
Factors Influencing Self-Reliance in Rice Production, The Case of Small Farmers in Bataan, Philippines

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Abstract The study was intended to determine the factors influencing small farmers' self-reliance in rice production that would enhance the respondents' productivity without bringing harmful effects on the ecological system but rather for a sustainable agriculture. It was conducted in selected barangays of Bataan, Philippines with a total sample of 360 small farmer-respondents selected through stratified random sampling. Primary data were collected during the harvest seasons of the year 2011-2012 through structured interview involving farmers' level of self-reliance and the factors influencing the respondents' self-reliance. Descriptive and multiple regression analyses were employed to analyze the collected quantitative data. The findings revealed the following: 1) Farmers' level of self-reliance was generally high on the aspects of state of mind, social and economic affairs while moderate on the aspects of technology management and natural resource management. 2) Multiple regression analysis showed that educational attainment, household size, number of crops, managerial subsystem, use of own seeds, use of organic fertilizer and farm work were the factors influencing the respondents' self-reliance. Based on the results of the study, the number of crops is found to be the highest predictor variable that significantly influencing farmers' level of self-reliance. The research also provided recommendations for small farmers to enhance rice production through self-reliance on the aspects of state of mind, social affairs, technology management, natural resource management, and economic affairs.

Keywords: small farmers, self-reliance, multiple regression analysis, enhance rice production

Introduction

Attainment of self-reliance in rice-production is extremely an important goal that small farmers in every farm community should achieve to ensure food security, such that rice is always accessible and affordable to all. Farmers should be self-reliant in their agricultural production and self-sufficient in their own consumption and way of living (Abas *et al.*, 2013). Farming has to depend on optimal use of local resources, human and animal labor, ecological processes, recycling and site-specific genetic resources. Production levels have to be raised, but at the same time it is necessary to

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stop depletion and degradation of the resource base (soil, nutrients, vegetation cover, genetic resources, indigenous knowledge and social cohesion). Self-reliance, local economies, strong local institutions and local "agri-culture" are important to prevent loss of sustainability (Reijntjes and Manintveld, 1993).

At present, Bataan province contributes almost 5% of the region's total production of rice in Central Luzon (BAS, 2012). Despite of this short production level, most of its residents nevertheless are dependent on rice farming which serves as one of the chief sources of livelihood aside from fishing and fish processing (Gache, 2010). Although Bataan is considered the microcosm of Philippines society, it faces the worsening problem of rice deficiency and increasing prices (Calderon *et al.*, 2008) in which the diminishing trend in rice yield in most rice producing areas in Bataan province is due to uncertainties in production (BAO, 2012). Most rice production methods, however, have involved the heavy use of chemical fertilizers, pesticides, and other products, resulting in a variety of socioeconomic and environmental problems. Many farmers have experienced financial difficulties, health issues, significant time consumption, and other problems (Doi and Pitiwut, 2014). Small farmers in Bataan should consequently find suitable ways and means to solve problems in rice production without bringing harmful effects on the ecological system but rather for a sustainable agriculture.

There are social indicators that measure farmers' self-reliance (Pretty, 1995), which may contribute to the retention of the agricultural population in the countryside, as the main pre-condition of sustainability. Oktarina *et al.*, (2012) avowed that education levels have influence in managing farming activities; farmer with higher educational level can be able to make decisions at once if faced by several problems related to farming activities, thus making a farmer to increase his self-reliance. According to the OECD (1999), farmer's educational level and effective farm management as well as timely adoption of environmentally friendly management practices are positively correlated. Literature has long established the influence of formal education on managerial capabilities of farmers, especially concerning awareness about production alternatives and the decision-making process. In most cases, empirical evidence has pointed to the positive impact of education on improving farmers' efficiency and, consequently, productivity. This has formed the body of the general consensus on the impact of education on agricultural growth. In addition, social indicator household size or the number of family members may give significant information about the structure of agricultural household and it highlights the trend of the retention of farm population in the countryside. The size of the farmer's own family might become more important in determining the availability of family labor for farm work (Ojehomon, 2009). However, the study of Alam *et al.*, (2011) showed that the size of a

family had no significant impact on paddy fields. Regarding farmers' sources of income, non-farm sources of income are important for the rural poor families to achieve *self-reliance* for two reasons. First, the direct agricultural income obtained by the poor is not enough to sustain their livelihoods, either because of landlessness or because the land they own or lease is insufficient. Second, wage employment in agriculture is highly seasonal, so that the poor value non-farm sources as employment supplementation.

The key objective of agricultural development, involving sustainable intensification of rice production and location specific attempts on crop diversification in predominantly small farmer holdings of the country, has aimed at achieving self-sufficiency in food grains production in a sustainable manner by improving the productivity on a short and medium term basis. Another objective is to attain self-reliance in the longer-term (FAO, 2001). In other words, diversity reduces the risk of having nothing to harvest from the garden. Indigenous agriculture also reduces the risk of going into debt and losing land, because it is more self-reliant, and does not depend on obtaining credit to purchase expensive seeds, fertilizer, pesticides, and irrigation pumps (CPFE 1991).

The Principle of Self-Reliance emphasized that development of "Man" must be suitable to the geographical and social conditions and that there must be proper promotion of knowledge and modern technology. The developments must be based on the principles of sustainable conservation and the development of natural resources (Komthong, 2003). The following are important aspects of the principle of self-reliance: 1) **State of Mind** - One should be strong, self-reliant, compassionate, flexible, possess a good conscience and place public interests as a higher priority than one's own (Kast and Rosenzweig, 1979). It also involves the morality, sufficiency, and patience to solve problem by them. Other components are: a) self-confidence to feel that they can decide or determine their own goal and believe in their capability to do things successfully; b) responsibility including awareness of duty and results of their actions; c) initiative cooperation defined by rural people pay attention to help each other; and d) satisfaction and pride in themselves defined by happiness in their status and freedom in their own way (Rerkrai, 1984). 2) **Social Affairs** - People should help one another, strengthen the community, maintain unity and develop a learning process that stems from a stable foundation. The people apply local wisdom with prudence which focuses on capacity building with the spirit of sustainability (Kast and Rosenzweig, 1979). 3) **Natural Resource Management** - The country's resources need to be used efficiently and carefully to create sustainable benefits and to develop the nation's stability progressively (Kast and Rosenzweig, 1979). Natural resources must be productively used in which its utilization is equally associated with conservation as well as full recovery. Rural people should participate in

management of their natural resources such as planning, determining rules of use, decide the scale for utilization of their natural resources by themselves and can work with networks to conserve their natural resources and they can transfer ideas for value-added raw materials to youths and embed their understanding of conservation of their natural resources (UNDP, 2010; Dillon, 1992). 4) **Technology Management** - Technological development should be used appropriately while encouraging new developments to come from the villagers' local wisdom (Kast and Rosenzweig, 1979). Technology should be suitable for communities to use effectively and can be maintained by them and it must not cause any damage to environment (Kundaji, 2009; UNEP-UNCTAD, 2008). 5) **Economic Affairs** - One needs to increase earnings, reduce expenses, and pursue a decent life (Kast and Rosenzweig, 1979) There is a balance between income and expenses, sufficient income for a comfortable life. For example, they have enough food, clothing, shelter, and medicine. Moreover, they have enough money to save or invest for future plans (Rerkrai, 1984).

The prime objective of the study was to determine the factors influencing farmers' self-reliance of to enhance their productivity in an ecologically sound way. The sufficient economic concepts which focus on farmers' capacity building through self-reliance by mobilizing social capital, local wisdom, and natural resources for sustainable rural developments (Thaiembassy, 2009) can be selected as a policy option. Application of knowledge on technology with prudence and self-reliance is essential for improving their farm management practice and overcoming market uncertainties.

Materials and methods

The study was conducted in Bataan, Philippines (Figure 1) in which stratified random sampling was employed to select the respondents and the sampling was done to divide the representative population into groups based on their source of water for irrigation. Stratifying a population was necessary because the population is not homogeneous and the respondents are not uniformly distributed throughout the study area.



Figure 1. Location Map of Bataan Province and *selected sample municipalities

Four municipalities (Dinalupihan, Pilar, Hermosa, and Abucay) were selected in random during the first stage of sampling, then 5 barangays were randomly selected from each sample municipality. The last stage involved random selection of small farmers in each barangay from the stratified list since random sampling gives an equal probability to every individual to be selected, thus making a total sample size of 360. Data were collected through utilization of interview schedule that composed of structured questionnaires as the main research tool during the harvest seasons of year 2011-2012. The obtained data was analyzed based on the objectives of the study by using descriptive statistics to describe the variables in the study. Multiple regression analysis was employed to determine the predictor variables related to self-reliance.

Results and Discussion

The majority of the respondents belonged to the age bracket of 41-50 indicating that they are in their productive years to do rice farming activities wherein male farmers dominate females in the study area while most of the respondents had 0.5 -1.0 hectare of land.

Table 1 shows the overall mean score of the respondents' level of self-reliance is 3.414 which means "high" degree and this implies that the majority of the small farmers in Bataan practiced their way of living in a state of self-reliant sustainability involving a natural simple lifestyle for their basic needs with a high degree of responsibility and believe in their own capability to do things successfully with morality and patience in solving their own problems. Moreover, a large portion of the respondents had fair sense of responsibility in choosing and using appropriate

technologies that are environmentally sound for their self-reliant sustainability. They had moderate sense of capability of taking the full accountability for the management of these technologies not only to operate them but also understand, adapt, and develop further according to their basic needs in rice farming activities.

Table 1. Farmers’ Level of Self-Reliance

Aspect Criteria	Mean Score
State of Mind High	3.858
Social Affairs High	3.603
Technology Management Moderate	3.016
Natural Resource Management Moderate	3.056
Economic Affairs High	3.540
Overall Mean	3.414
	High

Table 2 reflects the results of multiple regression analysis using the enter-remove method, a significant model emerged (F-statistics for R^2 , $p < 0.05$ and $p < 0.001$) in which substantial variables including the t and sig (p) values of the independent variables with the farmers’ level of self-reliance (dependent variable) give a rough indication of the impact of each predictor (independent variable), that is, a big absolute value t and small value p suggests that a predictor variable is having a large impact on the criterion variable (dependent variable). Based on the multiple regression model, the coefficient of determination R and the value R^2 which are 0.713 and 0.707 respectively, represent the predictor of the explanatory variables which account that 71.3 % variance in the dependent variable indicating a very strong relationship among the variables and this implies the appropriateness of the model. This further indicates a high relationship between dependent variable (farmers’ level of self-reliance) and the seven predictors of explanatory variables, such as educational attainment, household size, number of crops, managerial subsystem, use of own seeds, use of organic fertilizer, and farm work.

Table 2. Factors Influencing Respondents' Self-Reliance

Significant Level Independent Variable (sig)	Unstandardized Coefficients		Standardized Coefficient	Regression Coefficient	
	B	Std. Error	Beta	t-value	
Constant	1.374	0.644		1.586	0.114
Educational attainment	0.005	0.018	0.276	2.965	0.003**
Household size	0.123	0.030	0.097	2.778	0.037*
Total annual income	-9.724E-05	0.000	-0.131	-0.980	0.326
Number of crops	0.544	0.081	0.460	6.698	0.000**
Used recommended variety of seeds in the area	0.173	0.018	0.000	-0.004	0.997
Use certified seeds	0.059	0.077	0.045	0.758	0.449
Use of own seeds	0.183	0.086	0.108	2.141	0.033*
Use of organic fertilizers	0.028	0.073	0.019	2.383	0.002**
Goals & values subsystem	0.047	0.074	0.040	0.641	0.522
Technical subsystem	0.046	0.078	0.039	0.588	0.577
Organizational structural subsystem	-0.106	0.074	-0.106	-1.444	0.150
Managerial subsystem	0.089	0.043	0.111	2.060	0.040*
Informal structural subsystem	0.336	0.068	0.033	0.529	0.597
Farm work	0.003	0.002	0.603	5.734	0.000**
Off-farm work	-0.002	0.005	-0.036	-0.411	0.682
Leisure	-0.001	0.005	-0.010	-0.294	0.769

R (Regression Coefficient Value) = 0.713
R Squared (R²) = 0.707
Adjusted R Squared (R²) = 0.844
level
significant at .05 level

F-statistics (for R²) = .0000**
** = significant at .01
* =

Dependent Variable: Farmers'
level of self-reliance

Table 2 reveals that the Number of Crops cultivated by small farmer respondents aside from rice with a standardized regression coefficient of 0.460, (b = 0.460, at $p \leq 0.01$) has the biggest t-value (6.698) among other factors indicating to be the highest predictor variable that is positively influencing farmers' level of self-reliance. This means that additional of one crop cultivated by the farmers aside from rice crop increases their level of self-reliance by 46 %. In other words, an increase in the number of crops cultivated or the practice of multi cropping leads to an increase in farm productivity and eventually profit per unit land area in selected crops, thus farmers become more productive and more self-reliant.

Data from table 2 indicate that predictor variable Farm Work is significantly related to self-reliance as indicated by its standardized regression coefficient of 0.603, (b= 0.603, $p \leq 0.01$) with a t-value of 5.734, being the second highest factor influencing farmers' self-reliance. This implies that an increase in allocation of time to farm work leads to self-reliance in term of agricultural production. A change of farm work's time

allocation by 1 per cent translates into a change in variance for self-reliance by 60.3 %.

It can be observed from table 2 that Educational Attainment has standardized regression coefficient of 0.276, ($b = 0.276$, $p \leq 0.01$). Increase in respondents' educational attainment by one level translates into a change in variance for self-reliance by 27.6 %. This indicates that education empowers people to be independent thinkers and to reason things out before making any decision and ignorance enslaves people's minds, making it very difficult for them to reason things out. Without education they cannot participate fully in the implementation of policies which affect their lives because they do not understand. Education levels have influence in managing farming activities; farmer with higher educational level can be able to make decisions at once if faced by several problems related to farming activities, thus making a farmer to increase his self-reliance which conforms with the findings of Oktarina *et al.* (2012).

Predictor variable Household Size has standardized regression coefficient of 0.097, ($b = 0.097$, $p \leq 0.05$). This indicates that an additional of one household member leads to an increase in farmer's level of self-reliance by 9.7 %. This is expected relationship because large household size is considered a great source of human labor for small farmers and morale boosters to improve rice farming, thus there is no need to seek additional helpers to assist them in managing their farm which implies low cost of labor while some household members find additional income which may be generated from agricultural or non-agricultural and off-farm work to meet the needs of their family, and this is an indicator of self-reliance in terms of their productivity.

It can also be observed from table 2 that predictor variable Use of Own Seeds as respondents' adoption of rice crop management technology/practice has a standardized regression coefficient of 0.108, ($b = 0.108$, $p \leq 0.05$). Increase in the adoption of such rice crop management technology/practice leads to an increase in farmers' level of self-reliance. The reason is that, the respondents have been, and are still able to do so because rice is a self-pollinating crop and they are assured that there will be no significant change in performance after seasons of repeatedly using pure seeds. This, together with inherent knowledge systems, practices and experiences gained in rice farming including the innovated technologies, enables them to sustain their rice-farming culture. As Kundaji (2009) stressed, if the integrity of farming is to be restored and preserved, it is crucial for farmers to resist the corporate grip over seeds and regain and retain self-reliance in this and other inputs.

Predictor variable Use of Organic Fertilizer was found to be positively influencing and related to self-reliance. This implies that using organic fertilizer promotes the use of renewable organic resources available in the farm to maintain the soil productivity. According to UNEP-UNCTAD

(2008) it is most likely a holistic management technology approach in agriculture which promotes and improves the health of agro-ecosystem related to biodiversity. Furthermore, the use of organic fertilizer reduces farmers' dependence on external costly inputs, thus minimizing the cost of farm inputs which may increase their financial viability in the long run and eventually reduce their vulnerability and consequently enhances their self-reliance in crop production.

As shown in the table, farmers' perceptions toward farm system on the aspect "Managerial subsystem" as a predictor have a standardized regression coefficient of 0.111, ($b = 0.111$, $p \leq 0.05$) which statistically indicates that a change of farmers' insight about management aspect of the farm system by one unit leads to a change in variance of self-reliance by 11.1 %. This implies that farmer's good and efficient decision-making capability in relation to agricultural production tends to enhance farmer's productivity, hence increases farmer's level of self-reliance. Farmer needs to enhance his managerial skills in order to respond to the requirements of agricultural production and environmental conditions. As Dillon (1992) avowed, the central role of management is clearly emphasized and the components of the managerial subsystem will generally be the persons involved in management, their knowledge, experience, judgments and preferences, and the information systems used in exercising management.

Since the rest of the predictors had $p \geq 0.05$ which implies negative impact on the dependent variable, therefore the regression model can be written as:

$$Y = 1.586 + 2.965X_1 + 2.778X_2 + 6.698X_4 + 2.141X_7 + 2.383X_8 + 2.060X_{12} + 5.734X_{14}$$

Where: Y = farmers' level of self-reliance, X_1 = educational attainment, X_2 = household size, X_4 = number of crops, X_7 = use of own seeds, X_8 = use of organic fertilizer, X_{12} = managerial subsystem, and X_{14} = farm work.

Conclusion

Based on the results, the following conclusions may be drawn:

1. The number of crops cultivated by farmers is found to be the highest predictor variable that is positively affecting farmers' level of self-reliance. An increase in the number of crops cultivated aside from rice leads to diversification of farming to ensure continuous and year-round harvest for food and income to spread the risk of crop failure due to pests and disease occurrence and during times of adversities, thus farmers become more productive and more self-reliant.

2. Farmers' allocation of time to farm work is significantly influencing their level of self-reliance. The higher the rate of time allotted to farm work, the higher would be the level of self-reliance, that is, the more

time farmers' spend to work in the farm, the more they become industrious and diversified and hence become more self-reliant.

3. Educational attainment is directly related to farmers' level of self-reliance. The higher the farmer's educational level, the more they become independent thinkers to reason things out before making any decision related to farm management, hence becomes more self-reliant.

4. Household size is significantly influencing farmers' level of self-reliance. The larger the household size, the higher the level of self-reliance due to availability of human labor so no need to seek additional helpers to assist in managing their farm which implies low cost of labor and this is an indication of self-reliance in terms of farmers' productivity.

5. The use of organic fertilizer is positively related to farmers' level of self-reliance. High adoption on the use of organic fertilizer in rice cultivation promotes the use of renewable organic resources available in the farm to maintain the soil productivity which enhances farmers' management of conserving natural resources, thus reduces farmers' dependence on external costly inputs which minimizes the cost of farm inputs that may eventually increase their financial viability and consequently enhances their self-reliance in crop production.

6. The positive perceptions of farmers toward farm system on the aspect of managerial subsystem and farmers' level of self-reliance are directly related to each other. The more positive is the farmers' views about managerial aspect of the farm system leads to positive attitude and mindset to manage their farm through efficient planning, organizing and controlling to improve farm management practices to enhance rice yield and realize economic benefits for quality life, hence farmers become more self-reliant.

7. The use of own seeds in rice farming is directly related to farmers' level of self-reliance. High adoption of selecting and using farmers' seeds in rice cultivation is more independent and more ecologically sound production methods showing their ability to naturally adapt varieties to their own geographical locations, to conserve, renew and increase biodiversity, to reconstitute the carbonized organic matter stored in soil to produce sufficient quality and quantity of rice at a lower cost and with lower intake requirements, thus farmers become more self-reliant.

The researcher recommended the following to enhance farmer's self-reliance : **State of mind** – Changing farmers' mindset and values to become self-reliant and get rid of dependency on using external inputs; adoption of local wisdom combined with technology innovations is essential to improve farm management practices through sustainable, natural, green and organic rice cultivation, obtained from observations, analysis of the field situation including experiences and problems encountered in order to respond to the requirements of agricultural production and ecological conditions. **Social affairs** – Active participation

in community activities can give some benefits to farmers, especially in terms of exchange of labor among family members, and the sharing of information and knowledge in production, marketing and possible sources of funds; b) Make productive use of people's collective capacities to work together to solve common agricultural and natural resource problems..

Technology affairs – a) Minimize the use of those agro-chemical inputs that can cause harm to the environment and to the health of farmers and consumers; and b) Reinvent traditional sustainable technologies and combine with new knowledge to develop a more sustainable production system.

Natural resource management – Increase awareness of utilizing sustainable natural resource management and environmentally friendly rice farming activities to help reduce GHG emissions.

Economic affairs – a) Optimize time devoted to farm work to diversify income by producing different crops aside from rice and livestock and also if possible engage in off-farm work or non-agricultural activities; b) Productive use of the knowledge and skills of farmers, substituting human capital for costly external inputs such as chemical fertilizers and pesticides to minimize cost of production; c) Knowledge on basic farm accounting management, cash flow analysis as well as risk management so that farmers can look for a worst scenario and production of farmer's own consumption using the surplus to produce cash sales and a variety of crops to diversify risks, cutting unnecessary expenditures and preparing savings to cash shortfalls, particularly for adverse situation.

Finally, future research should be undertaken to formulate appropriate strategies on enhancing self-reliance in rice production and a follow-up participatory action research should be conducted to reinforce the study by implementing the formulated strategies to take into account the impact of the rice farming interventions with the purpose of developing and maintaining social and personal interactions that are none exploitative and enhance the social and emotional lives of all people who participate.

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