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RESEARCH ARTICLE

Impact assessment of IFSU- CHS Extension program: advancing sustainable livelihoods, health and cultural preservation in Barangay Nayon, Ifugao

Phyllice A Breboneria[1] & Lucky P Roaquin[2*]

[1]College of Health Sciences, Ifugao State University, Lamut, Ifugao 3605, Philippines
[2]College of Nursing, Saint Tonis College Inc., Tabuk City 3800, Philippines

*Correspondence email - phyllicebreboneria@gmail.com

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Abstract

The Community Extension and Development Program (CEDP) of Ifugao State University (IFSU), specifically the College of Health Sciences (CHS), aims to improve the socio-economic, health and environmental conditions of its target communities, including Barangay Nayon, Lamut, Ifugao. Foremost, findings reveal that the commercialization of a locally produced herbal product - Lagundi herbal candy - has been instrumental in enhancing community income, health awareness and environmental engagement. This study tested the hypothesis that integrated community development programs combining technology transfer, health education and livelihood support can generate multidimensional benefits regardless of geographic or cultural context. This study employed a descriptive-explanatory research design, using quantitative methods to assess the impact of the CEDP on the community. Data were collected from 20 respondents through surveys and interviews. Using frequency distribution and linear regression analysis, the study analyzed socio-demographic characteristics, organizational involvement, capacity-building outcomes, technology adoption and the program's economic, social and environmental impacts. Economically, the commercialization of Lagundi herbal candy contributed to income generation and entrepreneurial initiatives; however, improvements are needed in business sustainability and market expansion challenges remain in ensuring long-term business sustainability and market access. Socially, the program enhanced community health awareness, promoted herbal medicine knowledge and empowered local women and youth. Environmentally, it promoted sustainable practices and environmental conservation. Technology adoption was perceived as effective, though there is potential for improvement in modern extraction methods to ensure product quality consistency. While the program demonstrated measurable benefits across all domains, strategic efforts to modernize production technologies and scale market penetration are recommended. This case provides a replicable model for global community development stakeholders. The international community may draw transferable insights from integrating culturally grounded health interventions, sustainable enterprise development and local resource utilization as a pathway to holistic well-being.

Keywords: capacity building; community extension program; environmental sustainability; *Lagundi* herbal candy; socio-economic impact; technology adoption

Introduction

The Community Extension and Development Program (CEDP) of Ifugao State University (IFSU) serves as a strategic mechanism for addressing persistent rural challenges - poverty, poor health infrastructure and environmental degradation - in the Ifugao region, an area marked by strong indigenous cultural practices but limited socio-economic mobility. In line with the United Nations Sustainable Development Goals (SDGs), IFSU's extension programs aim to address critical objectives such as SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), SDG 8 (Decent Work and Economic Growth) and SDG 15 (Life on Land). These programs focus on integrating culturally relevant interventions to improve health outcomes, enhance economic opportunities and promote environmental conservation. Despite the breadth of these efforts, a notable gap exists in systematically assessing the actual impacts of these initiatives on the target communities, particularly in terms of their economic, social and environmental dimensions (1, 2).

The College of Health Sciences (CHS) at IFSU has played a pivotal role in these community extension efforts by developing health-focused programs that promote preventive care and utilize indigenous medicinal plants. One notable initiative is the commercialization of Lagundi herbal products, particularly the development of Lagundi herbal candy. This endeavour was inspired by the registered Utility Model authored by Lilian G. Tumapang titled "A Composition of Herbal Candy from Lagundi (Vitex negundo) Extract," with the registration number IPOPhil: 2/2016/000996 (3). This program not only underscores the use of traditional medicinal plants but also provides livelihood opportunities for residents. However, despite the apparent success of such programs, gaps

remain in understanding their broader and long-term impacts. Specifically, the extent to which capacity building and technology adoption have influenced community life's economic, social and environmental dimensions remains underexplored (4, 5).

While the CEDP initiatives address various community needs, a comprehensive evaluation of their outcomes across economic, social and environmental domains is lacking. This gap hinders the optimization of program strategies and the scalability of successful models (6). Although the program integrates the use of herbal medicinal practices, the effectiveness of these interventions in preserving cultural heritage and biodiversity has not been fully quantified (7). While the programs implicitly support the SDGs, explicit alignment with specific targets and indicators, such as target 8.3 (support productive activities, decent job creation and innovation) and target 15.1 (sustainable use of ecosystems), requires further articulation and measurement (8). The adoption of new technologies and behaviors, such as the production and commercialization of Lagundi herbal candies, has not been systematically analyzed, leaving a gap in understanding the barriers and facilitators of this process (9). The long-term sustainability of these programs, particularly their ability to foster self-reliance among beneficiaries and reduce dependency on external support, is insufficiently addressed (10, 11).

To bridge these gaps, this study assesses the capacity-building outcomes, technology adoption levels and the economic, social and environmental impacts of the IFSU-CHS Community Extension and Development Program in Barangay Nayon, Lamut, Ifugao. By employing an evidence-based approach grounded in Change Theory, the study will evaluate how targeted interventions have influenced individual and community-level outcomes (12, 13).Through this systematic assessment, the study aims to contribute to the continuous improvement of IFSU's extension programs. The findings will inform the design of future initiatives and serve as a model for integrating indigenous knowledge systems and modern technologies in community development (14). Ultimately, this research underscores the importance of aligning local development efforts with global sustainability goals to create resilient, inclusive and thriving communities (15, 16).

Materials and Methods

This study employed a convergent mixed-methods design to assess the impact of the Community Extension and Development Program (CEDP) in Barangay Nayon, Lamut, Ifugao. Twenty program beneficiaries were purposively selected based on their active participation in the program for at least 6 months. Data were collected using a 32-item structured survey and follow-up key informant interviews. Survey items covered socio-demographic data, organizational involvement, capacity-building outcomes, technology adoption and perceived program impacts, with responses rated on a 5-point Likert scale. Descriptive statistics (frequencies, means, percentages) were computed using Microsoft Excel (v2301), while linear regression analysis was performed using Jamovi (v2.4.8) to test hypothesized relationships between program inputs and economic, social and environmental outcomes. Statistical significance was set at $p < 0.05$. This deductive, evidence-based approach follows Change Theory and is designed for replication in similar global rural contexts by applying the same selection criteria, tools and analysis framework.

Results and Discussion

Socio-demographic characteristics of the respondents

The socio-demographic characteristics of the respondents (Table 1) of Barangay Nayon in Lamut, Ifugao is a rural, agriculture-dependent community composed mainly of indigenous Ifugaos. Despite limited access to higher education and healthcare, the population demonstrates resilience and strong cultural continuity. Infrastructure and services are modest, with intermittent access to water, electricity and telecommunications and environmental challenges such as deforestation and climate-related risks affect sustainability efforts.

Survey results from 20 female respondents reveal a predominantly employed population (80 %), with most engaged in part-time or seasonal work. Household incomes are modest, with 75 % earning between PHP 10001 and PHP 20000 monthly. Most households are medium-sized, rely primarily on wages and nearly all own communication and transport devices. Educational attainment is relatively high, with 60 % having completed secondary education and 10 % holding college degrees.

These findings support the research hypothesis by confirming the presence of foundational community assets - education, connectivity and income diversification - that enable effective capacity building, technology adoption and participation in income-generating programs like the commercialization of herbal Lagundi candy. The socio-economic profile indicates that interventions targeting livelihood and environmental sustainability are relevant and feasible within this setting.

Organizational characteristics

The organizational affiliation and involvement of the respondents (Table 2) reveal a high level of participation in various organizations. Most (85 %) are affiliated with organizations, while only 15 % are not. Among those involved, 71 % hold membership status and 29 % have taken on leadership roles as officers within these organizations. In terms of the number of organizations they are involved with, 35 % are active in 2-4 organizations, 29 % are involved in at least one organization and 18 % are highly engaged, being part of 5 or more organizations. Conversely, 18 % of respondents do not participate in any organizations. This data highlights a strong tendency towards community or organizational involvement among most respondents, with a substantial portion engaging in multiple organizations, either as members or in leadership capacities.

Capacity building outcomes

Capacity-building outcomes (Table 3) show a high level of effectiveness, with an overall weighted mean of 3.26 ("Strongly Agree"). Participants consistently reported applying acquired

Table 1. Socio-demographic characteristics of the respondents

Gender	Frequency (n = 20)	Percentage distribution
Male	0	0
Female	20	100
Age rrange		
18 - 30	6	30
31 - 40	6	30
41 - 50	6	30
51 - 60	2	10
Civil status		
Single	5	25
Married	15	75
Widowed	0	0
Others	0	0
Highest educational attainment		
None	0	0
Primary	3	15
Secondary	12	60
Technical/ Vocational	3	15
College	2	10
Post-Graduate	0	0
Others	0	0
Household size		
Small (up to 3 members)	2	10
Medium (4 - 6 members)	12	60
Large (7 and above)	6	30
Employment background		
Employed	16	80
Not Employed	4	20
Nature of employment		
Permanent	2	10
Short-term (Job/ Business/ Family owned)	7	35
Part-time (day to day basis)	11	55
Class of worker		
Wage and Salary worker	19	95
Own account worker	1	5
Unpaid Family	0	0
Location		
Within the province	20	100
Outside the province but within the region	0	0
Outside the region	0	0
Outside the country	0	0
Household income		
Sources of income		
Wages and salaries	19	95
Self-employed (farm and non- farm)	1	5
Government transfer payment	0	0
Investment	0	0
Monthly income		
Below P10000	3	15
P10001- P20000	15	75
More than P20000	2	10
Household assets		
Telecommunication devices (radio, television, mobile phones)	20	100
Household appliances	20	100
Transportation mechanisms (motorcycle, automobile)	19	95

Table 2. Organizational characteristics of the respondents

Organizational affiliation	Frequency (n=20)	Percentage Distribution
Affiliated	17	85
Not affiliated	3	15
Organizational involvement		
Officer	5	29
Member	12	71
Number of Organization		
None	3	18
At least 1	5	29
2-4	6	35
5 and above	3	18

Table 3. Level of capacity building outcomes of the respondents

Capacity building outcomes	Weighted mean	Interpretation
Utilization outcomes		
1. I was able to apply the knowledge/skills gained to my work	3.29	Strongly agree
2. I continue to use the knowledge/skills gained	3.33	Strongly agree
3. I increased my professional collaboration with organizations	3.24	Agree
4. I have trained others in the skills I learned	3.19	Agree
5. I was able to secure additional resources to expand or enhance my work	3.33	Strongly agree
6. The training program enabled me to produce better outputs	3.24	Agree
7. The technologies/knowledge/skills gained enabled me to perform better	3.29	Strongly agree
Personal outcomes		
1. I was offered a promotion as a result of my training	3.24	Agree
2. I have pursued work opportunities after the training	3.10	Agree
3. I gained greater satisfaction producing my own Lagundi candy	3.24	Agree
Organizational outcomes		
1. The organization increased its efficiency in undertaking the training	3.29	Strongly agree
2. The program promoted a more innovative culture in the organization	3.29	Strongly agree
3. The improved capacity allowed the organization to attract more funding	3.33	Strongly agree
Overall weighted mean	**3.26**	**Strongly agree**

knowledge and skills (mean = 3.29), improving performance (3.29) and maintaining long-term use in their work (3.33). These utilization outcomes suggest strong knowledge retention and practical application. Personal outcomes, including career advancement (3.24) and increased work satisfaction (3.24), highlight the training's impact on individual growth, though ratings were slightly lower than organizational outcomes. Respondents also pursued additional income opportunities (3.10), supporting the hypothesis that capacity building enhances self-reliance. Organizationally, the training fostered innovation (3.29) and improved access to funding (3.33), indicating broader institutional benefits. These results validate the research hypothesis that targeted training interventions contribute to economic and social improvements at both personal and organizational levels, enabling sustainable community development.

Adoption of technologies in producing lagundi extract candy

The evaluation of technologies used in Lagundi herbal candy production (Table 4) yielded a high overall weighted mean of 3.43 ("Strongly Agree"), indicating a broadly positive perception. Respondents showed strong awareness of the technology's role in mass production (3.70) and its benefits to product quality (3.75). However, knowledge of modern extraction methods remains limited (3.00), pointing to a need for targeted technical training.

Efficiency and cost-effectiveness scored consistently high, with operational cost management (3.70) and reduced labour and waste highlighting technology's role in sustainable profitability. Innovation was also well-regarded, with respondents acknowledging its value in improving competitiveness (3.55) and production processes (3.60). Perceptions of product quality and safety were positive, especially in preserving Lagundi's medicinal properties (3.60) and ensuring safe consumption (3.65), though concerns remain around consistency (3.25). These findings affirm the research hypothesis that technology adoption enhances economic and environmental outcomes while supporting the integration indigenous knowledge systems into scalable production processes.

Economic, social and environmental impacts of the community extension program of the IFSU- CHS

The evaluation of the IFSU-CHS Community Extension Program (Table 5) shows a substantial overall impact across economic, social and environmental domains, with a total weighted mean of 3.38 ("Strongly Agree"). Social impact scored highest (3.54), highlighting significant gains in community empowerment, health awareness and skills development. Environmental outcomes were also substantial (3.42), reflecting improved sustainability practices, though community involvement in ecological actions could be strengthened. Economic impact, while positive (3.24, "Agree"), showed relatively lower scores, especially in areas related to long-term business expansion and sustainability, indicating areas for growth. These findings support the research hypothesis by confirming that integrated extension programs

Table 4. Level of adoption of technologies of the respondents in producing lagundi extract candy

Production of herbal candy from lagundi extract technologies	Weighted mean	Interpretation
Awareness of technology		
1. I am familiar with the technologies used in producing herbal candy from lagundi extract.	2.75	Agree
2. The technology involved in the production of lagundi extract candy is accessible to manufacturers.	3.35	Strongly agree
3. I have sufficient knowledge about the equipment required for producing herbal candy from lagundi extract.	3.30	Strongly agree
4. I understand the importance of technology in the mass production of herbal candy from lagundi extract.	3.70	Strongly agree
5. I am knowledgeable about how modern technology is applied to improve the extraction process of lagundi.	3.00	Agree
Perceived efficiency of technology		
1. The technology used in producing herbal candy from lagundi extract increases production efficiency.	3.20	Agree
2. Technology speeds up the process of turning lagundi extract into consumable candy.	3.60	Strongly agree
3. Technology improves the overall quality of herbal candy produced from lagundi extract.	3.75	Strongly agree
Cost-effectiveness of technology		
1. The technology used in producing herbal candy from lagundi extract is cost-effective in the long term.	3.30	Strongly agree
2. The operational costs associated with using technology to produce lagundi extract candy are manageable.	3.70	Strongly agree
3. Technology-based production of herbal candy reduces labor costs.	3.45	Strongly agree
4. The use of technology increases the profitability of producing lagundi extract herbal candy by reducing material waste and time spent.	3.55	Strongly agree
Innovation and technological advancement		
1. I believe that newer technologies could further improve the production process of lagundi extract herbal candy.	3.60	Strongly agree
2. Innovation in production technology increases the competitiveness of lagundi extract herbal candy in the market.	3.55	Strongly agree
Impact on product quality		
1. The use of technology ensures consistent quality in every batch of herbal candy made from lagundi extract.	3.25	Agree
2. Technology maintains the integrity of lagundi extract's medicinal properties during the candy production process.	3.60	Strongly agree
3. The precision offered by technology improves the taste, texture and shelf life of herbal candy made from lagundi extract.	3.45	Strongly agree
4. Technology helps in maintaining uniformity in the size, shape and color of lagundi-based herbal candy products.	3.30	Strongly agree
Sustainability and safety		
1. The technology used in producing lagundi extract herbal candy minimizes environmental impact.	3.35	Strongly agree
2. I believe the production process using modern technology helps in conserving herbal resources.	3.50	Strongly agree
3. The equipment used in the production process ensures that the final product is safe for human consumption.	3.65	Strongly agree
4. Technological advancements in the production of lagundi extract candy ensure the process is energy-efficient.	3.55	Strongly agree
Overall weighted mean	3.43	Strongly agree

Table 5. Impact of the IFSU-CHS community extension program

Impact of the IFSU-CHS community extension program	Weighted mean	Interpretation
A. Economic impact		
1. The commercialization of lagundi herbal candy has contributed to economic growth within the community.	3.05	Agree
2. The program has created new sources of income for local families involved in the production process.	3.15	Agree
3. The commercialization has led to the development of other related entrepreneurial activities in the community.	3.30	Strongly agree
4. The commercialization project has generated sustainable employment opportunities for local residents.	3.50	Strongly agree
5. More women and youth in the community have gained employment through the production of lagundi herbal candy.	3.10	Agree
6. The program has provided stable and regular income to participants, improving their overall financial security.	3.20	Agree
7. Community members have developed valuable skills (e.g., production, marketing, financial management) through the program.	3.30	Strongly agree
8. The program has empowered local entrepreneurs by providing opportunities to expand their businesses.	2.90	Agree
9. The commercialization of lagundi herbal candy has strengthened the economic independence of participating households.	3.20	Agree
10. The program has successfully opened access to new markets for lagundi herbal candy beyond the local community.	3.35	Strongly agree
11. The commercialization initiative has established long-term business partnerships for the community.	3.20	Agree
12. The project has contributed to the overall sustainability of the local economy by supporting small-scale enterprises.	3.70	Strongly agree
13. The income generated from lagundi herbal candy commercialization has been reinvested into other community development projects.	3.05	Agree
14. The community has experienced an increase in overall economic activity as a result of the commercialization initiative.	3.40	Strongly agree
15. The program has increased the overall economic resilience of the community, making it less dependent on external sources of income.	3.25	Agree
Weighted mean for economic impact	3.24	Agree
B. Social impact		
1. The commercialization of lagundi herbal candy has increased awareness of herbal medicine within the community.	3.75	Strongly agree
2. The community extension program has improved local knowledge about the health benefits of lagundi.	3.75	Strongly agree
3. The project promotes the preservation of local culture and traditional knowledge about medicinal plants.	3.70	Strongly agree
4. The local community is actively involved in producing and commercializing lagundi herbal candy.	3.10	Agree
5. The program has created new opportunities for community members to contribute to the project's success.	3.15	Agree
6. Local residents feel a sense of ownership and pride in the commercialization of lagundi herbal candy.	3.55	Strongly agree
7. The program has provided community members valuable skills training (e.g., production, marketing).	3.65	Strongly agree
8. Community members involved in the project feel empowered and more confident in their abilities.	3.55	Strongly agree
9. The commercialization of lagundi herbal candy has improved the community's access to affordable health products.	3.70	Strongly agree
10. The project has positively impacted community members' overall health and well-being.	3.70	Strongly agree
11. The community feels more connected and supportive through the shared goals of this project.	3.30	Strongly agree
Weighted mean for social impact	3.54	Strongly agree
C. Environmental impact		
1. The commercialization of lagundi herbal candy promotes environmental awareness in the community.	3.50	Strongly agree
2. The program encourages sustainable harvesting practices of lagundi plants to protect local biodiversity.	3.60	Strongly agree
3. Local community members are informed about the importance of conserving natural resources during	3.05	Agree
4. The production of lagundi herbal candy has minimal negative impact on local land and water resources.	3.80	Strongly agree
5. The commercialization process promotes the use of environmentally-friendly materials (e.g., packaging, tools).	3.25	Agree
6. Waste management strategies are effectively implemented to minimize pollution during production.	3.60	Strongly agree
7. The community extension program is contributing to the long-term sustainability of local natural resources.	3.55	Strongly agree
8. The commercialization of lagundi herbal candy encourages reforestation or planting initiatives in the local area.	3.35	Strongly agree
9. The program has created awareness on the environmental benefits of utilizing local herbal resources in a responsible way.	3.45	Strongly agree
10. The project actively involves the local community in environmental conservation efforts.	3.25	Agree
11. The local community is encouraged to participate in environmental protection activities as part of the program.	3.05	Agree
12. The program has increased community responsibility towards environmental sustainability.	3.55	Strongly agree
Weighted mean for environmental impact	3.42	Strongly agree
Overall weighted mean	3.38	Strongly agree

rooted in local knowledge and technology adoption yield measurable benefits. However, sustained economic resilience may require deeper structural support.

Socio-demographic profile and the impact dimensions of the IFSU-CHS community extension program

Table 6 shows a strong relationship between demographic and economic variables (age, education, income, etc.) and the program's impact, with a Multiple R of 0.915 and R^2 of 0.837, indicating that 83.7 % of the variation in economic, social and environmental outcomes can be explained by these factors. The Adjusted R^2 of 0.742 confirms the model's reliability despite multiple predictors. These findings support the research hypothesis by showing that participants' profiles significantly influence the program's overall impact, reinforcing the value of tailoring community interventions to local socio-economic conditions.

Table 6: Regression analysis of the socio-demographic profile of the respondents and the impact of the IFSU-CHS community extension program

Regression statistics	Value
Multiple r	0.91513719
R square	0.83747607
Adjusted r square	0.74267045
Standard error	0.05571417
Observations	20

Organizational characteristics and the impact dimensions of the IFSU-CHS community extension program

Table 7 reveals a strong positive relationship between organizational affiliation, involvement and number of organizations with the program's economic, social and environmental impacts, as shown by a Multiple R of 0.831 and R^2 of 0.690. This means that 69 % of the variation in impact can be explained by these organizational factors. The Adjusted R^2 of 0.632 confirms a reliable model despite the small sample size. These results support the research hypothesis by highlighting that active organizational participation significantly enhances the perceived impact of the program.

Table 7: Regression analysis of the organizational characteristics of the respondents and the impact of the IFSU-CHS community extension program

Regression statistics	Value
Multiple R	0.83097672
R Square	0.69052231
Adjusted R square	0.63249524
Standard error	0.0665813
Observations	20

Capacity building outcomes and the impact dimensions of the IFSU-CHS community extension program

Table 8 shows a moderate positive relationship (Multiple R = 0.562) between capacity-building outcomes (utilization, personal and organizational) and the program's economic, social and environmental impacts. With an R^2 of 0.316, only 31.64 % of the variation in impacts is explained by these factors and the Adjusted R^2 of 0.188 indicates a weaker fit when accounting for model complexity. While the outcomes moderately influence impact, much of the variation remains unexplained, suggesting that other factors beyond capacity-building may play a stronger role-partially supporting the research hypothesis.

Table 8. Regression analysis of the capacity building outcomes of the respondents and the impact of the IFSU-CHS community extension program

Regression statistics	Value
Multiple R	0.56250229
R square	0.31640882
Adjusted R square	0.18823548
Standard error	0.09895456
Observations	20

Adoption of Technologies and the impact dimensions of the IFSU-CHS community extension

Table 9 reveals a moderate positive relationship (Multiple R = 0.618) between technology-related factors and the economic, social and environmental impacts. The R^2 value of 0.382 indicates that the model explains 38.16 % of the impact variation, though the low Adjusted R^2 (0.096) suggests that some predictors may not contribute significantly. The findings show that technology awareness, efficiency, cost-effectiveness, innovation, quality and sustainability moderately influence the impacts, supporting the research hypothesis to a limited extent and highlighting the need to explore other influencing variables.

Table 9. Regression analysis of the adoption of technologies of the respondents and the impact of the IFSU-CHS community extension program

Regression statistics	Value
Multiple R	0.61777753
R square	0.38164907
Adjusted R square	0.09625634
Standard error	0.10441032
Observations	20

Conclusion and Recommendation

Through its holistic approach, the IFSU-CHS Community Extension Program has positively impacted Barangay Nayon, Lamut, Ifugao, Philippines. The commercialization of Lagundi herbal candy has boosted local income and confirmed the research hypothesis that health-related community enterprises can drive multidimensional development. The program also promotes social empowerment and environmental sustainability. This offers a replicable model for rural development that integrates health, livelihood and ecological care. To ensure long-term success, efforts should focus on market expansion, sustainable business practices, technology upgrades and continued training and conservation efforts.

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Authors' contributions

PAB conceived the study, developed the research framework, wrote the research proposal and conducted data collection. LPR was primarily responsible for the statistical analysis and in writing the manuscript. All authors have read and approved the final version of the manuscript.

Compliance with ethical standards

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