Technical Efficiency of Farmers under the Community-based Participatory Action Research (CPAR) Project in Region XI, Philippines: An Application of Structural Equation Modeling

by

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ABSTRACT

The main objective of the study is to estimate and compare the effect of single and selected technology combinations on the production efficiency of Community-based Participatory Action Research (CPAR) beneficiaries in Region XI using the Linear Structural Relationships Model (LISReL). Latent and Observed variables were introduced to suffice the requirements of the former. For instance, (a) farm area, labor to family ratio, years in education and experience were categorize as measured indicators to the socio-demographic profile of farmers; (b) participation to trainings, lectures, and consultations as indicators of interest to the project; production knowledge and number of technology adopted for technology diffusion; and (d) technical efficiency to production, income and farmers repayment rates to evaluate their wellbeing condition. The overall results revealed that farmers’ socio-demographic and interest to the project manifested a positive significant direct relationship to their economic wellbeing. In addition, the indirect effect of socio-demographic and interest to the project via technology diffusion also recorded a positive link to the overall improvement of wellbeing.

In general, the effect of inputs to the level of farmers’ technical efficiency (TE) posted higher economic returns when at least four (4) technologies from the project would be adopted.

Keywords: CFA, CPAR, diffusion, EFA, latent variables, LISReL, measured indicators, path analysis, SEM, TE

I. Introduction

Agriculture continues to play as one of the major contributor to the country’s gross domestic product (GDP). It provides income and livelihood to millions of farmers and fisherfolk and employs about ninety-five (95) percent of the labor force particularly in the rural sector (Gert-Jan et al., 2009).

In the Philippines, majority of poor families are highly dependent on agriculture for livelihood. Hence, productivity must be pursued to ensure food sufficiency and employment opportunities in the countryside.

However, recent alarming threats in this sector have caused food prices to keep on rising, pulling-down millions of people back into poverty. In the face of these challenges, the country’s food sector, the Department of Agriculture (DA), outlined a major strategic intervention of programs and projects such as provision of planting materials, development of irrigation and postharvest facilities, intensified research (R&D), access to credit and trainings, technology demonstration and transfer which aims to boost the country’s food production at the optimum.

Republic Act (R.A.) 8435 otherwise known as the Agriculture and Fisheries Modernization Act (AFMA) of 1997 was one of the ambitious plan that hope to address the various issues that hinder the country’s food sector. AFMA is a comprehensive legislation which defines policies that promote
sustainable and environment-friendly technologies. It aims to conserve natural resources, achieve food security through a modernized and diversified agricultural system that is highly productive and competitive, facilitate public investment stream towards the rural economy, and envisioned to in place safeguards to the country as it becomes modernized (DA, 1998).

1 To enable maximum translations of food production productivity, and income level in the rural

 Participatory Action Research (CPAR) project to far-flung communities to ensure farmers' adoption to technologies would translate economic gains during and beyond its implementation (Salimar et al., 2008).

CPAR was deemed crucial in bringing a holistic pattern that would give adequate formulation and sustainability of the project with the main objective of improving farmers' quality of life. This was created in line with the goals of AFMA to modernize the agriculture and fisheries sectors and strengthen technology transfer through the active participation of farmers, scientists, researchers, and other experts. It was instituted through a farm and community-based framework which installs improved production system to assist local agricultural enterprises to become competitive in both domestic and global markets (CPAR Guidelines, 2006).

In line with this paradigm, DA-Southern Mindanao Integrated Agricultural Research Center (DA-SMIARC) positioned the project on commodities with short duration, easy to sell and have potential market niche. CPAR was implemented across the rural districts in Davao Region as presented in Table 1 at the Appendices.

Objectives of the Study

This study attempts to capture the effect of the project towards the beneficiaries overall wellbeing. Specifically, this has the following objectives:

1) To determine and compare the effect of single and selected technology combinations on the production efficiency of CPAR farmers; and

2) To apply the LISREL Model in the estimation process.

Significance of the Study

After the infusion and implementation of the phase II of this project, there was no adequate information that would follow through the success of it due to data constraints and absence of quantitative techniques that would address the underpinnings of the project. The absence of evaluation studies, particularly its effect to the beneficiaries, requires a follow through evaluation in order to convince DA policy-makers to replicate the project to strengthen technology adoption, combat poverty and foster rural growth & development. Hence, to provide such information, this study would attempt to estimate the efficiency of farmers under the CPAR project in the region.

More importantly, this study is necessary because a new methodology was employed to determine the farmers' technical efficiency (TE) using both the latent and observed variables. The use of latent variables permits some effect of the production TE which could not be captured directly by observed empirical data. Hence, there is a need to utilize them. Moreover, there have been numerous government projects implemented but only few studies attempted to capture their contribution towards the wellbeing of its recipients.

II. Methodology
Data were sourced from the DA SMIARC-XI which covers the socio-economic profile, production level, knowledge and number of technologies adopted. These were used as observed exogenous indicators to derive the overall result of the project.

Model Specification

Structural equation modeling (SEM) was employed in the process. SEM, in its most general form, consists of two parts: the structural equations and the measurement model. The former specify the causal relationships among the latent variables and describe the causal effects and the amount of unexplained variance. The latter model, however, specify how the latent variables or hypothetical constructs are measured in terms of observed variables. In this study the typical LISREL model consisting of a measurement and structural component was employed to capture the effect of the project on the technical efficiency of farmers along with the combinations of technology. The model can be expressed as:

\[ \eta = B\eta + \Gamma \xi + \zeta \]  \hspace{1cm} (1)

where:
- \( \eta \) = latent endogenous variable;
- \( \xi \) = factor loadings of latent exogenous variables;
- \( B \) = is the matrix of structural coefficients that relate \( \eta \) variable to another;
- \( \Gamma \) = structure coefficients that relate the \( \xi \) to \( \eta \);
- \( \zeta \) = contains the equation prediction errors or disturbance terms;

The latent endogenous variable is marked by improvement of farmers’ well-being (\( \xi_4 \)). While the latent exogenous are represented by the following:

- \( \xi_1 \) = social family structure;
- \( \xi_2 \) = attitude towards the project; and
- \( \xi_3 \) = technology diffusion

These \( \xi \) are vectors of latent exogenous concepts represented by the following:

A. Social family structure
- \( x_1 \) = farm size/area;
- \( x_2 \) = education; and
- \( x_3 \) = experience;
- \( x_4 \) = labor to family ratio;

B. Interest towards the project \( (\xi_2) \)
- \( x_5 \) = attendance to trainings
- \( x_6 \) = lectures;
- \( x_7 \) = consultations;

C. Diffusion/innovation \( (\xi_3) \)
- \( x_8 \) = production knowledge;
- \( x_9 \) = number of technology used;

D. Improvement of farmers' well-being \( (\xi_4) \)
- \( x_{10} \) = repayment rate;
- \( x_{11} \) = production efficiency;
- \( x_{12} \) = income;

\( \delta \) = are vectors of errors in both observed and latent models.

Empirical application

The study adopts the two-stage estimation procedure. Parameters of the production function were estimated through the stochastic frontier analysis (SFA) to derive the technical efficiency (TE) scores of farmers under the project, using production volume, area, education, extension received, labor to family ratio, technology adopted and production knowledge. After getting the TE scores, SEM was employed to examine the relationship between agricultural technologies to the latent variables reflected in
the conceptual framework of the study. There were two reasons considered in using the procedure. First, was to generate a realistic recommendation to benefit agricultural policy based on the objectives of the study. Second, was to avoid the problem of collinearity and lack of convergence during estimation due to farmers management biases (Mundluk, 1961). Hence, result of this paper would reveal the influential strength of the selected variables in measuring farmers’ TE.

**Production efficiency measurement**

The TE performance of farmers was measured using a parametric production function known as the stochastic frontier analysis (SFA). SFA has been widely used in empirical studies involving efficiency analysis particularly on firm-specific production efficiency (Greene, 1980; Aigner et al., 1977; Meeusen et al., 1977).

The stochastic frontier production function (SFPF) for the $i^{th}$ farmer can be specified as:

$$Y_i = f(X_i, \beta) e^\varepsilon \quad i = 1, 2, 3, \ldots n, k=1, \ldots m$$

(2)

where $Y_i$ is the output of the $i^{th}$ farmer, $X_i$ is a vector of $k$ inputs of the $i^{th}$ farm, $\beta$ is a vector of parameters and $\varepsilon$ is a farm-specific error term (Bravo-Ureta, 1990). The SFPF employed in this study assumed the logarithmic Cobb-Douglas form which can be written as:

The error term in equations (1) and (2) has two components that is,

$$\varepsilon_i = V_i - U_i \quad i = 1, 2, 3, \ldots n$$

(3)

$$\ln Y_i = \ln \alpha_0 + \beta_i \ln X_{ik} + \varepsilon_i$$

(4)

where $V_i$ is a two sided random error that permits variations in output due to factors outside the control of farmers and distributed as $V_i \sim iid \ N(0, \sigma_v^2)$, $U_i$ is a one-sided measure of technical (in)efficiency relative to the stochastic frontier and distributed as $U_i \sim iid| \ N(0, \sigma_v^2)$) (Aigner et al., 1977). $V$ and $U$ are assumed to be uncorrelated and independent of $x$.

On the other hand, to validate if the data collected would yield a promising result when SEM will be used, a normality test for all variables was conducted beforehand to normalized the distribution using the chi-square ($\chi^2$) tests.

SEM was employed to model the influence of technology transfer to farmers’ TE by the use of ‘LISREL’ (Jöreskog et al., 2000; Cziráky, 2004). SEM is a generic term used to describe different modelling approach to provide comprehensive analyses of direction and strength of the hypothesized relationships among the set of observed and latent variables.

Prior to the application of SEM, the exploratory factor analysis (EFA) was employed after generating the TE scores. EFA was used to specify different alternative models in the hope to find a model that would fit the data with theoretical support. It was to allow examination on several factors that might be correlated and identifies which observed variables appear to be the best factor. Confirmatory factor analysis (CFA) was employed next after EFA. CFA is used to examine patterns of interrelationships among the latent constructs, where each construct was measured by a set of observed variables to define the correlated constructs. The structural equation modeling (SEM) was employed next, which resemble from the CFA models. SEM and CFA are almost interrelated except that, the former postulates particular explanatory relationships among constructs. SEM approach was used to test theories among the latent variables under investigation. Moreover, it would test the validity and significance of the
hypothesis that a relationship between the observed variables and its underlying latent constructs do exists based on the knowledge theory and previous empirical findings.

III. Results and Discussion

Table 2 below presents the key general information of farmers under the Community-based Participatory Action Research (CPAR) Project in Region XI.

Table 2. Descriptive statistics of farmers covered under the CPAR project

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean n=387</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Area (in has)</td>
<td>1.009</td>
<td>0.290</td>
<td>0.500</td>
<td>1.750</td>
</tr>
<tr>
<td>Education (school years spent)</td>
<td>1.509</td>
<td>0.586</td>
<td>1.000</td>
<td>3.000</td>
</tr>
<tr>
<td>Experience (years in farming)</td>
<td>7.961</td>
<td>1.106</td>
<td>6.000</td>
<td>9.000</td>
</tr>
<tr>
<td>Family labor ratio (working: dependents)</td>
<td>0.428</td>
<td>0.215</td>
<td>0.220</td>
<td>0.900</td>
</tr>
<tr>
<td>Trainings attended ( frequency)</td>
<td>4.494</td>
<td>0.501</td>
<td>4.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Lectures attended ( frequency)</td>
<td>4.597</td>
<td>0.491</td>
<td>3.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Consultation attended (frequency)</td>
<td>3.845</td>
<td>0.780</td>
<td>4.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Prod’n Knowledge (% of farmers test scores)</td>
<td>5.824</td>
<td>1.230</td>
<td>4.000</td>
<td>8.000</td>
</tr>
<tr>
<td>Technology Used (no. applied)</td>
<td>3.902</td>
<td>0.745</td>
<td>3.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Income (from sale in Php)</td>
<td>12,561</td>
<td>2,216</td>
<td>7,528</td>
<td>15,800</td>
</tr>
<tr>
<td>Prod’n Efficiency$^2$ (technical efficiency scores)</td>
<td>0.898</td>
<td>0.457</td>
<td>0.691</td>
<td>0.957</td>
</tr>
<tr>
<td>Repayment (% loan paid from the project)</td>
<td>0.995</td>
<td>0.511</td>
<td>0.850</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Note: 
$^1$Household members who are capable of working without supervision are categorized as independent workers (ages 15 to 60) and those who have to be supervised are considered dependent (age <15 and >60).
$^2$Technical efficiency of farmer beneficiaries computed from Frontier 4.1 by Tim Coelli.

Based on result, most farmers have average farm size of 1.009 hectares and are landowners of their land. Their farm size varies between 0.500 to 1.750 hectares. Most of them have been into farming from six (6) to nine (9) years. The average farming experience was recorded at eight (8) years. The labor to family ratio was found at an average of 0.428, which means that family dependents under the project were relatively high. In terms of education, farmers have poor school participation rate which ranges only from grades one (1) to three (3). The low school participation level could be due to inadequate and/or absence of infrastructure facilities in some of the project area. Most of them have participated four (4) to five (5) trainings and consultations from the project. They also have attended three (3) to five (5) lectures. A wide gap was seen in terms of production knowledge which ranges from forty percent (40%) to eighty percent (80%). But, on the average it recorded at sixty percent (60%) which posted gradual improvements due to the project.

On the other hand, farmers’ TE registered at almost ninety percent (90%). This level has led to an estimated average income increase of Php12,561.00 per year and eventually reflected a repayment rate to almost a hundred percent (100%). In general, the promising effect of the project can be attributed to the magnitude of technology used by farmers which varies between three (3) to five (5) technologies.

In the application of SEM, both the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were primarily considered in the model building stage. This was to validate the exogenous and endogenous latent and observed variables of the study and find a close fit between inter-related
theoretical models with the proposed one. After finalizing the potential variables for the proposed model, SEM was used to pre-test and capture the behavior of each predictor using the Student edition of LISREL for Windows from the Scientific Software International (SSI). The LISREL approach involves simultaneous estimation among latent and observed multiple exogenous and endogenous variables that may include reciprocal causation and interdependence (Jöreskog and Sörbom, 1989). Hence, it allows simultaneous estimation of direct, indirect, and total effects of a series of indicators.

Path results of farmers under crops project

Figures 1 and 2 in the Appendices, present the production technical efficiency (TE) of crops farmers and the number of technologies used which displayed positive result. Wealth, extension and education posted large influence to technology used. Farm area, labor and extension exhibit great influence to farmers’ TE while extension and experience shared a strong influential factor to production knowledge. Moreover, findings revealed that the effect of endogenous observed indicators (production knowledge and number of technology used) to TE is high when at least four (4) or more technologies would be adopted.

Figure 3 shows the simultaneous SEM analysis where socio-demographic profile, interest to the project, technology diffusion, and improved well-being were treated as latent variables in the model. Results revealed that all observed exogenous indicators posted positive significant correlation at five percent (5%). Farm area and education were identified as the two (2) most influential variables that influence the socio demographic profile of farmers. This means that the contribution of land ownership increases incentive to invest. On the other hand, educational experience showed positive influence to the project implying the number of years a farmer spent in school posted affirmative contribution to production knowledge and TE. Moreover, participation to trainings, lectures and consultations displayed significant influence on farmers’ interest to the project, yielding the former (trainings) as dominant indicator. This means that agri-related activities help enhances farmers’ knowledge and comprehension.

Moreover, income, repayment rates, and TE displayed positive correlation to the overall wellbeing of farmers, revealing the latter as the principal indicator. The result implies that production TE has really contributed improvements to farmers’ income and repayment rates.

Direct, indirect, and total path results

The direct, indirect and total effects were analyzed to identify influential latent exogenous factors that affect the overall wellbeing of farmers covered by the project. Based on the result, farmers’ socio-demographic condition and interest to the project yielded a positive direct effect to economic wellbeing. The indirect effect between them (socio-demographic and interest to the project) via technology diffusion, which acted as latent mediating indicator in the model, showed encouraging link to the overall wellbeing of farmers.

Path results of farmers under livestock project

Figures 4 and 5 shows the path analysis of the livestock project involving the magnitude of technology used. Based on the findings, the socio-demographic profile has positive pressure to farmers’ production knowledge, technology used and production technical efficiency (TE).

Farm area and family worker ratio reflected as two (2) most influential factors to TE. Both extension and experience also revealed a strong relationship to production knowledge while education, income and extension displayed positive relation to the technology used. Moreover, the result specifies
that the effect of inputs to farmers' TE is high when at least four (4) or more technologies were adopted from the project which corresponds to higher production returns.

Figure 6 shows the SEM output of the livestock project. Initially, the estimated result of all exogenous indicators in the model pointed a positive link to all latent endogenous variables. For instance, farm area, education, experience and family worker/labor ratio reflected positive connection to socio-demographic profile confirming the former two (2) indicators (farm size and education) as the most influential. This implies that farmers are usually eager to participate and avail the project if they owned their lands and have access to education. Attendance to trainings, lectures, and consultations also claimed positive relationship on farmers' interest to the project. In other words, if farmers have high involvement to production-related trainings, their likelihood of interest also increases.

On the other hand, farmers' inherent knowledge to farm production and technology used reveals significant connection towards technology diffusion. In short, both indigenous knowledge and technology used play crucial role to technology diffusion. This can be perceived that adoption to technology is also dependent to the inherent indigenous knowledge of farmers where project managers should take into consideration in the future.

**Direct and mediating path results**

Farmers' socio-demographic profile and interest to the project reflected significant direct link to their wellbeing. Similarly, the indirect effect between the two via technology diffusion posted positive correlation.

Findings also revealed that all observed exogenous variables posted positive relationship to all latent endogenous variables. In other words, understanding farmers' behavior can provide program implementers the type of strategic mechanisms that are necessary to far-flung areas to improve productivity and wellbeing.

For instance, it was found that farm size played significant role to farmers' TE wherein they are more eager to adopt the project technologies, that is if they owned the land. Moreover, their participation to government projects increases when trainings, consultations and lectures are periodically provided to them.

In general, the path analysis results of both crops and livestock projects revealed the effect of inputs to TE which are relatively higher when farmers adopt at least four (4) technologies. This corresponds to the gradient approach to technological innovation as presented in the findings of Kebede (1993).

**IV. Summary, Conclusion and Recommendations**

The study investigated the technical efficiency (TE) of farmers covered by CPAR Project in Region XI. It employed the structural equation modeling (SEM) to determine and compare the effect of single and selected technology contributions to the production efficiency of CPAR farmers.

Based on the path analysis results, crops TE and socioeconomic status displayed positive link to each other. Income/wealth, experience and education resulted large influence to technology used. The combined effects of farm area, labor and extension exhibit significant outcome to farmers' TE. More so, extension education and experience shared common factors to production knowledge.

For the livestock project, similar results were obtained. Extension and experience posted strong correlation to production knowledge. Wealth, extension and experience yielded positive variability to the magnitude of technology used.
Findings of both crops and livestock revealed the effect of technology adoption to farmers’ TE which translates to higher production output when four (4) or more technologies will be used. It is noteworthy to underscore that ownership rights trigger household farmers to invest and participate further to the project, provided that on-site trainings, consultations and lectures will be visible in their community. This finding also corresponds to the gradient approach of technology innovation as presented in the works of Kebede (1993).

On the other hand, trainings and consultations are two (2) imperative factors shaping the structure, function and decision-making process of farmers’ interest to the project. The contribution of existing indigenous knowledge towards decision-making (e.g. on the magnitude of technologies used) also emphasize a crucial role to technology diffusion.

Farmers’ TE, income, and repayment significantly contributed to their economic wellbeing. The effect of education and extension were essential to influence production knowledge and technology diffusion. Becker (1990) argues that weak adoption of technology can be explained by different opportunity costs such as, the labor-time spent and special extension programs for family members with low off-farm employment opportunities.

In the region, where rural households have limited off-farm activities for self-employment, it is important to strengthen extension and education to help farmers understand technology diffusion and encourage them to explore to other agri-related income activities. Examples of intervention are the following: educate beneficiaries to venture to other high value crops and livestock that require less capital inputs from them. Aside from that, the presence of government extension workers, for at least twice (2) a month must be sustained by the concerned government agency to encourage more participation, knowledge sharing and technology diffusion.

Farmers’ TE can be further maintained when other enhancing inputs, such as cash or credit, are provided to them.

One of the challenges faced by government projects particularly in the rural districts of most developing countries is during its initial stage. Findings of the study suggest that the process and consequence of decision-making to production can be influence if strategic interventions are designed to enhance existing indigenous skills and knowledge of farmers.

In general, the success of technology diffusion can be attain when the following parameters are set: (i) intervention strategies that recognize experience, enterprise and region-specific potentials of farmers, (ii) existing skills that matches technology requirements, and (iii) production risks which shall be mitigated by the government.

Recommendations

Given the positive effect of the CPAR project in Region XI, the following recommendations are suggested:

1). Government must provide rural communities covered under the project access to basic education. The study has found that most of the beneficiaries of the project has very low school participation rate, which ranges only from grades one (1) to three (3). This problem could be due to the absence of government infrastructure facilities and services like school buildings, roads, and teachers for them to be able to benefit and improve their standard of living.

2). Project managers must consider a strategy that would utilize the indigenous knowledge of the community. The Department of Agriculture – Bureau of Agricultural Research (DA-BAR) must take into consideration the existing indigenous knowledge of the project beneficiaries and enhance these to ensure a more inclusive and participatory project approach.
3). Government should allocate funds to replicate the project to other areas in the region. Based on the findings, the project has collectively contributed to farmers’ wellbeing due to the increase of production TE, income and repayment rates as a consequence of technology diffusion introduced by the project. With these findings, government must provide funds to replicate this approach to other far-flung communities in the region to foster livelihood opportunities and combat poverty.

4). Strict compliance of commitment must religiously be observed by both regional and local agriculture extensions. Project managers must religiously exercise their commitments to the project. DA-BAR should introduce a mechanism that would channel mobility/transportation allowance to the local project extension workers in order to regularly visit and monitor the progress of the community. In every visit, the project extension workers should submit a structured form survey for the periodic assessment of the project.

5). Generation of baseline information through comprehensive data gathering should be in place before the project commence. It has been commonly observed that whenever a government local project is implemented, no prior baseline surveys were conducted by the project managers. This time, however, with the recent call of transparency and accountability, project managers of government projects should secure baseline survey of respondents to facilitate smooth flow of assessment during midterm and post evaluation.
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# APPENDICES

Table 1. Beneficiaries of CPAR Project in Region XI.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Barangay/Sitio</th>
<th>No. of beneficiaries</th>
<th>Crops (% to total)</th>
<th>Livestock (% to total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gov. Gen., Dvo Oriental</td>
<td>Tiblawan</td>
<td>20</td>
<td>6.90</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Chicote</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>San Isidro, Dvo Oriental</td>
<td>La Union</td>
<td>25</td>
<td>8.62</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Bitaogan</td>
<td>-</td>
<td>-</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42.27</td>
</tr>
<tr>
<td>Laak, ComVal</td>
<td>Cebodela</td>
<td>16</td>
<td>5.52</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sonlon</td>
<td>40</td>
<td>13.79</td>
<td>-</td>
</tr>
<tr>
<td>Sta. Maria, Dvo del Sur</td>
<td>San Isidro</td>
<td>25</td>
<td>8.62</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Mabuhay</td>
<td>20</td>
<td>6.90</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cadaatan</td>
<td>15</td>
<td>5.17</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>San Roque</td>
<td>21</td>
<td>7.24</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Baslawan</td>
<td>10</td>
<td>3.45</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Pong-pong</td>
<td>10</td>
<td>3.45</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Buka</td>
<td>8</td>
<td>2.76</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Kidandan</td>
<td>6</td>
<td>2.07</td>
<td>-</td>
</tr>
<tr>
<td>Malalag, Dvo del Sur</td>
<td>Tubig</td>
<td>9</td>
<td>3.10</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>San Isidro</td>
<td>35</td>
<td>12.07</td>
<td>-</td>
</tr>
<tr>
<td>Marilog Dist., Dvo City</td>
<td>Maluan</td>
<td>30</td>
<td>10.34</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ilian</td>
<td>-</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>290</td>
<td>97</td>
<td></td>
</tr>
</tbody>
</table>

Source: Department of Agriculture XI

Figure 1. Technical efficiency and socioeconomic variables
(no. of technologies adopted) = 3 (crops).
Note: * Significant at 0.05 percent level.

Figure 2. Technical efficiency and socioeconomic variables (no. of technologies adopted) = 4 (crops)

Figure 3. Technical efficiency of farmers under CPAR crops project in Region XI, Philippines.
Figure 4. Technical efficiency and socioeconomic variables (no. of technologies used) = 3 (livestock).

Figure 5. Technical efficiency and socioeconomic variables (no. of technologies used) = 4 (livestock).
Note: * Significant at 0.05 percent level

Figure 6. Technical efficiency of farmers under CPAR livestock project in Region XI, Philippines.