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# Influence of Social and Human Capital on Farmers' Compliance and Sustainability with Philippine National Standards for Organic Agriculture in Benguet, Philippines

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## Abstract

This study examines the influence of social and human capital on compliance with the Philippine National Standards for Organic Agriculture (PNSOA) and the sustainability of this compliance among 137 certified organic farmers in Benguet, Philippines. Survey data were collected from active members of six certified organic Farmer Organizations across La Trinidad, Itogon, and Tublay using descriptive-correlational research design. Key dimensions assessed included social networks, social trust, civic-mindedness, and community cohesiveness (social capital), and environmental attitude, risk attitude, information-seeking behavior, and knowledge of organic farming (human capital). Regression and mediation analyses were conducted to examine direct and indirect relationships among these variables. Regression show that social trust and information-seeking behavior are strongest predictors of compliance with PNSOA standards. Risk attitude and knowledge of organic farming also exert significant positive effects on compliance, while profit orientation shows a negative relationship. Mediation analysis reveals that compliance fully mediates the relationships of both social capital and human capital with the sustainability of compliance. Results are consistent with the Theory of Planned Behavior (TPB) and Diffusion of Innovation Theory (DIT). Policy implications include targeted training programs, stable market linkages for organic produce, and trust-strengthening mechanisms within farmer organizations to reinforce both compliance and long-term sustainability.

## Introduction

Organic farming has emerged as a critical pathway to sustainable food production globally offering a system that promotes ecological balance, biodiversity conservation and human health through the elimination of synthetic chemical inputs. In the Philippines, organic agriculture aligns closely with the country's traditional farming practices, contributing to improved soil fertility, enhanced food safety, and reduced chemical-related health risks among farming communities (Constance & Choi, 2010; Scialabba & Müller-Lindenlauf, 2010). In contrast to conventional agriculture and genetically modified organisms known to degrade soil quality and pose health risks (Schreinemachers et al., 2012; Manigbas et al., 2018), organic farming offers a viable and increasingly demanded alternative.

The Philippine National Standards for Organic Agriculture (PNSOA), grounded in PNS/BAFS 07: 2016 (Bureau of Agriculture and Fisheries Standards [BAFS], 2016), provides a structured framework for organic crop production, guiding farmers in the conservation of biodiversity and the avoidance of synthetic inputs (BAFS, 2016; Amekawa, 2011). As consumer awareness of health and environmental concerns continues to drive demand for certified organic products, compliance with PNSOA standards has become an increasingly important determinant of market access, product quality, and long-term farm viability. For smallholder farmers, organic certification offers tangible benefits: lower reliance on purchased chemical inputs, increased resilience to climate variability, and access to premium market prices (Banzon et al., 2013; Setboonsarng, 2006). Sustained compliance with PNSOA standards thus holds both economic and environmental significance for farming households and rural communities.

However, sustained compliance with these standards presents significant challenges. Farmers face limited access to certified organic inputs, inadequate technical knowledge, and financial constraints (Kumar & Meena, 2017; Field, 2015). This entails that successful organic farming may depend on farmers' social and human capital beyond financial support. Social capital can help farmers share resources and access essential knowledge, facilitating the transition to and maintenance of organic practices (Yaméogo et al., 2018; Pretty, 2003). Likewise, human capital improves farmers' ability to maintain organic practices and meet standards. Studies show that strong environmental attitudes and deep technical knowledge play a crucial role in promoting commitment to environmental compliance (Tey et al., 2014; Liu, 2016).

Significant gaps are evident in related literatures. Most studies on organic farming in the Philippines context have primarily focused on economic and political obstacles, such as certification cost, input accessibility and availability, and government assistance, while significantly overlooking the impact of farmers' relational and personal competencies on their enduring commitment and sustainability (Banzon et al., 2013; Schreinemachers et al., 2012; Gibbon & Bolwig, 2007). There is limited studies on the interplay between social capital and human capital and the sustainability of organic practices among Filipino smallholders. The gap is more pronounced in indigenous communities like those in Benguet, where distinct geographical, cultural, and institutional elements influence the social and human capital framework in ways that have not been analyzed in relation to PNSOA compliance. Colting-Pulumbarit et al. (2018) found that organic farming households in La Trinidad, Benguet exhibited higher social and human capital relative to conventional farming households, highlighting the interdependent relationship between organic practices and capital formation, thereby contextualizing the framework for the present study's investigation into the influence of these capitals on compliance and sustainability.

This study addresses these gaps with direct relevance to agricultural policy, extension practice, and rural development in the Philippines. Benguet province is a particularly instructive context: it is a highland indigenous farming community where organic farming intersects with traditional land management, mountainous terrain, and a social structure that spans both formal farmer organizations and indigenous ethnic networks. These conditions distinguish it from the lowland and commercially oriented environments examined in prior studies, making it both a theoretically and policy-relevant case for understanding how social and human capital operate under markedly different circumstances.

The findings provide baseline data for designing targeted interventions across extension units, farmer organizations, LGUs, and policymakers, moving beyond generic capacity-building toward context-specific support that accounts for the actual capital resources and constraints of smallholder organic farmers in highland communities.

This study specifically seeks to: (1) assess the levels of social and human capital among certified organic farmers in Benguet; (2) investigate the influence of social and human capital dimensions on adherence to PNSOA standards; (3) determine the extent to which social and human capital contribute to the sustainability of compliance; and (4) test whether compliance mediates the relationship between social and human capital and the sustainability of organic farming practices.

**Theoretical Framework and Empirical Studies**

The Theory of Planned Behavior (TPB) guides this study by analyzing how farmers' attitudes, social expectations, and perceived control influence their adoption and sustainable practice of organic practices. TPB explains that intentions to perform a behavior are influenced by attitudes toward that behavior, perceived social expectations, and self-efficacy (Liu et al., 2018; Ajzen, 1991). This framework is relevant to organic farming as it highlights the motivational and control factors necessary for compliance with organic standards, including the influence of community expectations and farmers' self-perceptions. TPB thus provides a holistic perspective on the cognitive, social, and environmental influences that drive compliance with biological standards (Constance & Choi, 2010).

Diffusion of Innovation Theory (DIT) also informs this study by explaining how farmers adopt and maintain organic practices. The DIT assumes that adoption is influenced by perceived benefits, consistency with existing values, ease of use, and observable results. In organic farming, these factors relate to farmers' views about the environmental and economic benefits of organic practices and how well they fit into existing routines (Adebiyi, 2019; Ledermann, 2012; Rogers, 2003). DIT emphasizes social learning in communities where peer networks and visible successes encourage the adoption of sustainable practices and underscores that compliance is shaped by complex decision-making influenced by social factors and the observable benefits of organic methods.

Social and human capital theories deepen this analysis. Social capital, which includes networks, trust, and reciprocity, supports compliance by promoting mutual support and resource sharing among farmers (Gómez-Limón et al., 2014; Pretty, 2003). In the context of organic farming, social capital enables access to information, resources, and collaborative support, all of which contribute to meeting organic standards (Yaméogo et al., 2018). Human capital, which consist of knowledge, skills, and environmental attitudes, improves farmers' ability to manage the complexities of organic certification and maintain compliance (Tey et al., 2014; Marbuah, 2019). By integrating these theories, this study examines how social and individual assets collectively facilitate compliance with organic standards.

Empirical studies highlight various factors that impact farmers' ability to maintain organic practices. Government support is crucial by providing financial subsidies, training, and technical assistance to strengthen the viability of organic farming (Scialabba & Hattam, 2002). Such support helps farmers overcome obstacles such as high certification costs and limited access to inputs (Banzon et al., 2013; Teklewold et al., 2013; Altieri & Toledo, 2011). Social networks such as cooperatives also play an essential role by providing knowledge, information, and mutual reinforcement that enable farmers to stay up to date on best practices and ensure compliance with organic standards (Schreinemachers et al., 2012). In the Philippine highland context, Colting-Pulumbarit et al. (2018) found out that organic farming households in La Trinidad, Benguet exhibited higher social and human capital which includes greater organizational participation and cooperative engagement, compared to conventional farming households establishing that the organic farming system itself reinforces capital dimensions that this study examines as drivers of compliance.

Trust in these networks is crucial for sustainable compliance. Trust-based relationships between farmers and institutions facilitate collaboration, knowledge sharing, and joint problem-solving, particularly in areas with limited formal support. Studies show that strong community ties promote ecological practices, particularly where institutional support is lacking (Banzon et al., 2013; Kumar & Meena, 2017; Padel, 2001). In Serbia, Tomas Simin et al. (2024) found that organic farmers negative perceptions towards institutional support and limited understanding of regulatory policy frameworks constitute significant limiting factors to the progress of organic farming. Similarly, Purnomowati et al. (2026) found out that in an organic farming community in East Java, Indonesia, trust functions as a critical component of social capital specifically in influencing cooperative behavior and resource utilization. Human capital factors such as environmental awareness, knowledge of organic practices, and risk tolerance also influence compliance, as environmentally conscious farmers are more likely to consistently adhere to organic standards (Thompson et al., 2014; Wu & Mweemba, 2010).

Figure 1 provides the study's conceptual framework, built by combining the Theory of Planned Behavior, Diffusion of Innovation Theory, and Social and Human Capital Theory into a single mediation model that structures how the study reasons through its variables. Three components make up the framework: two predictors, social capital and human capital; a mediator, compliance with PNSOA standards; and an outcome, sustainability of compliance, meaning whether sustainable practices continue over time. Social capital is represented by trust, networks, and norms, while human capital is represented by knowledge, attitudes, and skills. Both are expected to shape sustainability directly and indirectly, through compliance with PNSOA standards. Path a1 is the hypothesized link between social capital and compliance, and a2 is the same link for human capital. Path b captures the hypothesized effect of compliance on sustainability. Paths c1' and c2' represent the direct effects that social capital and human capital are expected to have on sustainability once compliance's mediating role has been accounted for.

## Methodology

### Research Design

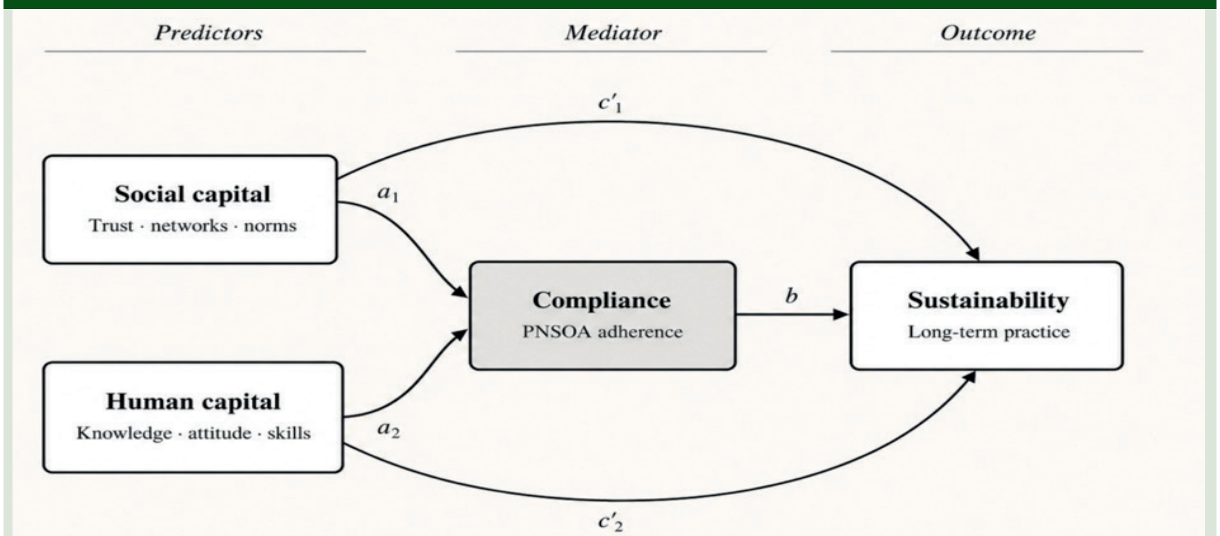
This study used a quantitative research design with descriptive correlational design to systematically analyze the impact of social and human capital on compliance with the PNSOA and the sustainability of organic farming practices. This design enabled precise measurement and statistical analysis of variables and facilitated an in-depth examination of the relationships between social capital, human capital, compliance, and sustainability in line with the objectives of the study. In addition, a mediation analysis was conducted to examine whether compliance acts as a mediating factor between social and human capital and sustainability, providing a nuanced understanding of how these variables interact to influence sustainable practices in organic farming.

### Locale, Population, and Sampling Method

The research was conducted from August to December 2019 in three municipalities of Benguet – La Trinidad, Itogon, and Tublay – where

**Figure 1**

*Conceptual Framework of the Study*




*Note. $a_1$ and $a_2$ denote the hypothesized effects of social capital and human capital on compliance; b denotes the hypothesized effect of compliance on sustainability; $c'_1$ and $c'_2$ denote the hypothesized direct effects of social capital and human capital on sustainability.*

significant efforts have been made to promote organic farming. These areas were selected because they host six farmer organizations (FOs) certified by a second or third party for organic farming. The sample consisted of 137 active FO members selected through purposive sampling. Respondents actively participate in organic practices with the support of their FO leaders and their operations had undergone inspections and certifications that met PNSOA standards.

Purposive sampling was used to directly target members practicing certified organic farming, as these individuals could provide insight into both compliance with PNSOA standards and their experiences with sustainable practices. This sampling method was chosen following previous studies on farmers' compliance with organic practices (Milagrosa, 2007), which highlight the challenges in identifying and accessing a relevant sampling frame. Given the specificity of the study objectives, purposive sampling ensured that only respondents with relevant experience and compliance status were included in the analysis.

**Data Collection Tool**

Data collection included structured questionnaires assessing four key areas: social capital, human capital, compliance with PNSOA standards, and sustainability of compliance. Social capital items measured social networks, trust, community cohesiveness, reciprocity, and civic-mindedness. Human capital items included environmental attitudes, profit orientation, risk attitude, information-seeking behavior, and knowledge of organic farming practices.

To assess compliance with PNSOA standards, questions were based on the applicable PNS/BAFS 07:2016 (BAPS, 2016) guidelines during the data collection period, which covered practices such as seed selection, soil management, fertilization, pest control, and conservation efforts. The five evaluated compliance dimensions, namely: seeds and planting materials, crop rotation and soil management, fertilization practices, pest and disease management, and soil and water conservation, represent the core operational criteria most readily observable at the smallholder farm level and most consistently evaluated during the organic certification inspections conducted for the respondent farmers. Finally, sustainability of compliance was assessed using items that measured the likelihood of long-term compliance with organic farming standards, considering economic viability, environmental benefits, and the alignment of these practices with respondents' farming methods.

Responses were recorded on a four point Likert scale, reflecting the level of agreement or frequency of the practices. The reliability and validity of the survey tool were established prior to primary data collection. Content validly was established through expert panel review, during which the instrument was assessed by the research adviser and panel members who have experience and knowledge in organic agriculture, social science research methodologies, and rural development. Each item was evaluated for its relevance to the target concept, representativeness of the domain, and clarity of language. The questionnaire categories were closely connected with the theoretical constructs investigated in the research and the chosen crop-production criteria used to operationalize compliance and sustainability.

Reliability was assessed through a pilot test of 30 respondents selected from the same demographic but excluded from the main study sample. Internal consistency was computed with Cronbach's alpha ($\alpha$) for each scale. The coefficients obtained were 0.706 for Social Capital (18 items), 0.762 for Human Capital (15 items), 0.760 for Compliance (17 items), and 0.774 for Sustainability (17 items). All four scales exceeded the generally recognized minimal criterion of $\alpha$>0.70 (Taber, 2018), indicating acceptable internal consistency across all instruments.

**Data Analysis**

The data analysis used in this study includes three main methods: descriptive analysis, regression analysis, and mediation analysis. Each method is tailored to provide insights into the relationships between social capital, human capital, compliance, and sustainability, following the study's objectives and research questions. Descriptive statistics provide an overview of levels of social capital, human capital, compliance with PNSOA standards, and sustainability of compliance. Means (M) are calculated to represent the central tendency of each variable, accompanied by a qualitative description.

Formula:

$$\text{Mean (M)} = \frac{\sum X}{N}$$

Where: X represents individual scores for each item in a dimension (e.g., social trust, environmental attitude), and N is the number of respondents. This averaging calculation allows each variable to be interpreted on a scale, categorizing them as high, moderate, or low levels of social and human capital compliance, and sustainability. The composite means of the different item indicators for each variable were the ones reported in the results.

Regression analysis was used to examine the predictive relationships between social and human capital (independent variables) and compliance with PNSOA standards (dependent variable). This analysis helps identify the specific dimensions of social and human capital that have a significant impact on compliance. The formula for simple linear regression: $Y=\alpha + \beta X + \epsilon$, where: Y is the dependent variable (compliance level), X is the independent variable (e.g., social trust or environmental attitude), $\alpha$ is the intercept, $\beta$ is the regression coefficient (representing the effect of X on Y), and $\epsilon$ is the error term. The coefficient of determination ($R^2$) indicates the proportion of variance in compliance explained by predictors.

Mediation analysis was conducted to assess whether compliance mediates the relationship between social capital and human capital and the sustainability of compliance. This allows the researcher to understand both the direct and indirect effects of each form of capital on sustainability.

The mediation paths are as follows: *Path A:* Effect of social capital or human capital on the mediator (Compliance). *Path B:* Effect of the mediator (Compliance) on the dependent variable (Sustainability). *Path C* (Total Effect): Direct effect of social capital or human capital on sustainability without accounting for the mediator. *Path C'* (Direct Effect): Direct effect of social capital or human capital on Sustainability, controlling for Compliance.

The indirect effect is calculated as : Indirect Effect: $=\beta a \times \beta b$, where $\beta a$ and $\beta b$ are the coefficients of Path A and Path B, respectively. The total effect equals the direct effect plus the indirect effect. The Sobel Test for the indirect effect uses the formula: $z = (\beta a \times \beta b) / \sqrt{(\beta b^2 \sigma a^2 + \beta a^2 \sigma b^2)}$, where $\sigma a$ and $\sigma b$ are the standard errors of $\beta a$ and $\beta b$ respectively, as reported alongside each path in Table 6, enabling independent verification of the Sobel z-statistic for each mediation model.

### Data Gathering Procedure and Ethical Considerations

The researcher asked permission from the municipal mayors and the officers of the FOs through letters for him to gather the needed information. Upon approval, the researcher sought the assistance of the officers and staff of the Municipal Agriculture Office (MAO) to administer the questionnaire and to be enumerators for those respondents who have difficulties in reading the specific questions and writing their responses. After the initial data gathering and analysis, the researcher validated the initial finding through KIIs and FGDs. The KIIs were undertaken through appointments with the officers.

This study followed ethical research standards and ensured voluntary participation, informed consent, and confidentiality. All respondents were informed about the purpose of the study, and the anonymity of their answers was assured. Care was taken to respect respondents' time and privacy.

## Results and Discussion

### Level of Social Capital

The data in Table 1 show that respondents have moderate levels of social capital across all dimensions, with an overall mean of 2.80. Social capital dimensions such as social trust (2.97) and civic-mindedness (2.91) are highest, indicating that farmers have moderate levels of trust in their communities and show some interest in local issues. These results are consistent with studies suggesting that trust and community interest are key components in fostering collective efforts in organic farming (Yaméogo et al., 2018). Social trust, which scored near the moderate capital cap, highlights the importance of mutual trust between farmers, which can facilitate resource sharing and reduce the risks associated with organic farming practices.

Membership and participation (2.72) and general reciprocity (2.67) also reflect moderate levels of commitment, suggesting that while there is some level of interaction and support within farmer organizations (FOs), these networks may not be fully optimized. The presence of moderate levels in these dimensions highlights that while farmers can organize and participate in groups, these networks may need to be strengthened to improve collaboration, knowledge sharing, and compliance support. This result is consistent with the conclusions of Tey et al. (2014) on the importance of social networks for improving agricultural compliance through collaborative learning and peer reinforcement.

The moderate scores in generalized reciprocity and FO participation are not surprising once the highland context is considered. Farming communities in Benguet are scattered across barangays divided by rough terrain and limited transport — consistent attendance at meetings or communal activities is genuinely difficult. Ibaloi and Kankana-ey farmers also carry substantial obligations to clan networks and customary systems that predate and, frankly, outrank formal agricultural organizations in cultural importance. And organic farming on mountain slopes is hard, time-consuming work; there is often nothing left over for reciprocal labor or collective events. The moderate reciprocity score reflects time and access constraints more than any absence of cooperative spirit.

The moderate community cohesiveness score (2.78) suggests that respondents generally feel a sense of belonging but may occasionally encounter conflict or diverging interests within their communities. According to the Diffusion of Innovation Theory (DIT) cited by Ledermann (2012), cohesive communities facilitate the spread of sustainable practices by creating an environment in which innovative techniques and ideas can be more easily adopted. Therefore, strengthening cohesion among farmers could accelerate the adoption of organic farming practices in these communities.

The results underscore the role of social capital as an influential yet moderate factor in organic compliance. The moderate levels observed suggest a foundation that can be expanded, particularly by enhancing cooperative activities and trust-building exercises within FOs. These improvements may lead to better compliance with PNSOA standards and increased long-term sustainability consistent with Colting-Pulumbarit et al. (2018) who similarly found that organizational participation is among the most consequential social capital indicators for organic farming households in the same highland Benguet context.

**Level of Human Capital**

Table 2 shows a moderate overall level of human capital among respondents (2.99) with significant differences between individual

**Table 1**

*Level of Social Capital Dimensions*

| Dimension of Social Capital | Mean | Qualitative Description |
|---|---|---|
| Social Network | 2.76 | MSC |
| Membership & Participation | 2.72 | MSC |
| Social Trust | 2.97 | MSC |
| Generalized Reciprocity | 2.67 | MSC |
| Community Cohesiveness | 2.78 | MSC |
| Civic-Mindedness | 2.91 | MSC |
| Overall Social Capital | 2.80 | MSC |

*Note: MSC = Moderate Social Capital (2.50–3.24); HSC = High Social Capital (3.25–4.00); SSC = Slight Social Capital (1.75–2.49); LSC = Low Social Capital (1.00–1.74).Industry Button Mushroom Project Growing House*

**Table 2**

*Level of Human Capital Dimensions*

| Dimension of Human Capital | Mean | Qualitative Description |
|---|---|---|
| Environmental Attitude | 3.13 | MHC |
| Profit Orientation | 2.58 | MHC |
| Risk Attitude | 3.29 | HHC |
| Information-Seeking Attitude | 3.24 | MHC |
| Knowledge About Organic Farming | 2.91 | MHC |
| Overall Human Capital | 2.99 | MHC |

*Note: HHC = High Human Capital (3.25–4.00); MHC = Moderate Human Capital (2.50–3.24); SHC = Slight Human Capital (1.75–2.49); LHC = Low Human Capital (1.00–1.74).*

dimensions. Risk attitude has the highest mean among all Human Capital dimensions (3.29), indicating that respondents emphasize caution, require substantiated evidence before adopting new practices, and prioritize avoiding unverified farming decisions. The regression analysis reveals a significant positive effect on compliance with PNSOA requirements, aligning with the literature's general characterization of risk-averse orientation (Kumar & Meena, 2017), though this finding requires careful interpretation.

All respondents are certified organic farmers who have already crossed the adoption threshold. Risk aversion therefore does not manifest as reluctance toward organic farming; rather, it translates into meticulous adherence to the structured PNSOA framework. For cautious farmers, compliance with proven standards is the risk-minimizing choice, reducing the likelihood of crop failure, inconsistent input quality, and market rejection. This aligns with the Diffusion of Innovation Theory (Rogers, 2003), which suggests that cautious adopters follow established protocols more rigorously once adoption has occurred.

The high mean for information-seeking attitude (3.24) complements this finding, indicating that these farmers proactively seek information to validate their decisions alongside their cautious orientation. Taken together, these results suggest that Benguet organic farmers function as calculated risk managers who assess, verify, and then comply. This is a counterpoint to Kumar and Meena (2017), whose finding that risk aversion correlates with lower compliance appears context-dependent. Within a formal certification framework, risk aversion reinforces compliance rather than diminishes it.

Attitude toward the environment scored moderately (3.13), indicating some awareness of the importance of the environment, but likely hampered by production priorities or constraints. This is consistent with Liu et al. (2018), who argue that stronger environmental attitudes are crucial for sustained organic compliance and suggest that further interventions could increase environmental awareness.

Information-seeking attitudes (3.24) also reflected a moderate interest in learning new techniques. According to the Diffusion of Innovation Theory (Adebiyi, 2019), informed farmers are more likely to adopt sustainable practices, although this moderate value indicates barriers to entry. Similar studies (Teklewold et al., 2013) suggest that knowledge-sharing networks could bridge these gaps, particularly in resource-limited environments.

Knowledge of organic farming (2.91) is moderate, suggesting basic knowledge with potential gaps in advanced techniques required for compliance. Consistent with the theory of planned behavior (Schreinemachers et al., 2012), greater knowledge can strengthen compliance by increasing trust and behavioral control. Improved training and educational support advocated, as suggested by Yaméogo et al. (2018) could reinforce this dimension.

Profit orientation has a significant negative effect on PNSOA compliance ($\beta = -0.151$, $p<0.05$). Farmers who prioritize income are less likely to stay fully compliant. The economics could largely explain why. Organic compliance costs are immediate and visible: extra labor, certified inputs, manual pest control. The price premium, by contrast, is delayed and uncertain, and many smallholders never reach it due to limited market access. That said, the mean score of 2.58 suggests these are not purely profit-driven farmers; community and environmental values still factor into how they work, a tension Field (2015) observed between economic and ecological motivations. The clearest policy response would be stable premium pricing and dependable market linkages, which are conditions that would make compliance a rational choice rather than a financial liability.

### Level of Compliance with PNSOA Requirements

As shown in Table 3, the overall compliance score of 3.27 indicates that respondents are broadly compliant with the PNSOA standards (PNS/BAFS 07:2016), operative at the time of the study), with high compliance observed in critical areas such as fertilization practices, pest control, and soil and water conservation. This result highlights the strong commitment of farmers in the municipalities of La Trinidad, Itogon, and Tublay to maintain organic farming practices in line with national standards.

The moderate level of compliance in the use of organic seeds and planting material (2.99) suggests that although farmers are pursuing organic seeds, challenges such as cost, and availability remain significant barriers. This finding echoes previous studies highlighting seed sourcing as a key issue in developing areas where certified organic seeds are often expensive and scarce (Kumar & Meena, 2017). According to the Theory of Planned Behavior (TPB), perceived control over resources affects compliance, suggesting that greater access to affordable organic seeds could improve compliance (Liu et al., 2018).

Compliance with crop rotation and soil management practices is moderate (mean=2.77), indicating difficulties in consistently implementing these practices due to logistical and resource constraints. Crop rotation is critical to soil health, but these limitations hinder adoption. Schreinemachers et al. (2012) observed similar constraints among smallholder farmers, and the Diffusion of Innovation Theory (DIT) suggests that ongoing support, training, and incentives could increase adoption and improve compliance (Ledermann, 2012).

Fertilization practices scored highest (3.70), indicating a strong preference for organic fertilizers such as compost over chemical alternatives. This commitment highlights farmers' appreciation of long-term soil health benefits and is consistent with TPB, where positive environmental attitudes support compliant behavior (Schreinemachers et al., 2012).

**Table 3**

*Level of Compliance with the Requirements of PNSOA for Crop Production*

| Compliance Dimension | Mean | Qualitative Description |
|---|---|---|
| Seeds and Planting Materials | 2.99 | MC |
| Crop Rotations and Soil Management Practices | 2.77 | MC |
| Fertilization Practices and Growth Regulators | 3.70 | HC |
| Pest and Disease Management | 3.50 | HC |
| Soil and Water Conservation | 3.38 | HC |
| Overall Compliance Level | 3.27 | HC |

*Note: HC = High Compliance (3.25–4.00); MC = Moderate Compliance (2.50–3.24); SC = Slight Compliance (1.75–2.49); LC = Low Compliance (1.00–1.74).*

Pest and disease control practices also showed high compliance (3.50), with farmers relying on non-chemical methods. Soil and water conservation (3.38) also showed high compliance, particularly through techniques such as drip irrigation and terracing relevant to Benguet's mountainous terrain.

Overall, Compliance (3.27) and Sustainability (3.31) are high, although Social Capital (2.80) and Human Capital (2.99) are at moderate levels. Three factors explain this apparent asymmetry: (1) the purposive sample comprises of exclusively certified organic farmers who have surpassed the adoption threshold, suggesting that moderate capital levels are adequate, rather than inadequate, for compliance within this demographic; (2) the regression model ($R^2$=0.58) confirms that social capital (SC) and human capital (HC) are significant predictors of high compliance, even at moderate levels; and (3) compliance engenders institutional momentum; once farmers achieve certification, structural accountability mechanisms within farmer organizations (FOs) bolster ongoing compliance. Collectively, these factors explain the alignment of limited financial resources with favorable compliance outcomes among committed organic practitioners.

**Level of Sustainability of Compliance with PNSOA Requirements**

As shown in Table 4, the overall sustainability score of 3.31 indicates a high level of farmers' commitment to maintaining organic practices over time, with compliance particularly strong in fertilization, pest control, and soil and water conservation. This result suggests that respondents not only comply with PNSOA standards but are also likely to maintain these practices in the long term, emphasizing the alignment of their agricultural goals with the principles of sustainable agriculture. Sustainability of compliance with certified organic seeds and planting materials shows moderate compliance (2.82). Farmers recognize the value of organic seeds, but face challenges such as limited access and high costs that hinder long-term use. This is consistent with Kumar and Meena (2017) and Field (2015) who highlight seed procurement as a persistent obstacle in organic farming. According to the Theory of Planned Behavior (TPB), perceived control over

**Table 4**

*Level of Sustainability of Compliance with PNSOA Requirements for Crop Production*

| Compliance Dimension | Mean | Qualitative Description |
|---|---|---|
| Seeds and Planting Materials | 2.82 | MS |
| Crop Rotations and Soil Management Practices | 3.22 | MS |
| Fertilization Practices and Growth Regulators | 3.54 | HS |
| Pest and Disease Management | 3.36 | HS |
| Soil and Water Conservation | 3.59 | HS |
| Overall Sustainability Level | 3.31 | HS |

*Note: HS = Highly Sustainable (3.25–4.00); MS = Moderately Sustainable (2.50–3.24); SS = Slightly Sustainable (1.75–2.49); LS = Lowly Sustainable (1.00–1.74).*

seed access influences sustainability intentions and highlights the need for institutional support in this area.

Crop rotations and soil management practices also show moderate sustainability (3.22). Crop rotation supports soil fertility, but as Schreinemachers et al. (2012) note smallholders often rely on external support. The Diffusion of Innovation Theory (DIT) suggests that wider adoption could make crop rotation a more sustainable norm in local agriculture (Ledermann, 2012).

Soil and water conservation scores highest (3.59), with terracing and drip irrigation widely practiced across farms. This finding is consistent with Yaméogo et al. (2018) agreement and emphasizes the importance of conservation for the long-term viability of agriculture. The high score reflects strong social support from farmer organizations and underlines TPB's assertion that a positive attitude promotes compliance. Fertilization is close behind (3.54), where composting is the norm rather than the exception This high compliance highlights farmers' understanding of the benefits of organic fertilization on soil health, as Banzon et al. (2013) have determined. According to TPB, positive attitudes toward soil enrichment and community-based programs support sustained compliance. Pest and disease control also performs well (3.36) and shows a continued preference for non-chemical pest control. This finding supports Field's (2015) observations on the effectiveness of community training for sustainable pest management. DIT and TPB suggest that social support and environmental awareness contribute to the continued use of biological control.

In summary, high sustainability scores in fertilization, pest control, and conservation reflect well-established practices, while moderate scores in seed sourcing and crop rotation highlight areas that require further support. Strengthening these areas could improve sustainable compliance with PNSOA standards and promote resilience and long-term commitment to organic farming in Benguet.

**The Influence of Social and Human Capital on Compliance with PNSOA Standards**

As shown in Table 5, the overall regression model is statistically significant with an F-statistic of 15.63 ($p<0.001$), indicating that the combination of the social and human capital dimensions significantly predicts compliance with PNSOA standards. The $R^2$ value of 0.58 suggests that 58% of the variance in compliance can be explained by social and human capital factors. The adjusted $R^2$ of 0.55 supports moderate model fit.

***Social Capital Dimensions***

The dimensions of social capital have varying degrees of influence on compliance, with social trust emerging as the strongest predictor ($\beta=0.412$, $p=0.001$). This finding is consistent with previous studies, such as those by Yaméogo et al. (2018), who emphasize the role of trust in collective action and the successful implementation of sustainable practices. The significant positive influence of social trust suggests that farmers who have high trust in their networks, including family, local authorities, and agricultural cooperatives, are more likely to comply with organic standards. This finding is consistent with the Theory of Planned Behavior (TPB), which suggests that perceived social support and trust can increase individuals' motivation to conform to community or societal norms. Tomaš Simin et al. (2024) similarly found in Serbia that the strength of the trust connection between farmers and institutions significantly

**Table 5**

*Regression Analysis of Social and Human Capital on Compliance with PNSOA Standards*

| Predictor Variables | Standardized Coefficient (β) | p-value |
|---|---|---|
| Social Capital Dimensions | | |
| Social Network | 0.213 | 0.01*** |
| Membership & Participation | 0.187 | 0.02** |
| Social Trust | 0.412 | 0.001*** |
| Generalized Reciprocity | 0.194 | 0.03** |
| Civic-Mindedness | 0.208 | 0.015** |
| Human Capital Dimensions | | |
| Environmental Attitude | 0.293 | 0.005*** |
| Profit Orientation | -0.151 | 0.05ni |
| Risk Attitude | 0.276 | 0.007*** |
| Information-Seeking Attitude | 0.358 | 0.002*** |
| Knowledge About Organic Farming | 0.324 | 0.003*** |
| Model Summary | | |
| $R^2$ | 0.58 | |
| Adjusted $R^2$ | 0.55 | |
| F-Statistic | 15.63 | $p < 0.001$ |

*Note: *** Strong positive impact ($p < 0.01$); ** Moderate positive influence ($0.01 \le p < 0.05$); ni = Negative impact ($p = 0.05$). SE = Standard Error.*

affects compliance results. Purnomowati et al. (2026) further demonstrated that in an organic rice farming community in Indonesia, trust is the primary variable influencing cooperative behavior and resource use among the many aspects of social capital. This highlights its cross-cultural importance as a technique for facilitating compliance.

Social network (β=0.213, p=0.01) and civic-mindedness (β=0.208, p=0.015), also show significant positive relationships with compliance. Organizational membership and participation (β=0.187, p=0.02) and generalized reciprocity (β=0.194, p=0.03) have moderate but positive influences, suggesting that active organizational commitment and reciprocal community relationships strengthen compliance, though to a lesser extent than direct social trust and network dimensions.

***Human Capital Dimensions***

Information seeking (β=0.358, p=0.002) and knowledge of organic farming (β=0.324, p=0.003) are the strongest human capital predictors of compliance, highlighting the importance of proactive learning and technical understanding. Farmers who actively seek information through workshops, training, or consultations with agricultural experts demonstrate higher compliance, supporting the DIT's focus on knowledge dissemination for the introduction of innovations (Ledermann, 2012). Environmental attitude (β=0.293, p=0.005) also shows that a strong positive orientation toward environmental protection promotes compliance with organic standards (Tey et al., 2014).

Risk Attitude has a significant positive effect on compliance (β=0.276, p=0.007). Farmers with cautious dispositions treat strict PNSOA compliance as a risk-reduction strategy, not risk avoidance, but calculated management. The high information-seeking attitude score (3.24) supports this: these are farmers who gather information before acting, then follow established protocols closely.

Profit orientation, by contrast, pulls in the opposite direction (β=−0.151, p=0.05). Organic compliance costs are immediate and certain; premium pricing is delayed and not guaranteed. The moderate mean of 2.58 suggests these farmers have partly moved away from pure profit logic, but the cost-benefit gap remains a deterrent. Schreinemachers et al. (2012) and Field (2015) both observed this tension that profit motives and ecological principles, as Field puts it, occupy competing moral registers in farmer decision-making.

**Mediation Analysis of Compliance Between Social and Human Capital and Sustainability of Compliance**

To better understand the dynamics of social and human capital in promoting sustainability in organic farming, a mediation analysis was conducted. This analysis examines whether compliance with PNSOA standards serves as a mediator between social and human capital and sustainability. The mediation framework considers compliance as a potential pathway through which social and human capital influence the long-term sustainability of organic farming practices.

Table 6 shows the results of both mediation analyses, reporting the direct, indirect, and total effects with standard errors and Sobel z-statistics for full transparency and replicability. The mediation analysis indicates that both social capital and human capital are fully mediated. The Social Capital model shows a significant and positive relationship between social capital and compliance (Path a: $\beta=0.347$, SE=0.065, $p<0.001$). This relationship highlights the significance of social resources in promoting compliance. Compliance with PNSOA standards significantly enhances sustainability (Path b: $\beta=0.572$, SE=0.077, $p<0.001$). While the total effect of social capital on sustainability is significant (Path c: $\beta=0.254$, $p<0.001$), the direct effect of social capital on sustainability becomes non-significant (Path c': $\beta=0.055$, $p=0.440$) when compliance is accounted for as a mediator. The Sobel Test confirms full mediation by demonstrating a substantial indirect effect ($\beta=0.198$, SE=0.046, $z=4.356$, $p<0.001$; $\sigma a=0.065$, $\sigma b=0.077$). This means that social capital's influence on the long-term sustainability of organic practices operates entirely through the structured pathway of PNSOA compliance, not through any independent direct channel.

The Human Capital mediation model provides a similar pattern. Human capital has a significant positive effect on compliance (Path a: $\beta=0.306$, SE=0.093, $p=0.001$), and compliance has significant positive effect on sustainability (Path b: $\beta=0.572$, SE=0.077, $p<0.001$). The total effect is significant (Path c: $\beta=0.203$, $p=0.046$), however the direct effect of human capital on sustainability is not significant when compliance is accounted for (Path c': $\beta=0.030$, $p=0.741$). The Sobel Test confirms full mediation by demonstrating a significant indirect effect ($\beta=0.175$, SE=0.058, $z=3.023$, $p=0.003$; $\sigma a=0.093$, $\sigma b=0.077$). This finding indicates that farmers' environmental attitudes, information-seeking behavior, and knowledge of organic farming do not independently sustain organic practices; rather, they do so by first improving adherence to PNSOA standards, which in turn supports long-term sustainability.

The full mediation identified for both social and human capital is a theoretically significant

**Table 6**

*Mediation Analysis of Compliance Between Social and Human Capital and Sustainability of Compliance*

| Path | β | SE (σ) | t / z | p-value | Interpretation |
|---|---|---|---|---|---|
| Social Capital | | | | | |
| Path a: SC → Compliance | 0.347 | 0.065 | t = 5.403 | < 0.001 | Significant |
| Path b: Compliance → Sustainability | 0.572 | 0.077 | t = 7.419 | < 0.001 | Significant |
| Path c (total): SC → Sustainability | 0.254 | 0.068 | t = 3.735 | < 0.001 | Significant |
| Path c' (direct): SC → Sustainability | 0.055 | 0.071 | t = 0.775 | 0.440 | Non-significant |
| Indirect Effect (Sobel): σa = 0.065; σb = 0.077 | 0.198 | 0.046 | z = 4.356 | < 0.001 | Full mediation |
| Human Capital | | | | | |
| Path a: HC → Compliance | 0.306 | 0.093 | t = 3.311 | 0.001 | Significant |
| Path b: Compliance → Sustainability† | 0.572 | 0.077 | t = 7.419 | < 0.001 | Significant |
| Path c (total): HC → Sustainability | 0.203 | 0.101 | t = 2.012 | 0.046 | Significant |
| Path c' (direct): HC → Sustainability | 0.030 | 0.090 | t = 0.331 | 0.741 | Non-significant |
| Indirect Effect (Sobel): σa = 0.093; σb = 0.077 | 0.175 | 0.058 | z = 3.023 | 0.003 | Full mediation |

*Note: † Path b is shared across both mediation models as Compliance → Sustainability is estimated from the same regression equation. β = unstandardized regression coefficient; SE = standard error; Sobel* $z = (\beta a \times \beta b) / \sqrt{\beta b^2\sigma a^2 + \beta a^2\sigma b^2}$. *Full mediation: Path c significant and Path c' non-significant.*

finding that aligns with and strengthens the conceptual model. The structured pathway to PNSOA compliance is the only method by which relational capital (social) and individual capital (human) may optimize their effect on sustainability. This confirms the primary proposition of the conceptual framework, claiming that compliance is the significant link between farmer's capital endowments and sustainable agricultural outcomes, rather than just a legal requirement. The finding that the strength of SC mediation (z=4.356) greater than that of HC mediation (z=3.023) is interesting to note. This suggests that, relative to individual cognitive resources, relational resources may be more effective in translating compliance into long-term sustainability. These findings align with the Theory of Planned Behavior and the Diffusion of Innovation Theory: adherence to established standards, grounded in social learning and community responsibility, creates behavioral momentum that sustains organic practices over time.

## Conclusions

The results suggest that farmers in the Benguet communities studied generally have moderate levels of social and human capital. Within social capital, dimensions such as social trust and community cohesion play a prominent role in promoting collaboration and resource sharing that support compliance with PNSOA standards. In human capital, risk attitudes, and active information-seeking are particularly powerful, highlighting the need for strong environmental awareness and continuous learning to maintain sustainable practices.

Social and human capital contribute significantly to compliance with PNSOA standards, with social trust, community engagement, and environmental attitudes being the most influential factors. These dimensions promote collective responsibility and a shared commitment to sustainable agriculture, thereby enabling higher levels of compliance. Profit orientation exerts a significant negative effect on compliance, reflecting the real cost-benefit asymmetry that profit-conscious farmers perceive between the immediate burdens of organic compliance and the deferred, uncertain realization of premium price benefits.

Compliance with organic standards has a positive impact on the sustainability of organic farming practices. Farmers who consistently adhere to organic practices are better able to maintain long-term sustainability as they reap the environmental and economic benefits of organic farming. Compliance serves as a reinforcement mechanism, strengthening farmers' commitment to sustainability and their ability to withstand challenges such as market volatility and environmental changes.

The mediation analysis reveals that compliance fully mediates the relationship between social capital and sustainability(Sobel z=4.356, $p<0.001$). and between human capital and sustainability (Sobel z=3.023, p=0.003). In both cases, the direct effect of capital on sustainability becomes non-significant once compliance is controlled, validating that both forms of capital influence long-term sustainable practices entirely through structured compliance to PNSOA standards rather than through independent direct pathways. This finding positions compliance as the principal method through which social and human capital are translated into sustainable organic agriculture, rather than just as a regulatory outcome.

## Recommendations

The findings point to four areas where intervention would matter most. Social Capital is the most structurally constrained. DA-CAR, LGUs, and MAOs can support barangay-level satellite clusters within existing Farmer Organizations. Smaller, closer groupings would reduce the travel burden on dispersed mountain communities and create regular venues for peer exchange and compliance monitoring. Trust-building efforts that engage Ibaloi, Kankana-ey, and other ethnolinguistic group leaders directly would carry more weight than generic programs, as these communities already have cooperative traditions worth building on.

Human Capital development needs competency-based organic farming modules, farm-based demonstrations, digital extension services, and record-keeping training. TESDA, DA-CAR, and BSU can deliver competency-based training in composting, bio-inputs, soil management, and certification documentation through FO-managed farms where farmers can practice in their own ecological context. Mobile extension tools can fill the gap for those in remote barangays.

Certification costs are a known deterrent. Group certification schemes that distribute financial and administrative burdens across FO members, combined with streamlined OCCP pathways and quarterly MAO-FO monitoring visits, would reduce attrition before it becomes a certification risk. Market reliability is probably the sharpest lever for profit-oriented farmers. Procurement agreements with institutional buyers such as hospitals, schools, and government canteens, alongside transparent premium price guarantees from BAFS and DA-CAR, would make compliance a rational economic decision rather than an act of faith.

Future research can investigate how Social Capital and Human Capital interact, as they appear mutually reinforcing even though this study could not fully test that relationship. A replication using the updated PNS/BAFS 337:2022 compliance framework would also be valuable next step.

## Conflict of Interest

There are no known conflicts of interest associated with this publication. No significant financial support for this work could have influenced its outcome.

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