership, irrigation facilities, insurance, storage facilities, market linkages, digital connectivity, transportation, family labor, and institutional backing will be better positioned to handle the production risks. On the contrary, a woman who has weak access to land, credit, water infrastructure, unpaid care duties, weak market linkages, and institutions will perceive a climate risk as multiple risks. The loss of crops can have economic, social, and environmental impacts on her life.

The concept of Feminist Political Ecology is especially relevant in analyzing this particular observation as it highlights the relationship between the environment-related risk and gender inequality with respect to accessing resources, technology, labor, and decision-making power. Another framework the Agricultural Innovation Systems Framework suggests that resilience should not be attributed exclusively to the women entrepreneurs but rather implies a need for providing women-specific services such as climate information, infrastructure, insurance/recovery mechanism, technology, finance, extension, market linkages, and institutional support.

6.2 Integrated Interpretation

In light of the results of this study, the women innovators in agricultural startups in the Cagayan Valley possess high levels of innovation productivity and agency; however, these accomplishments have been made within a context of structural inequality. In terms of the statistical results, it is clear that lack of social and institutional support, poor supportive environment in general, financial constraints, and access issues with regard to land are strongly negative predictors of innovation productivity. In addition, it has been shown through qualitative methods how these social processes work; specifically, the difficulties related to getting loans, insecure or limited access to land, expensive or inappropriate machinery, unpaid domestic and care work, gender discrimination, institutional support, and poor access to markets. In other words, the innovation productivity of these women does not solely depend on their individual capabilities and motivations or business experience.

In terms of Intersectionality Theory, the above mentioned obstacles should not be addressed as separate and additive issues. Women face neither “gender barriers,” nor “money barriers,” nor “technology barriers,” nor “care barriers.” Instead, the combination of being a woman, a rural entrepreneur, a caregiver, a land user/non-user, a borrower, a person within certain type of a household, and an active participant of gendered agricultural market determines what opportunities and limitations she has. For instance,

while two women may both run agricultural businesses as startups, the extent to which they can introduce innovations depends greatly on whether or not they own the land, have collaterals, live close to markets and administrative offices, have access to the Internet and transport, have the support from family in matters of care, have certain networks, and have access to credit and education.

This high rate of reported innovation productivity cannot be taken as an indication that there are no structural barriers at all or that they do not exist or matter. On the contrary, from the evidence provided together women manage to innovate despite the constraints. This productivity could be related to women's endurance, adaptability, agricultural expertise, informal network building, help from the family, and much personal effort on the part of women in managing to combine their enterprise activities with household duties. Women's endurance cannot be used as a reason to accept inequality and place the blame on women for removing the existing structural barriers. The fact that women are able to make their enterprises more efficient, earn money, launch new products, and meet development deadlines does not necessarily mean that there is equality in innovation.

The moderate degree of protection of intellectual property can be regarded as a special intersectional interpretation of innovation results of women. In this way, although women may possess knowledge, experience and entrepreneurial abilities to invent or modify their products, optimize production process and earn money, they still may face disadvantages while working within the formal institution of intellectual property protection, scaling and distribution of innovation results. Protection of intellectual property usually demands resources, information about legislation, time to accomplish the documentary procedure, transportation or Internet access, consultations of the appropriate offices and connection to the institutions of support services. In this way, despite having innovative abilities at the enterprise level, women having limited financial resources, unpaid care responsibilities, living in remote areas, poor Internet connection, lack of information about the legal issues and weak connection to the institutional infrastructure may not manage to register, patent, trademark, certify or commercialize their innovations.

Moreover, the finding of the increased innovation productivity among women in extended families is another example of the relevance of the relationships in the household to innovation possibilities. This finding should not be seen as simply a strength of the extended family. On the contrary, it implies that the way the household is organized in terms of care, labor, income, mobility, and decision making can affect women's ability to get involved in innovation. As in cases when care and labor in the household are divided between the extended family members through childcare, elder care, housework, farming, transportation, marketing, or enterprise, women may find themselves having more opportunities to engage in training, contacts with service providers, experimentation, technology use, traveling to markets, and management of their business.

Nevertheless, Intersectionality Theory needs to be used with caution regarding the assumption that all extended-family structures are supportive. The extended family structure can offer labor, caregiving, informal financing, and social support, but at the same time, the household might present an unequal household structure, constraints on mobility of women, competition for labor of women, lack of control over finances, and lack

of decision-making power in the business. Equally, in the case of nuclear families, there might be women who enjoy supportive partners, have more autonomy, financial control, and few household conflicts. The important thing is, thus, not only the household structure but also the gender division of resources, work, support, and entrepreneurship.

The study also highlights that the barriers interact with one another in a vicious cycle. The lack of access to land may lead to women not being able to generate collateral for themselves, which may then limit their access to formal borrowing. The inability to access finances may mean that women cannot invest in gender-appropriate machinery, ICTs, irrigation, inputs, packaging, certification, intellectual property rights, and market access. With a lack of machinery, women may have to resort to doing things manually, which means more labor and more time poverty. Time poverty, in turn, will mean less access to training, extension services, networking, market trips, e-commerce, and all other documentation needed for loans and licenses. It is important to note that lack of social and institutional support will also aggravate the problem, as women will have no mentors, referral to credit, legal advice, market contacts, technological assistance, and advocacy when faced with exclusion.

This interpretation is consistent with the theoretical framework of Feminist Political Ecology, which recognizes that the distribution of access to, and control over, land, finances, technology, labor, knowledge, and the environment is structured by gender power dynamics. In the current study, both insecure land tenure and constrained financing can be considered not just issues of finance, but also issues of inequitable access to productive capital, as well as inequity in bargaining power within households, communities, markets, and institutions. Likewise, poor design of agricultural machinery should not be limited in meaning simply to issues of design. Rather, it should also be seen as an issue that relates to whose experience is the assumed norm for farmers, who receives training in technology use, who makes the purchase decisions, whose labor is valued enough to be mechanized, and whose physical needs are addressed in agriculture technology design.

6.3 Meta- Inferences

In general, the combined results indicate that female entrepreneurs in agri-businesses have considerable agency and innovative capacities, but these take place under uneven social, economic, familial, technological, institutional, and environmental circumstances. The findings do not point to an individual-deficiency model whereby low efficiency, inability to scale up, and weak intellectual property protection are due to insufficient motivation or capacity on the part of women. On the contrary, the results reveal that innovation efficiency is influenced by intersecting barriers relating to land and financial access, gendered technology, unpaid care work, familial support arrangements, institutional inclusion, markets, rural infrastructure, and environmental risks.

Thus, the Intersectionality Theory serves as the primary theory explaining the integrated findings since gender-based disadvantage is more severe when it coincides with factors like poverty or asset deprivation, rurality, unpaid care work, poor institutional linkages, poor digital and transport infrastructure, and exclusion from mainstream finance and innovation systems. The Feminist Political Ecology helps us understand the power dynamics which regulate access to land, money, technology, labor, and natural resources, whereas the Agricultural Innovation Systems Approach helps us comprehend

why the outcomes of individual women innovating depend on the nature of the institutional and networked system in which they operate. In summary, our findings imply that helping women innovate within agriculture cannot merely be done through entrepreneurship education or funding alone.

7.CONCLUSION

This study examined the intersectional barriers, experiences, and demographic factors that influence innovation among women in agricultural startups in Cagayan Valley. It concludes that women innovators are productive, but their productivity depends mainly on structural and relational conditions, not on personal traits. They achieve efficiency and income gains, develop new products and services, and meet development deadlines despite difficult conditions, which reflects their agricultural experience, entrepreneurial capability, knowledge, skills, and adaptability. Their productivity cannot be explained by personal capability, effort, education, age, marital status, or motivation alone.

The women's accounts describe innovation under gendered and unequal conditions. Machinery is often designed without women in mind, unpaid care and enterprise work compete for the same time, and access to land, credit, and institutions is limited. Cultural constraints and environmental hazards add to these pressures. These experiences support Intersectionality Theory, because gender combines with household type, caregiving duties, rural location, property ownership, financial standing, mobility, technology access, education, and institutional networks. Two women with the same gender, sector, or marital status can therefore have very different innovation opportunities.

Age, marital status, and number of children were not associated with innovation productivity. Structural family status was, with women in extended families more productive than those in nuclear families. This does not mean extended families are automatically beneficial. What matters is how household labor, care, income, and decision-making are distributed, and whether women control enterprise resources and decisions. The regression results identify the strongest negative predictors as low social and institutional support, limited finance and land access, and a weak overall support environment. Women's innovation success therefore depends on access to credit, land, markets, technical expertise, mentors, training, networks, family support, public services, and responsive institutions. Intellectual property protection was the weakest outcome, because women may have the skills to innovate but lack the money, time, legal knowledge, internet access, mobility, and guidance to protect and commercialize their work.

Feminist Political Ecology shows that gendered power relations shape access to land, finance, technology, labor, and knowledge. The effects chain together: land ownership and collateral determine financing, financing determines technology, technology determines labor demand and time poverty, and time poverty limits access to markets, training, institutions, and innovation. Unpaid care work and restricted access to productive resources are therefore not private problems but central to who can take part in

innovation. The Agricultural Innovation Systems framework adds that innovation is not the work of the entrepreneur alone. It needs cooperation among women entrepreneurs, financial organizations, government agencies, extension agencies, universities, technology providers, cooperatives, markets, incubators, digital service providers, and IP institutions. The study reveals system gaps: women may have ideas and practical skills but cannot get finance, land support, mentorship, technology, certification, legal advice, IP protection, or commercialization help.

8.RECOMMENDATIONS

For government agencies and LGUs

1. Establish a comprehensive women's desk for agricultural innovations at the provincial or municipal level. This desk must manage the referral process among the Department of Agriculture, Department of Trade and Industry, Department of Science and Technology, local government units, financial institutions, cooperatives, universities, and any other relevant organizations.

2. Devise gender-specific financing systems for women-owned agricultural enterprises. These must consist of low-interest rates, easy application procedures, flexible repayment schedules, small loan amounts, guarantees, collective lending schemes, and non-traditional forms of security for women who lack land ownership or tangible assets.

3. Support the empowerment of women regarding land tenure, productive assets, and land services. These must involve awareness campaigns on land rights, land leases, agrarian support services, joint production, documentation of property rights, and avenues through which women could empower themselves with regard to productive resources.

4. Establish local help desks for intellectual property rights protection, product certification, packaging, branding, food safety regulations, company registration, and commercialization. Such help desks can provide guidance, consultancy, assistance in documentation, and referrals to appropriate departments.

5. Invest in rural digital, energy, transportation, water, storage, and market infrastructure. Internet connectivity, power supply, irrigation, cold storage, post-harvest facilities, transportation linkages, and market facilities will minimize costs and risks associated with innovation by female entrepreneurs.

For financial institutions

1. Identify loan requirements that unintentionally discriminate against women without any form of land ownership, valuables, good credit records, or sufficient documentation.

2. Provide financial products aimed at women for various innovation stages such as start-up capital, equipment, working capital, packaging, certification, digitization, intellectual property registration, product development, and expanding into new markets.

3. Financial literacy and loan readiness assistance is required in the areas of developing business plans, budgeting, repayment strategies, documentation, credit applications, and loan terms and conditions.

4. Work with local governments, cooperatives, women organizations, and extension offices for referrals, mentorship, financial literacy, and easily accessible community based services.

For agricultural, technology, and extension institutions

1. Design and promote gender-responsive agricultural machineries and technologies based on the body dimensions of women, their safety, work load, mobility, cost, ability to maintain the equipment, and the actual situations in women-operated enterprises.

2. Implement equipment rental, service sharing, cooperative mechanization, or leasing schemes. Through such mechanisms, women will be able to use equipment without incurring huge capital costs or purchasing them.

3. Conduct training schedules and modes that take into consideration the care obligations of women. For example, there can be weekend trainings, mobile or barangay-based trainings, online and hybrid trainings if internet connectivity is available, and repeat trainings.

4. Strengthen mentorship and peer learning systems that connect women innovators to agricultural experts, experienced entrepreneurs, technology providers, universities, cooperatives, processors, buyers, and business incubators.

5. Engage women entrepreneurs in the design, pilot testing, procurement, training and evaluation of technologies. The experiences of women entrepreneurs must be used in determining what technologies are promoted and how the services are provided.

For families and communities

1. Foster the shared distribution of childcare, elderly care, domestic work, farm work, transportation, and business functions within the family.

2. Carry out community education and advocacy to dispel stereotypes that equate machinery use, farming, financial decisions, and entrepreneurship with masculinity.

3. Encourage family members to view women's businesses as economically relevant and worthy of time, resources, decisions, mobility, and support.

4. Create women's entrepreneur organizations at the village level or strengthen existing ones for the purposes of information exchange and cooperation in purchasing, equipment, marketing, mentoring, and advocacy.

For women innovators

1. Get involved in or establish women-run cooperatives, producer groups, savings groups, and enterprise clusters in order to promote collective bargaining, market access, equipment, knowledge exchange, and peer learning.

2. Go for help wherever you can from governmental organizations, universities, extension services, incubators, cooperatives, women's groups, and financial literacy sources in regard to credit, training, technology, certification, product development, and intellectual property.

3. Keep records of innovations, product improvement, production processes, consumer response, cost, and enterprise outcomes that will be useful for product protection, funding applications, business planning, certification, and marketing.

4. Establish strategic collaborations with buyers, suppliers, processors, technology firms, local organizations, and other women innovators in order to increase market access, networking opportunities, and resource access.

For future researchers

1. Perform longitudinal studies to observe how barriers and innovation productivity evolve over time and measure the success of any interventions made with respect to improving innovation productivity of women.
2. Increase the sample size and its geographic diversity – include women from distant municipalities, indigenous people, different value chains, as well as different firm sizes.
3. Separately study interaction effects through statistical analysis – e.g., whether there is a difference in the influence of finance barriers depending on the type of family, rural status, caregiving burden, age, education, property, access to digital information, institutional linkages, etc.
4. Study male, household member, lender, extension worker, technology provider, and policy maker perspectives to better understand the process of institution/household enabling/disabling women's innovation in agriculture.
5. Investigate the unexpected positive regression coefficients for gender stereotypes and sociocultural barriers using qualitative follow-ups and statistical techniques.

DECLARATIONS

Author Contributions

LSL: Conceptualization, Draft preparation, Writing, Investigation, Study Administration: MLTJ: Methodology, Formal Analysis, Reviewing, Validation; LMDR: Draft Preparation, Writing, Reviewing, Editing.

Competing Interest

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