Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 1 Issue 6 (2025)

Comprehensive Analysis on the Impact of Consolidated Rice Farming and Mechanization Program in South Cotabato, Philippines

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Publication Date: June 29, 2025 DOI: 10.5281/zenodo.16875640

Abstract

This study evaluates the Consolidated Rice Farming and Mechanization Program (CRFMP) in South Cotabato, which aims to enhance rice production through land consolidation, mechanization, and cooperative farming. The research study used a mixed-methods approach, including surveys, key informant interviews, and focus group discussions, to examine the socioeconomic, technical, environmental, and institutional constraints that limit program implementation and farmer participation. Anchored on Maslow's Hierarchy of Needs and Goldratt's Theory of Constraints, the study finds that CRFMP has increased rice yields from 3.68 to 8.1 metric tons per hectare. However, institutional fragmentation, limited credit access, inadequate mechanization infrastructure, and weak cooperative structures hinder optimal outcomes. Financial constraints remain essential, with nearly half of farmers earning below PHP 10,000 monthly, limiting investments in modern technologies. Mechanization remains cooperative-dependent, with 87.5% of farmers lacking machinery ownership. Environmental bottlenecks, including poor irrigation, asynchronous planting, and soil degradation, further hinder productivity. Correlation analysis reveals strong positive relationships between Maslow's needs and farmer satisfaction, with Safety Needs (r = 0.88) and Physiological Needs (r = 0.87) as key predictors. Farmer attitudes significantly affect CRFMP participation. A prevailing risk-averse outlook, shaped by institutional uncertainty and fluctuating farm incomes, limits mechanization adoption and cooperative engagement. Older farmers (86% of participants) resist new technologies, while younger, educated farmers show openness to innovation but face capital and institutional barriers. Despite aspirations for growth and self-actualization, as reflected in the study's high self-actualization scores, systemic constraints and fragmented trust within cooperatives limit program ownership and engagement. The findings focus on implementing integrated reforms addressing structural barriers while encouraging behavioral shifts, confidence, and innovation-oriented mindsets to ensure CRFMP's long-term success.

Keywords: *Agricultural Modernization, Consolidated Rice Farming, Farmer Mindset, Cooperative Governance, Institutional Constraints*

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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1.0 Introduction

Agriculture remains the cornerstone of human development, with rice serving as one of the most important staples for nearly half of the global population (Wijerathna-Yapa & Pathirana, 2022). Norman Borlaug's call to intensify agricultural production and improve food distribution continues to resonate, especially in the face of climate change, diminishing resources, and the pressure to feed a rapidly growing population; as he stated, *"To feed the world's growing population, we must intensify agricultural production and ensure that we have the means to grow and distribute food efficiently."* This sentiment captures the essence of the challenges faced in rice farming today. Ensuring food security while promoting environmental sustainability has become a central dilemma confronting modern agriculture (Foley et al., 2011; Godfray et al., 2010).

In the Philippines, where approximately 47% of the land is devoted to agriculture (Stuart-Smith, 2023), rice holds incomparable significance not only as a staple crop but as a symbol of cultural identity and social cohesion (Merez, 2021; Leocadio et al., 2000). However, rising production costs, the impacts of climate variability, and structural inefficiencies continue to threaten the country's rice self-sufficiency. In response, the government and development partners have advocated for farm consolidation and mechanization as strategic approaches to improve productivity, reduce costs, and modernize the sector (Amongo et al., 2021). These interventions aim to scale up agricultural production by clustering small farms and introducing technologies that support efficient, climate-resilient farming.

Programs like the Consolidated Rice Production, Mechanization Program, and Processing Center—locally known as the Consolidated Rice Farming and Mechanization Program (CRFMP), represent such innovations in the province of South Cotabato. This initiative, which includes a centralized rice processing facility in Barangay Liwanay, Banga, targets over 240,000 households across Koronadal City and the municipalities of Surallah, Tantangan, Norala, and Sto. Niño and Banga. The pilot site in Barangay Dajay, Surallah, recorded promising results in its early stages, achieving an average yield of 8.1 metric tons (MT) per hectare, significantly exceeding the 2021 provincial average of 3.68 metric tons per hectare (Sarmiento, 2023). Despite these accomplishments, only a small fraction of the intended 3,000 hectares has been consolidated and mechanized, indicating persistent challenges in scaling the program.

The CRFMP promotes the clustering of smallholder farms and mechanization through the use of modern equipment such as transplanters and harvesters. These technologies are envisioned to reduce labor dependency, lower production costs, and enhance land productivity. The program is aligned with national policy frameworks like the Agriculture and Fisheries Modernization Act (RA 8435), which supports technological advancement and sustainability in agriculture. Complementing this is the Farm and Fisheries Clustering and Consolidation Program (F2C2), which emphasizes integrating small farmers into competitive markets and value chains. F2C2 promotes the use of shared service facilities and access to credit, training, and infrastructure under laws like RA 11321 (Sagip Saka Act of 2019) and RA 10969 (Free Irrigation Service Act), which support farm clustering and the expansion of irrigation.
Both CRFMP and F2C2 share the objective of modernizing Philippine agriculture through the consolidation of fragmented farms, resource optimization, and enhanced market access. These programs allow farmers to pool resources and share equipment, which improves farm management and increases yield outcomes. Initial pilot results show a positive impact. However, implementation bottlenecks remain, especially in the form of social, institutional, and logistical constraints.

While several studies recognize the potential of farm consolidation and mechanization for improving productivity and farmer welfare, fewer have explored the ground-level barriers that impede widespread adoption. Research often focuses on policy design and pilot results but lacks a comprehensive analysis of the underlying constraints, particularly from the perspectives of farmers and local stakeholders. There is

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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insufficient investigation into how issues like land tenure insecurity, limited capital, fragmented social networks, lack of trust in institutions, and ecological concerns hinder farmer participation and the effective scaling of consolidation programs.

This study addresses that gap by examining the multifaceted constraints, socioeconomic, technical, environmental, and institutional, that affect the implementation and success of the CRFMP in South Cotabato. By integrating perspectives from literature, policy, and on-the-ground realities, the study contributes a critical understanding of the systemic issues facing the program. Its findings are expected to inform more effective program strategies and promote inclusive, sustainable agricultural modernization.

The purpose of this study is to conduct a comprehensive analysis of the Consolidated Rice Farming and Mechanization Program in South Cotabato, focusing on its broader impacts and challenges. Specifically, the study aims to identify the barriers farmers face in participating in the program, assess the key constraints in its implementation, and offer evidence-based recommendations to improve its effectiveness and scalability. In doing so, the research seeks to support policy and institutional reforms that empower smallholder farmers, promote sustainable practices, and enhance food security in the region.

2.0 Methodology

2.1 Research Design

This study employed a convergent mixed-methods design, integrating both quantitative and qualitative approaches to address the research objectives comprehensively. The quantitative component utilized a structured survey designed based on Maslow's Hierarchy of Needs to identify the specific challenges experienced by farmer-participants of the Consolidated Rice Farming and Mechanization Program (CRFMP). This approach facilitated the examination of how various levels of unmet needs, from basic physiological requirements to self-actualization, affected farmer engagement and satisfaction with the program. On the other hand, the qualitative component adopted a phenomenological approach to explore the lived experiences of farmers, program implementers, and partner agencies. The qualitative analysis was anchored in Goldratt's Theory of Constraints (TOC) to identify and classify systemic, institutional, and operational bottlenecks hindering effective program implementation. The integration of both methods enabled a multidimensional understanding of the issues surrounding CRFMP.

2.2 Research Locale

The research was conducted in Barangay Dajay, Surallah, South Cotabato, the designated pilot site of CRFMP. This site was selected because of its relevance to the study, having hosted three cropping cycles of the consolidated rice farming initiative. The location provided a rich setting to evaluate the long-term impacts of land consolidation and mechanization practices. The CRFMP in Dajay covered approximately 210 hectares of rice land, involving 103 farmer-beneficiaries.

2.3 Research Participants

For the quantitative survey, purposive sampling was employed to select 64 respondents out of the 103 participating farmers. These respondents were selected based on their level of involvement and experience in the program. The qualitative participants included 17 key informants composed of five program implementers from the Office of the Provincial Agriculturist (OPAG), four representatives from partner agencies, and eight officers from the Upper Valley Agricultural Cooperative (UVACO).

2.4 Research Instruments

Three main data collection tools were employed in this study. First, a structured questionnaire was designed for the quantitative survey. It captured demographic data, participation satisfaction, and perceived barriers with constructs derived from Maslow's theoretical framework. The questionnaire was pilot-tested and

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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validated by experts in agricultural extension and rural development. Second, a semi-structured interview guide was used for the Key Informant Interviews (KIIs) to elicit in-depth responses from agricultural extension officers, program coordinators and representatives from partner agencies. This tool was developed with reference to TOC and relevant sociological theories. Third, an FGD guide was used to facilitate group discussions with farmer leaders, focusing on shared experiences, perceptions of program effectiveness, and collective challenges in program adoption.

Data Gathering Procedure

The data-gathering process began with securing approval from the Office of the Municipal Agriculturist in Surallah. Once permission was granted, the researcher personally administered the questionnaires to ensure comprehension, clarify ambiguities, and ensure the accuracy of responses. Written and verbal informed consent was obtained from all survey participants. The KIIs and FGDs were conducted through scheduled face-to-face interactions and audio-recorded (with consent) to ensure accurate transcription. These sessions were carried out in accessible venues within the barangay and coordination with local cooperative offices. Informants were asked open-ended questions that probed into institutional policies, support mechanisms, technological adoption, training effectiveness, and social relations among stakeholders. Field notes were also taken to document observations and context during interactions.

For the quantitative analysis, data were encoded and cleaned using Microsoft Excel and analyzed using SPSS software. Descriptive statistics such as means, frequencies, and percentages were used to summarize socio-demographic characteristics, participation levels, and satisfaction indicators. To explore relationships among variables, Pearson's correlation coefficient was applied, particularly to examine how factors like financial status, land tenure, or access to mechanization correlated with levels of satisfaction or continued participation. For the qualitative analysis, thematic analysis following the six-step framework of Creswell and Poth (2018) was employed, which includes data familiarization, initial coding, theme identification, theme review, definition, and report production. Statements from interviews and FGDs were categorized under emerging themes, which were then organized into five main types of constraints using the Theory of Constraints framework: institutional, technical, socioeconomic, market-related, and environmental. The TOC allowed the study to pinpoint bottlenecks, evaluate their impacts on program delivery, and propose actionable solutions based on evidence and theoretical underpinnings. Moreover, sociological lenses such as the Structural-Functional Perspective (Nisbet) and Conflict Theory (Marx) were applied to interpret the broader social and institutional dynamics affecting CRFMP implementation, including power disparities and governance inefficiencies.

The study also incorporated triangulation by comparing primary data with relevant secondary sources such as program reports, policy briefs, and evaluation documents from the Office of the Provincial Agriculturist and Department of Agriculture Region XII. In this procedure, it enhanced the validity and depth of the findings by ensuring consistency across multiple data sources. Following the integration of findings, targeted recommendations were formulated through the TOC's "exploitation and elevation" steps, strategies that aim to maximize existing resources and eliminate critical barriers. These recommendations were refined through stakeholder validation involving program beneficiaries, community leaders, and agricultural officers, ensuring that the outputs are feasible, contextually grounded, and oriented toward practical implementation.

Ethical Considerations

Ethical protocols included obtaining informed consent, ensuring confidentiality, allowing withdrawal, and protecting participants' identities, especially key informants. Participants were fully informed of the study's objectives, methods, risks, and benefits, verbally or in writing, depending on literacy levels. Informed consent was documented through signed forms, with care taken to ensure comprehension (O'Sullivan et al.,

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2021; Hassan, 2023). Personal data were anonymized, securely stored, and accessible only to the research team. Aggregated reporting ensured that no personally identifiable information was disclosed. Key Informant Interviews followed a non-attribution protocol to prevent identification and potential repercussions (Gergely et al., 2022). Key informants were assured that their insights would remain anonymous and not be traceable in any published material. This approach followed best practices for ethical research and data protection (USAID, 1996; Rahaman et al., 2021; Stevens, 2022).

3.0 Results and Discussion

Overview of the Consolidated Rice Farming and Mechanization Program in Barangay Dajay, Surallah, South Cotabato

This chapter presents the results of the study that assessed the impact of the Consolidated Rice Farming and Mechanization Program (CRFMP) on rice productivity and farmer welfare in South Cotabato. It analyzes the experiences of rice farmers under the implementation of the program, citing successful outcomes as well as persistent challenges that hinder full agricultural efficiency and rural development. The findings are discussed in the context of broader governance structures and development theories relevant to decentralized agricultural service delivery in the Philippines.

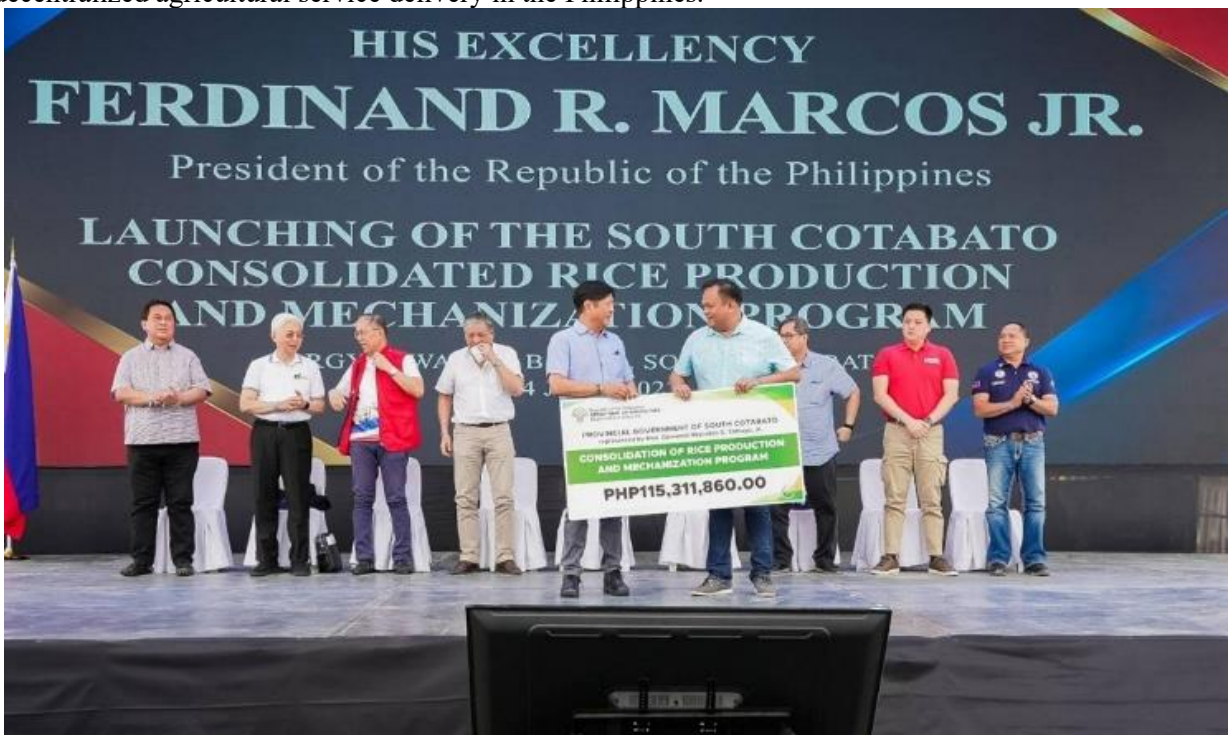

Figure 01 (Photo Courtesy of the Presidential Communications Office) illustrates the recognition of this achievement, showing Governor Reynaldo Tamayo Jr. alongside President Ferdinand R. Marcos Jr. during the turnover of PHP 115 million in support of CRPMP. The success of this pilot program led to its expansion from 1,600 hectares to a projected 3,000 to 4,000 hectares, aiming to stabilize the provincial rice supply for up to 10 months annually (Doguiles, 2023). These results not only reflect technical and economic gains but also underscore the importance of inclusive planning and context-responsive governance.

Under the Consolidated Rice Farming and Mechanization Program (CRFMP), the provincial government facilitated the clustering of smallholder farms into consolidated production zones, enhancing access to modern machinery, reducing production costs, and improving yield performance. Farmers reported significant productivity improvements, with pilot areas in Barangay Dajay, Surallah, achieving yields of 10

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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to 12 tons per hectare, notably higher than the national average and the program's initial target of 8 tons (PIA, 2023). The increased productivity was primarily attributed to synchronized farming practices, timely interventions, and mechanized land preparation, which reduced production costs from PHP 11,000 to PHP 5,000 per hectare. These quantitative results demonstrate that effective decentralization, when guided by proactive local leadership and inter-agency coordination, can bridge policy gaps and enhance agricultural performance.

Further analysis of the operational framework of the program (see Figure 02) shows that CRFMP is built upon four components: Farm Consolidation, Production Support, Mechanization, and Processing and Marketing. These components are implemented through sequential stages such as social preparation, cooperative formation, farm operation, input distribution, capacity building, and systematic monitoring and evaluation. The structured framework reflects an integrated approach that goes beyond mere input provision and promotes institutional strengthening at the local level.

Importantly, the success of the CRFMP also based on its multisectoral collaboration. Key stakeholders include both national agencies (e.g., DA-RFO XII, PhilMech, ATI-RTC XII, NFA, LBP, DA-ACPC) and local offices (e.g., OPAG, PCDO, OMAg), as well as farmer cooperatives and private actors. These partnerships ensured that interventions were not only timely and well-targeted but also reinforced by training, financing, insurance, and market linkage mechanisms, which align with Participatory Development Theory that emphasizes the role of community involvement and knowledge co-production in achieving sustainable outcomes. The CRFMP strengthened the local stakeholders and promoted ownership by integrating farmer voices in planning and implementation, which led to higher program acceptance and sustainability.

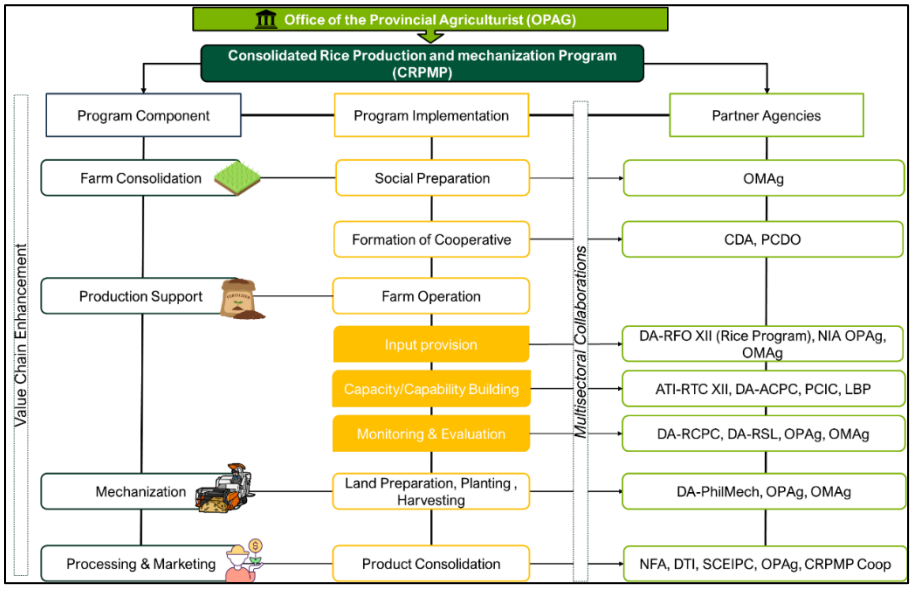

Figure 02. Framework of the Consolidated Rice Farming and Mechanization Program (CRFMP) under the Office of the Provincial Agriculturist (OPAG) showcasing its program components, implementation processes, and multisectoral collaborations with partner agencies in Region XII.

Despite these successes, challenges remain, and the field interviews and focus group discussions revealed lingering limitations in cooperative management, equipment maintenance, access to credit for operational expenses, and sustainability of mechanization benefits without continued public support. In some instances, disparities in capacities and engagement levels of the farmers led to uneven program outcomes, which

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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needed continuous institutional support, especially in organizational development, equipment servicing, and post-harvest value chain integration.

From a governance perspective, CRFMP illustrates a hybrid model where decentralization is not merely administrative but developmental, marked by local initiative, participatory planning, and coordinated support. However, it also revealed that the limitations of decentralization occur when local government units lack the fiscal autonomy or technical capacity to respond independently to complex agricultural needs. While the Local Government Code of 1991 envisioned empowered LGUs, reality shows that most still rely heavily on national directives, resources, and technical prescriptions, constraining localized innovation. The CRPMP also presents a critique of the Modernization Theory, which often promotes technology diffusion without accounting for local context. Mechanization under CRPMP became successful not simply due to the introduction of machinery but because it was embedded in a system of farmer clustering, cooperative support, and responsive local governance. In contrast, other national mechanization efforts that provided equipment to individual farmers without collective structures were often underutilized. Thus, the participatory and context-adaptive features of CRFMP suggest a more grounded and practical model of agricultural modernization.

Assessment of Farmer Participation in the Consolidated Rice Farming and Mechanization Program

This section presents the findings and discussions related to farmer participation in the Consolidated Rice Farming and Mechanization Program (CRFMP), with a specific focus on the challenges farmers face, the responsiveness of the program to individual needs, and its relevance to the broader agricultural conditions of the local farming community.

Demographic Profile of Farmer Participants

The study analyzes the socio-demographic characteristics of the farmer-respondents to establish the context within which the CRFMP operates. Results showed that participants vary widely in age, gender, educational attainment, household income, farm size, land tenure, and years of farming experience. These differences help explain the diversity in program engagement and adaptation levels among participants. The demographic profiling revealed that participation in the program is not uniform across all farmer types. Some vulnerable groups, such as tenants, landless laborers, and elderly farmers, are underrepresented or less active in program activities. The gaps that were identified need targeted support mechanisms, such as specialized training for older or less literate farmers and land access facilitation programs for informal cultivators. The design of the program and implementation strategies reflect partial alignment with the characteristics of its target beneficiaries.

Gender Distribution

The distribution of gender shows an equal gender split (50% male, 50% female) among farmer participants, indicating strong gender inclusivity in the CRFMP. The balanced participation of the farmers suggests that both men and women access support services and decision-making opportunities equitably, aligning with FAO's (2018) emphasis on gender-balanced agricultural development. The result reflects progress in dismantling traditional gender roles in farming, especially in rural areas like South Cotabato.

Age Distribution

The average age of respondents is 57.6 years, with 86% aged 50–69 and no participants under 30 (Figure 6). This trend reflects the aging farming population, mirroring national patterns of rural youth migration (Delco, 2020; Asis, 2020). The majority of the farmers were older, which limits mechanization uptake and innovation due to lower tech adaptability. As Borda et al. (2023) and NEDA note, reversing youth disengagement requires policy reforms, secure land tenure, credit access, and youth promotional programs with incentives to make farming more attractive.

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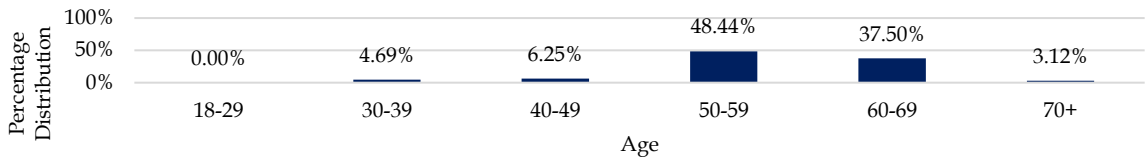

Figure 06. Age Distribution of Farmers Who Participated in Consolidated Rice Farming and Mechanization Program

Household Size

Most farmers belong to medium-sized households, with 53.12% having 4 to 6 members. The medium-sized households support efficient labor distribution for small-scale farming, consistent with Palis (2020) and Anabo (2021), who describe Filipino farms as labor-reliant and family-based. However, as younger members seek off-farm jobs, particularly corporate jobs, labor shortages arise, leading to the need for mechanization and labor-sharing programs (Morales et al., 2022; Qiu et al., 2024).

Monthly Income

Nearly 47% of respondents earn below PHP 10,000 per month, while only 15.63% earn above PHP 30,000. These figures point to persistent economic vulnerability. Low income restricts investment in farm inputs and technologies, reinforcing dependence on government aid. Briones (2022) and Touch et al. (2024) advocate for targeted subsidies, market access, and credit facilities to improve income stability and resilience among low-earning farmers.

Educational Attainment

Most respondents completed secondary or partial tertiary education, with 29.69% being high school graduates, 23.44% having some college education, and 21.88% holding a bachelor's degree. While these results suggest a moderate educational profile, the lack of technical and advanced training may hinder full utilization of mechanization and agri-technologies (Okoroji et al., 2021; Tey et al., 2024). Studies by Ruzzante et al. (2021) and Naicker et al. (2024) noted that higher education positively influences the adoption of innovations and climate adaptation strategies.

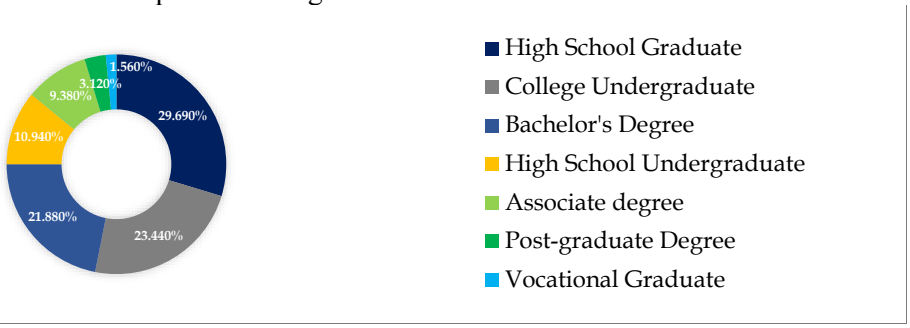

Figure 10. Educational Attainment of Rice Farmers in Consolidated Rice Farming and Mechanization Program

Farm Characteristics: **Knowledge and Consensus on Synchronized Planting**

The data revealed that 90.62% of respondents possess knowledge about synchronized planting, while an even higher proportion—96.88%—express agreement or willingness to adopt the practice which demonstrates strong alignment with the principles of the Consolidated Rice Farming and Mechanization Program (CRFMP), which promotes synchronized planting as a strategy to enhance productivity, optimize water use, and strengthen pest and disease control. The high levels of awareness and readiness to implement synchronized planting reflect the effectiveness of extension services and farmer education initiatives under

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the CRFMP. Synchronized planting is widely recognized for achieving economies of scale, improving irrigation scheduling, and enabling coordinated pest and disease management efforts (Philippine Rice Research Institute, n.d.). These findings indicate that farmers are not only aware of modern farming methods but are also receptive to collaborative approaches mainly for the success of consolidated farming (Uddin et al., 2014; Qiu et al., 2024).

Land Tenure Systems

Respondents reported varied land tenure arrangements: 42.19% own their land, 34.38% lease land, 12.5% practice sharecropping, and 10.94% engage in contract farming. These diverse systems reflect differing degrees of land control, significantly influencing farmer behavior and decision-making within the CRFMP. Secure land ownership typically empowers farmers to invest in long-term productivity-enhancing technologies and infrastructure due to the assurance of reaping future benefits (Abdulai et al., 2011). In contrast, tenants and sharecroppers often face shorter planning horizons, discouraging significant investments or credit access due to the absence of collateral such as land titles (Lawry et al., 2016). Meanwhile, contract farming may offer input or market support but can reduce farmer autonomy and long-term investment motivation (FAO, 2008). Understanding these tenure dynamics is essential, as they shape farmer participation, investment behavior, and, ultimately, the overall success of agricultural programs like the CRFMP (Mazhar et al., 2023).

Farm Mechanization Status

Data indicate a significant gap in farm mechanization, with 87.5% of respondents reporting no ownership of farm machinery. This reliance on shared or rented equipment may compromise the timeliness and efficiency of farm operations. Only 6.25% own a Kuliglig, 1.56% own a transplanter, and another 1.56% own a complete set of machinery, including tractors and harvesters. Rodriguez and Piadozo (2016) differentiate highly mechanized farms are which possess essential tools like water pumps, hand tractors, power tillers, and threshers, from low-mechanization farms, which rely on outsourced services. To address mechanization gaps, CRFMP facilitates the formation of cooperatives, allowing farmers to consolidate resources and submit proposals for machinery acquisition. This strategy aligns with requirements set by the Department of Agriculture and the Philippine Center for Postharvest Development and Mechanization (PhilMech), which mandate cooperative membership to qualify for machinery grants and services (Rodriguez & Piadozo, 2016; PhilMech, 2020).

Consolidated Area and Cropping Cycles

Table 01. Summary of Cropping Cycles, Synchronized Planting Frequency, and Consolidated Area (ha) in the CRFMP

Category	Mean	Std Deviation	Minimum	Maximum
Cropping Cycles Practicing Synchronized Planting	2.91	±1.23	1	8
Consolidated Area (ha)	1.59	±1.15	0.37	5.88
Cropping Cycles Participated in CRFMP	3.69	±0.73	2	4

Farmers report participating in an average of 2.91 synchronized planting cycles, with a range of 1 to 8, which is consistent with the 2.5 cycles per year typical in Central Luzon (Kajisa et al., 2022). However, asynchronous planting can lead to increased pest and disease losses and lower irrigation efficiency (Loevinsohn et al., 1992). The mean consolidated farm area is 1.59 hectares, with a maximum of 5.88 hectares. The results suggest that while farmers participate in synchronized cropping, the uncertainty surrounding land consolidation remains. The findings align with the national average farm size of 1.5 hectares, underscoring the prevalence of smallholder farming (Center, 2017). Although farmers engage in

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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multiple cycles under CRFMP (average 3.68), the limited scale of land consolidation may restrict efficiency gains from mechanization and shared resource use (Yin & Song, 2024). Expanding consolidation and enhancing support for synchronized planting and mechanization can strengthen productivity and sustainability in rice farming communities.

Challenges to Farmer Participation in the Consolidated Rice Farming and Mechanization Program (CRFMP) through Maslow's Hierarchy of Needs

This study used Maslow's Hierarchy of Needs to examine how the fulfillment of human needs influences farmer engagement. Maslow's model outlines five levels such as physiological, safety, social, esteem, and self-actualization, where each corresponds to aspects of the farming experience. These range from access to land and inputs to secure tenure and income to social belonging, recognition, and personal growth. Understanding these needs helps explain decisions of farmers to engage with or withdraw from development programs like the CRFMP.

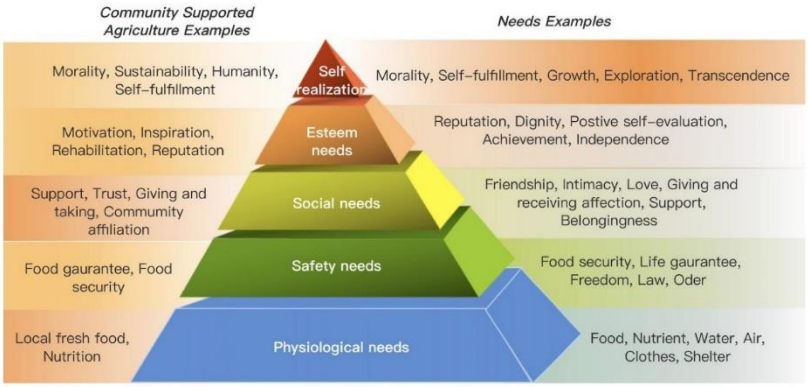

Figure 15. Correspondence between community-supported agriculture and Maslow's hierarchy of needs (Tian et al., 2024).

Table 03 presents the Pearson correlation matrix exploring the relationships among farmers' demographic characteristics (e.g., age), program-related factors (satisfaction, synchronized planting, consolidated Area, and program involvement), Maslow's hierarchy of needs (physiological to self-actualization), and Understanding of the CRFMP. Correlation coefficients (r) measure the strength and direction of associations; p-values at 0.01 (**) and 0.05 (*) significance levels denote statistical relevance.

Table 03. Correlations Relationship Between Hierarchical Needs Fulfillment and Farmer Participation in the Consolidated Rice Farming and Mechanization Program (CRFMP)

	Physiological Needs	Safety Needs	Social Needs	Esteem Needs	Self-Actualization	Understanding (Program)
Farmers' Age	-0.108	-0.23	-0.23	0.005	-0.008	0.029
Satisfaction	.872**	.883**	.883**	.821**	.785**	.610**
Synchronized Planting	-0.148	0.019	0.019	0.007	-0.062	-0.062
Consolidated Area	-.385**	-.279*	-.279*	-.399**	-.248*	-0.165
Program Involvement	.252*	0.14	0.14	0.16	0.196	0.192
Physiological Needs	1	.701**	.701**	.676**	.615**	.603**
Safety Needs	.701**	1	1.000**	.522**	.493**	.369**
Social Needs	.701**	1.000**	1	.522**	.493**	.369**
Esteem Needs	.676**	.522**	.522**	1	.793**	.555**

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Self-Actualization	.615**	.493**	.493**	.793**	1	.734**
Understanding (Program)	.603**	.369**	.369**	.555**	.734**	1

	Farmers' Age	Satisfaction	Synchronized Planting (Practice)	Consolidated Area	Program Involvement
Farmers' Age	1	-0.139	-0.079	0.118	-0.143
Satisfaction	-0.139	1	-0.037	-.376**	0.208
Synchronized Planting	-0.079	-0.037	1	0.066	.425**
Consolidated Area	0.118	-.376**	0.066	1	-0.089
Program Involvement	-0.143	0.208	.425**	-0.089	1
Physiological Needs	-0.108	.872**	-0.148	-.385**	.252*
Safety Needs	-0.23	.883**	0.019	-.279*	0.14
Social Needs	-0.23	.883**	0.019	-.279*	0.14
Esteem Needs	0.005	.821**	0.007	-.399**	0.16
Self-Actualization	-0.008	.785**	-0.062	-.248*	0.196

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Program Indicators

Age-Related Differences Affect Farmer Engagement and Needs Fulfillment in CRFMP

Farmer age showed weak negative correlations with satisfaction (r = -0.139), program involvement (r = -0.143), and needs fulfillment, particularly safety and social needs (r = -0.230). The result suggests that older farmers experience lower satisfaction and are less engaged in the CRFMP. The age factor may hinder participation due to limited adaptability to mechanization and group farming. Age-related barriers, including avoidance of new technology and preference for traditional methods, are consistent with findings from Yap et al. (2023) and Corpuz (2024), who note that older farmers often resist innovations due to lack of exposure and fear of criticism. Thus, addressing age-related apprehensions is important for inclusive program implementation.

CRFMP Enhances Farmer Satisfaction Through Psychological and Technical Support

Farmer satisfaction is strongly and positively correlated with all five hierarchical needs (r = 0.785** to 0.883**) and with program understanding (r = 0.610**), indicating that CRFMP effectively promotes both technical success and psychological-social well-being. Satisfaction is closely linked to improved access to inputs, reduced labor, and strengthened community recognition—factors essential for fulfilling physiological to self-actualization needs (Red et al., 2021). Effective communication and training, as emphasized by Pal et al. (2023), further enhance this satisfaction. However, a significant negative correlation between satisfaction and consolidated area (r = -0.376**) highlights organizational challenges in larger groups, such as unequal benefit-sharing or coordination issues (Akdemir et al., 2018). Thus, improving satisfaction requires addressing both technical support and equitable social mechanisms (Orge et al., 2022).

Adoption of Synchronized Planting Reflects Farmer Commitment but Not Fulfillment

Synchronized planting shows a moderate positive correlation with program involvement (r = 0.425**) but weak, non-significant associations with satisfaction and all need categories. While this practice improves technical outcomes such as pest control and resource efficiency (Flor et al., 2021), it does not inherently impact psychological well-being or personal fulfillment. Issaka et al. (2024) argue that technical adoption is not synonymous with satisfaction. Similarly, Aguda et al. (2022) emphasize that service quality, not merely practice adoption, determines satisfaction. Therefore, while synchronized planting enhances

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operational efficiency, its limited psychological impact necessitates complementary efforts that address trust, communication, and farmer support systems.

Influence of Land Consolidation on Farmer Satisfaction and Maslow's Hierarchy of Needs Fulfillment in the CRFMP

The consolidated area under CRFMP shows significant negative correlations with multiple indicators of farmer satisfaction and needs fulfillment. Specifically, as consolidated land size increases, satisfaction decreases (r = -0.376**), alongside reduced fulfillment of physiological (r = -0.385), safety and social (r = -0.279*), esteem (r = -0.399**), and self-actualization needs (r = -0.248*)**. While land consolidation aims to enhance mechanization efficiency, these findings suggest unintended psychosocial consequences. Larger consolidated areas may challenge equitable access and complicate collective management, resulting in coordination difficulties, diluted autonomy, and lower perceived benefits among farmers. Similar outcomes were observed in China, where land fragmentation, ownership disputes, and transfer complexities undermined consolidation goals (Zhang & Chen, 2021; de Vries, 2022). Furthermore, structural vulnerabilities—such as weak governance, limited benefit-sharing mechanisms, and minimal stakeholder engagement—may marginalize smallholders (FAO, 2002; Karkacıer & Karabaş, 2019). In the Philippines, PIDS reports show that agrarian organizations often fail due to poor management and insufficient capitalization, compounded by communication gaps in rural areas (Ocampo, 2021). These challenges underscore the need for inclusive, transparent policy frameworks with legal clarity, fair compensation, and institutional support to sustain both productivity and farmer well-being (FAO, 2002).

Participation of Farmers in the Consolidated Farming and Mechanization Program

Farmer participation in CRFMP exhibits a moderate positive correlation with synchronized planting (r = 0.425) and basic needs fulfillment (r = 0.252*)**, indicating that active involvement strengthens both technical adoption and material well-being. Participation promotes coordination, optimizes input use, and aligns with CRFMP goals of mechanization and productivity enhancement (Galang, 2020; Akosikumah et al., 2025). Although correlations with self-actualization (r = 0.196) and program understanding (r = 0.192) are not statistically significant, the positive direction implies that involvement supports psychological growth, confidence, and awareness. This trend affirms the importance of engagement-driven learning, where farmers internalize the value of the program through experience (Li et al., 2024). Supporting studies focus on the fact that participation intention and behavior are influenced by program awareness and perceived benefits (Dong et al., 2023). Additionally, mental health in farming communities is strengthened by autonomy, purpose, community support, and institutional facilitation (Saju et al., 2024). Thus, active participation in CRFMP not only enhances productivity but also improves psychological resilience and long-term commitment of the farmers.

Maslow's Hierarchy of Needs Indicators

Physiological Needs

The results show a strong positive correlation between the fulfillment of physiological needs and overall farmer satisfaction with the Consolidated Rice Farming and Mechanization Program (CRFMP) (r = 0.872**). The correlation result suggests that meeting basic needs, such as food, income, water, shelter, seeds, and fertilizers, is essential for farmers to feel motivated and engaged. These needs form the foundation of Maslow's hierarchy, and unless addressed, higher-level motivations such as social connection or self-actualization cannot materialize (Aguda et al., 2022). In rice farming, physiological needs include secure access to essential production inputs. Programs such as the Department of Agriculture's Rice Resiliency Project (RRP), which distributed seeds and fertilizers nationwide during the COVID-19 pandemic, have shown that addressing these needs can boost productivity and food security (Layaoen, 2020). Moreover, physiological needs are significantly correlated with safety and social needs (r = 0.701**), indicating that once basic inputs are secured, farmers are more likely to feel stable and participate

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in collective activities like synchronized planting or shared machinery use. Positive associations are also observed with esteem (r = 0.676), self-actualization (r = 0.615**), and Understanding of the program (r = 0.603), implying that addressing basic needs enables further engagement and growth (Tian et al., 2024). Similar studies support these findings, such as in Indonesia, salt farmers who had their basic needs met reported higher satisfaction across all of Maslow's levels (Cahyanti et al., 2023). In India, meeting income and input needs in farmer-producer groups fostered participation and personal development (Harrington et al., 2024).

Safety Needs

The results indicate a perfect correlation between safety and social needs (r = 1.000**), underscoring that farmers' sense of safety within the Consolidated Rice Farming and Mechanization Program (CRFMP) is inseparable from their social connectedness. Safety, in this context, extends beyond physical protection to include integration into cooperative structures and community support systems. Safety needs also show strong positive associations with satisfaction (r = 0.883**), esteem (r = 0.522), self-actualization (r = 0.493), and Understanding of the program (r = 0.369), highlighting their role in enhancing overall well-being and active program engagement (Suwanmaneepong et al., 2024). When farmers experience income stability, secure input delivery, and reduced production risks, they become more confident, motivated, and participative. Findings align with research from Thailand, where participatory irrigation management increased efficiency and strengthened social capital among farmers (Suwanmaneepong et al., 2024). Similarly, in Southern China, agricultural socialized services such as shared machinery and cooperative farming have boosted technical efficiency and reduced risk for smallholders, thereby promoting collaboration and cohesion (Cai et al., 2024). In CRFMP, safety is strengthened through mechanisms such as timely access to machinery, secure land tenure, irrigation support, and dependable input distribution. These provisions mitigate uncertainties and promote collective trust, allowing farmers to plan confidently and operate effectively.

Social Needs

Results show that social needs are the initial requirement for the success of the Consolidated Rice Farming and Mechanization Program (CRFMP), with a perfect correlation to safety needs (r = 1.000**), supporting the idea that social belonging and security are intertwined. In this context, emotional reassurance from being part of a supportive farming community is as vital as physical or economic security. Social needs are also strongly correlated with satisfaction (r = 0.883**), indicating that mutual support, trust, and cooperation among farmers enhance their overall program experience and commitment. A significant correlation with physiological needs (r = 0.701**) further suggests that when basic farming resources are accessible, farmers are more likely to engage socially and participate in collective practices. This finding supports studies emphasizing that cooperative farming improves productivity and reduces input costs through strong community ties (Kareska, 2025). Moderate correlations with esteem (r = 0.522**), self-actualization (r = 0.493**), and Understanding of the program (r = 0.369**) indicate that social cohesion contributes to farmers' sense of respect, growth, and program comprehension. Peer support fosters a culture of recognition and motivates continuous improvement (Lowder et al., 2025). However, a weak negative correlation with consolidated farm size (r = -0.279*) suggests that expanding the scale of collective farming may strain interpersonal bonds, highlighting the need for stronger social infrastructure to sustain cooperation. Additionally, social needs show insignificant relationships with synchronized planting (r = 0.019) and overall involvement (r = 0.14), indicating that social cohesion alone may not drive technical participation without complementary institutional support. The negative correlation with age (r = -0.23) implies that younger farmers may place a higher value on social interaction and collective engagement within CRFMP.

Esteem Needs

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Esteem needs are strongly correlated with self-actualization (r = 0.793), satisfaction (r = 0.821), and program understanding (r = 0.555), suggesting that recognition, respect, and a sense of personal worth are essential to sustaining farmer motivation in CRFMP. Farmers who feel acknowledged through decision-making roles, leadership opportunities, or recognition of their contributions tend to demonstrate higher psychological engagement and program loyalty. In a collectivized farming system, esteem is not limited to personal pride but reflects perceived trust, peer respect, and institutional value. Programs that empower farmers and promote inclusive leadership encourage deeper commitment and greater initiative. This aligns with findings from Indonesia, where esteem ranked high among farmer satisfaction drivers, particularly when tied to role recognition (Cahyanti et al., 2023). The positive association between esteem and program understanding (r = 0.555) further indicates that knowledge enhances confidence. When farmers understand the goals and mechanisms of the program, they are more likely to appreciate their contributions, boosting both self-esteem and performance. That is why there is a need for capacity building, participatory processes, and clear communication to nurture technical competence and psychosocial well-being (Moruzzo et al., 2019).

Self-Actualization

Self-actualization, the highest tier in Maslow's hierarchy, emerges as a vital psychological need among farmers participating in the Consolidated Rice Farming and Mechanization Program (CRFMP). It shows strong correlations with esteem (r = 0.793), satisfaction (r = 0.785), and Understanding of the program (r = 0.734). These associations affirm that farmers who feel respected, competent, and well-informed are more likely to pursue personal growth, innovation, and long-term goals within the farming system (Fabella, 2023). The strong link between self-actualization and esteem suggests that farmers must first experience a sense of value and recognition before striving for higher-order fulfillment, such as autonomy, mastery, and influence. Likewise, the strong correlation with satisfaction reinforces the idea that empowerment and personal development significantly elevate the overall experience of program participants. Supported by findings from Indonesia, salt farmers reported high satisfaction with self-actualization indicators, such as "I feel I have fulfilled my potential," indicating that acknowledgment and growth opportunities significantly improve motivation and fulfillment (Cahyanti et al., 2023). Moreover, the correlation between self-actualization and Understanding of the program (r = 0.734) underscores the role of knowledge in fostering empowerment. When farmers clearly comprehend the objectives and benefits of the CRFMP, they are more inclined to take initiative, engage in leadership roles, and adopt innovative practices. Self-actualization in agriculture is not an abstract concept but a concrete outcome of effective program design, where education, communication, and autonomy are prioritized (Li et al., 2024). Thus, the pathway to self-actualization is facilitated by programs that invest in farmer education, recognize contributions, and create enabling environments for growth. The impact of CRFMP is magnified when farmers are not treated merely as beneficiaries but as empowered agents of agricultural transformation.

Understanding of the Program: Catalyst for Empowerment and Participation

When farmers grasp the structure, objectives, and mechanisms of the program, they are more confident, participative, and motivated. Understanding enables alignment between individual aspirations and program goals, reinforcing trust and encouraging proactive involvement. The positive correlation with esteem reflects that knowledge promotes capability and recognition of farmers who understand the system are more likely to take on leadership, contribute ideas, and gain peer respect. The association with self-actualization further reveals that knowledge fuels ambition. As farmers become more informed, they pursue innovation, take initiative, and develop a forward-thinking mindset. Deci & Ryan's Self-Determination Theory emphasizes that competence and autonomy are foundational for psychological growth and sustained motivation (Ryan & Deci, 2000). Furthermore, program understanding mitigates uncertainty and builds collective confidence, which is key to success in consolidated and mechanized farming systems. Misunderstandings can erode trust and participation, especially when farmers feel excluded or

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underinformed. Therefore, continuous farmer education, clear communication strategies, and participatory planning are not ancillary but essential to sustainability and impact of the program

Table 5. Summary of Challenges Faced by Farmers in the CRFMP, Aligned with Maslow's Hierarchy of Needs

Maslow's Hierarchy of Needs	Specific Challenge for CRFMP Farmers	Program Implication
Physiological Needs (basic resources)	– Lower satisfaction in large consolidated areas – Inconsistent income or yield. – Farm input and water supply remain inconsistent across areas. – Larger farm clusters reduce individual farmer benefits from seeds, fertilizers, and combined harvester use.	Guarantee timely, affordable input delivery and fair labor machine-sharing rules inside clusters.
Safety Needs (Land security, stability, health)	– Land tenure concerns and unequal lease agreements persist in pooled plots. – Income volatility increases with falling rice prices; – No insurance or crop failure support	Strengthen land-use contracts; bundle crop insurance and price-support schemes with mechanization services.
Social Needs (Belonging,teamwork, trust)	– Low trust and weak peer coordination hinder effectiveness in larger farmer groups. – Forced cooperation without trust – Older farmers (average age 58) show reluctance to collaborate.	Invest in team-building, conflict-resolution training, and mentorship links between older and younger members.
Esteem Needs (recognition,self-worth)	– Many farmers report feeling overlooked in large cooperatives, where a small group commonly holds leadership roles. – Low visibility of individual contributions – Recognition mechanisms like training certificates or "model farmer" awards are limited or absent.	Rotate leadership posts, publicize yield successes, and issue skill badges after CRFMP workshops.
Self-actualization (growth)	– Ambition is high, but an aging workforce and gaps in tech skills constrain innovation. – Larger consolidated areas often require standardized practices and centralized decision-making, which can limit individual expression and innovation. – Farmers may feel like mere laborers rather than independent decision-makers in their farming operations.	Pair mechanization with entrepreneurship modules (e-trading, value-added rice) and simplify machine for older operators.

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Cognitive Understanding (enabler)	– Orientation quality varies across barangays; some members remain unclear on benefit-sharing terms and scheduling rationale.	Launch year-round "CRFMP Clinics": mobile advisories, demo days, and hotline support in local dialects.

Barriers to Effective Implementation of the Consolidated Rice Farming and Mechanization Program

1. **Institutional Constraints**

Fragmentation among key implementing agencies including the Department of Agriculture (DA), National Irrigation Administration (NIA), Cooperative Development Authority (CDA), and Local Government Units (LGUs) creates major implementation bottlenecks. These agencies operate with overlapping roles and limited coordination, leading to duplicated efforts, inefficient resource use, and policy misalignment. For example, NIA's focus on contract farming blurs its original mandate of irrigation development, conflicting with DA's and LGUs' responsibilities. Delays in machinery procurement and input delivery, coupled with inconsistent policy enforcement, weaken program execution. Farmers are left unsure of which agency to approach, diminishing program trust and participation. These findings echo Custodio & Sombilla (2025), who noted that unclear institutional roles reduce program efficacy and create governance paralysis in decentralized agricultural systems.

a. Organizational Structure and Governance

Cooperative-based implementation faces internal governance issues. Despite having formal bylaws, many farmer organizations cannot enforce rules consistently. Reports show that some members violate agreements—by delaying dues, refusing to join communal work, or misusing equipment without facing sanctions. Leadership authority causes resentment among compliant members and weakens group cohesion. Leaders often feel torn between enforcing rules and maintaining unity, leading to inaction. Moreover, the lack of external institutional support, such as grievance mechanisms or legal mediation from CDA or LGUs, means disputes go unresolved, discouraging long-term participation. The absence of robust internal accountability reflects a profound structural weakness that ultimately impairs cooperative performance and discourages external stakeholder support.

b. Operational Efficiency and Farmer Participation

Timely input delivery remains a critical issue. Farmers reported delayed access to seeds, fertilizers, and pesticides, which disrupted synchronized planting, shortened crop cycles, and reduced yields. Due to these delays, some had to purchase inputs privately at higher prices, increasing production costs. The root cause lies in budget limitations at the provincial level, with the Office of the Provincial Agriculturist (OPAG) dependent on national agency allocations. CRFMP, intended as a gap-filling initiative, lacks stable provincial funding, resulting in an inconsistent flow of resources. This unreliable delivery system not only affects productivity but erodes the trust of the farmers. Bello et al. (2021) emphasized that untimely aid undermines farmer morale, especially when government support is perceived as politicized or misaligned with actual local needs.

c. Technological Access and Support

While mechanization is central to CRFMP, farmers encountered issues with the suitability and availability of machinery. Several transplanters provided by the program broke down mid-operation or were incompatible with local field conditions. These technical mismatches forced farmers to hire manual labor on short notice, raising operational costs and causing planting delays. Furthermore, the limited number of machines created scheduling conflicts and delayed service delivery across farming clusters. These outcomes reflect a lack of localized assessment in technology deployment. As noted by Sebastian et al. (2019), top-down mechanization programs often fail when machinery is distributed without consideration for terrain,

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
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operator training, or maintenance infrastructure. Thus, without field matching and technical support, mechanization becomes burdensome rather than beneficial.

2. Socioeconomic Constraints

The average age of farmer-participants is 57.6 years, with minimal youth engagement. Younger individuals are increasingly disinterested in agriculture due to low profitability, limited access to land, and poor working conditions. Many farmers also struggle financially. Almost half earn below PHP 10,000 monthly, restricting their ability to invest in quality inputs or equipment. This financial fragility increases dependence on government support and limits resilience during supply chain disruptions. Asia (2020) and Borda et al. (2023) confirm that without structural reforms—such as credit access, income diversification, and youth inclusion—agriculture will remain unattractive and unsustainable for future generations.

3. Technical Constraints

Adoption of modern technologies is slow due to limited technical knowledge and weak extension services. Some farmers resist innovation due to cultural preferences for traditional methods or a lack of confidence in new practices. Farmers also reported that introduced technologies (e.g., biofertilizers or seeds) were not properly explained or contextualized, resulting in poor uptake and mixed outcomes. Furthermore, infrastructure deficiencies, such as insufficient drying facilities and inadequate irrigation—hamper the effective use of introduced technologies. These challenges align with the findings of Israel (2014) and Uddin et al. (2014), which highlight the importance of participatory extension and continuous capacity-building in enhancing technology adoption in smallholder settings.

4. Market Constraints

Access to stable and profitable markets remains limited. Farmers reported low prices for palay, delayed payments, and reliance on middlemen. Only a few cooperatives have access to processing facilities or market linkages that allow them to command premium prices. It weakens incentives to invest in quality inputs or postharvest handling. Rising production costs and uncompetitive pricing reduce net income, making it difficult for smallholders to achieve sustainable profits. Ballesteros and Ancheta (2020) emphasized that developing cooperative-based value chains and improving local processing capacity are critical for helping farmers break out of low-price, low-productivity cycles.

5. Environmental Constraints

Climate-related risks, such as variable rainfall, pest outbreaks, and occasional floods—pose significant threats to farm productivity. Farmers also reported soil degradation due to over-reliance on chemical inputs and improper mechanization. Poor irrigation infrastructure, coupled with the absence of crop insurance, exposes farmers to financial losses during environmental shocks. These vulnerabilities reduce confidence in intensifying production or adopting risky but potentially rewarding innovations. Touch et al. (2024) and Qiu et al. (2024) stress the importance of climate-resilient practices, diversified cropping, and environmental safeguards in sustaining rice production amid changing ecological conditions.

4.0 Conclusion

This study contributes to a deeper understanding of how institutional structures, farmer psychology, and socio-technical constraints intersect to influence the implementation of the Consolidated Rice Farming and Mechanization Program (CRFMP) in South Cotabato. By integrating Maslow's Hierarchy of Needs and Goldratt's Theory of Constraints, the study offers a novel framework for assessing not only the tangible outcomes of agricultural program, such as yield gains and mechanization levels—but also the intangible dimensions of farmer satisfaction, trust, and willingness to engage. The findings underscore that despite the potential of the program to improve productivity through land consolidation, mechanized farming, and cooperative action, persistent issues such as input delays, fragmented governance, inadequate training, and

weak cooperative enforcement continue to limit its full impact. Notably, the study revealed that addressing farmers' basic, social, and self-actualization needs is crucial for improving participation and fostering sustainable behavioral change. As a practical contribution, the study offers a comprehensive set of evidence-based recommendations that can guide local government units, policymakers, and development organizations in refining program implementation strategies. Future research may explore comparative evaluations of similar rice consolidation programs across different regions or assess the long-term behavioral shifts among farmers following targeted training and incentive interventions. Integrating digital tools for input tracking, real-time farmer feedback, and localized climate advisory systems could also serve as valuable enhancements for future program iterations.

5.0 Contributions of Authors

All the authors were responsible for the conceptualization of the study. Raul D. Teves, DVM, conducted and collected the necessary data, analyzed the study and drafted the manuscript. Dr. Jesusa D. Ortouste, his adviser, provided technical guidance, supervised the research process, and reviewed and edited the manuscript.

6.0 Funding

The researcher solely funded this research dissertation.

7.0 Conflict of Interests

The author declares no conflicts of interest, financial or otherwise, that could have influenced the study's findings or conclusions.

8.0 Acknowledgment

The author wishes to express sincere gratitude to those who have provided invaluable support throughout this study. Foremost, the author is deeply grateful to Dr. Jesusa D. Ortouste, the research adviser, for his expert guidance, patience, and encouragement. Special thanks are also extended to the staff of the Office of the Provincial Agriculturist South Cotabato, which was crucial in facilitating the research. Moreover, Dr. Adrian V. Protacio, the English Critic Reader and Editor, for his dedication to refining the manuscript, and Dr. Romualdo M. Ortouste, for his assistance with data analysis and statistical computations, were appreciated. Further, thanks to the family for their unwavering support, love, and encouragement throughout the research process. Furthermore, the author expresses gratitude to all those who contributed in various ways to complete this study successfully.

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