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Factors influencing organic farm income in Chitwan district of Nepal

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Premium price is one of the most attractive features of organic farming but having access to one possess various difficulties, especially in the context of developing countries. The objective of this study is to analyze factors impacting involvement in marketing of crops and intensity of income generation therein between organic and conventional farmers by taking into consideration the existence of premium market. It was conducted in semi-urban Chitwan district of Nepal where group conversion to organic farming exists. Data from 285 respondents, selected using stratified sampling method, were analyzed using probit and ordinary least square model. This study finds that income from organic farming is less than conventional farming because production per hectare, commercialization rate and price at which the crops are sold per unit is higher for conventional farm, and access to premium market is very limited. This should be the primary focus for making organic farming monetarily attractive.

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1. Introduction

Nepal is predominantly an agriculture-based economy that accounts for 36% of the gross domestic product (GDP) and employs 66% of the 26.5 million people (MoAD, 2015). Therefore, the progress in this sector is very much essential for improving lives of the majority and for the development of the economy as a whole. Among others, monetary benefit is one of the major driving forces for the farmers as it provides resources to re/invest in not just farming activities but other sectors such as education and health as well which ultimately improves their living standard. According to Ramdhani and Santosa (2012), economic justification plays an important role for smallholder farmers than social and environmental benefits, to sustain with their farming enterprise in a long run. Especially in developing countries, where smallholder farmers contribute over 80 percent of food consumed, income still plays a vital role followed by environmental, technological, social and political aspect (IFAD, 2013). Within this sector, there is a growing interest in income generation from organic farming compared to conventional farming.

Conventional farming is known for its profit orientation. Although massive breakthrough in agricultural technologies backed by modern plant breeding, improved agronomy, and the growth of conventional fertilizers and modern pesticides brought remarkable changes in food productivity (IFPRI, 2002), such conventional means of production was later criticized for it brought environmental, economic and social concerns. Excessive and inappropriate use of chemical fertilizers and pesticides polluted ground water, streams, rivers, and oceans; degraded land; caused professional hazard; killed beneficial insects and other wildlife; and affected those who consumed it through food residue (DFID, 2004; Kassie & Zikhali, 2009). Organic farming, on the other hand, is conceived to be one of the most sustainable approach to food production system, an alternative to ecologically unsound practices of conventional farming. It combines tradition, innovation and science to adapt to local conditions and sustain the health of soil, ecosystem and people (IFOAM, 2014a). In the growing context of climate change, organic farming is praised for its ability to be

resilient and at the same time mitigate and adapt to the changing climate (IFOAM, 2009). Organic farming, though provides social and environmental benefits, the argument over monetary return is the major bottleneck for its large scale adoption.

In case of organic farming, it is the probability of getting price premium that makes this endeavor a profitable one than conventional farming. In many scenarios income increase through improved yield along with the combination of reduced cost. But it is the premium that attracts farmers to shift to organic farming which usually makes up for any yield or productivity losses that may incur during the transition (Giovannucci, 2005). In Nepal, in addition to the export market for organic products (DoAE, 2006; Tamang, Dhital, & Acharya, 2011; Pokhrel & Pant, 2009), local market in urban areas is also on rise (FiBL & IFOAM, 2009; FiBL & IFOAM, 2010). However, marketing is usually done unsystematically on the basis of community trust (Sharma, 2005). Farmers are able to get premium price based on this mutual trust irrespetcive of the fact that the product is not certified. And in some cases, though the farm is certified, farmers are not able to get premium price because of poor marketing system and skill (Singh & Maharjan, 2013). Thus, the profitability of organic farming through access to premium market cannot be simply explained by the fact that it is certified especially for local market in the context of Nepal.

The objective of this study is to analyze market involvement of organic farmers for the purpose of selling crops and an extent to which they are able to generate income thereof. The purpose is also to relate with conventional farmers so as to evaluate how it performs comparatively by taking into consideration the existence of premium market, either local or export based. By analyzing the difference in the level of income received under various farming systems, we will be able to understand the opportunities and challenges of market for organic products. Farm households can be observed as an autonomous entity that has capacity to make decision to the best of their interest considering their limited resources. Therefore, the study also assesses various demographic and farm characteristics that defines the ability and preparedness of farmers to sell crops in the market

for monetary income. Recognizing such traits will assist in making decisions for making this farming system monetarily attractive for the farmers.

For reasons mentioned above, this study assesses the gross farm cash income (hereafter referred to as 'cash income'), i.e. the monetary income obtained from selling cereals, vegetables, spices, pulses, oil seed and/or fruits in the market without the deduction of the cost incurred under two different farming systems, i.e., organic and conventional farming.

2. Prospects and challenges of organic market in developing countries including Nepal

The worldwide market share for organic products is growing immensely reaching US$ 64 billion in 2012, an increase of 156% compared to a decade earlier (FiBL & IFOAM, 2005; FiBL & IFOAM, 2014). Smallholder farmers from developing countries are able to gain more profit through integration into the global organic market that is more intense in developed countries. But they are also prone to facing numerous other difficulties resulting from lack of adequate financing, management skills, consistency in workforce, logistics, partnership and cooperation, and cultural differences. The technical aspects of marketing organic products on a global scale such as obtaining and maintaining internationally recognized standards, high level of record keeping, delay in procuring certification, cost of certification and annual re-inspection becomes major obstacles for smallholder farmers (Barrett, Browne, Harris, & Cadoret, 2002; Harris, Browne, Barrett, & Cadoret, 2001; Halberg, Alroe, Knudsen, & Kristensen, 2006). Moreover, globalization of organic food market is encouraging specialization, capital intensification, export orientation, increased processing, packaging and long-distance transporting that is controlled by few large corporate retails. It reduces diversity, increases risk of a single crop failure and limits natural nutrient cycling processes which could have been achieved through multiple/intercropping system. Market concentration also exposes farmers in case of price fluctuation or market failure and control of price by very few retailers (Kilcher, Eisenring, & Menon, 2008; Knudsen, 2010; Halberg, Alroe, Knudsen, & Kristensen, 2006).

Thus, it is reasonable to argue that local organic market equally plays a significant role, especially for smallholder farmers who cannot afford to take on huge risks that comes with globalization. Besides local organic market is flourishing in developing countries, especially in urban areas where consumers are becoming more aware about its health benefits and their ability to purchase getting higher (BIOFACH, 2014a; BIOFACH, 2014b; FiBL & IFOAM, 2012; FiBL & IFOAM, 2013; FiBL & IFOAM, 2014; IFOAM, 2014b). However, in developing countries it is mainly characterized by absence of or slow steps towards implementing national regulation, lack of knowledge among consumers, lack of accessibility and authenticity, and deterring consumers from buying due to its expensiveness (IFOAM, 2003). Though organic products are usually not certified, it can fetch higher price based on consumers' willingness-to-pay in a local market in addition to providing with other benefits of increased productivity, saving on purchase of external inputs and transport cost, and getting up-close with the consumers (FAO, 2014; Halberg, Alroe, Knudsen, & Kristensen, 2006).

In case of Nepal, organic sector is small and the overall development remains quiet slow (Bhatta, Doppler, & KC, 2008) but nevertheless it is growing gradually (Adhikari, 2011). Currently it accounts for 0.12% of the total agricultural land (FiBL & IFOAM, 2014). Some of the organic products like tea, coffee, honey, large cardamom, ginger and medicinal herbs are already exported as well (DoAE, 2006; Tamang, Dhital, & Acharya, 2011; Pokhrel & Pant, 2009). The prospect of selling organic products in an international market has further increased after Nepal became a member of World Trade Organization (WTO) which identifies it as a potential export crop (Bhandari, 2006; Pant, 2006). The local organic market is also on rise with diverse channels such as ad hoc organic bazaars, small retail outlets, supermarket corners, multi-level direct selling and internet marketing (FiBL & IFOAM, 2009; FiBL & IFOAM, 2010). The government has also enacted National Standards of Organic Agriculture Production and Processing 2007 (2064) which is an important step as National Accreditation Body is now responsible for maintaining and enforcing organic standards and organic certifiers. Although implementing the standard has not been realized accordingly as setting standard with certification mechanism for each product while

at the same time making stakeholders aware of it is complicated and expensive (Pokhrel & Pant, 2009). It has also collaborated under the label of Certification Alliance (CertAll) which is the alliance of private and government linked certification bodies for low cost inspection and certification (FiBL & IFOAM, 2011). Nevertheless, still large part of the local market depends on producers, processors, distributors and consumers interlinked through loose marketing networks (Sharma, 2005).

3. Study area and sample design

This study was conducted in Chitwan district, which lies in the southern part of Nepal. Geographically, Nepal is divided into three ecological zones in which the southern part is basically a plain area, also known as Tarai region, with elevation below 300 m and accounting for 20.1% of the total land area (Figure 1). Even so, 34% of the total cultivable land lies in this part as it has the most fertile soil compared to other parts of the country (FAO, 2013). Indiscriminate use of agro-chemicals in Chitwan district is very much existent but in some areas the concept of organic farming has also been emerging with the initiation of few enthusiastic farmers who started organic farming for health benefits and reinstating soil fertility that had been affected from long term use of conventional inputs. At present, group conversion of organic farming is visible mainly in three VDCs (Village Development Committees, the smallest administrative unit), i.e. Phoolbari, Shivanagar and Mangalpur (Figure 2). The support from various non-governmental and government organizations has deepened the activities enriching the movement of organic farming. For instance, farmers are provided training related to organic farming from general to more specific ones such as preparation of bio-fertilizers and pesticides, market promotion and network development; distribute pamphlets on Plant Health and Clinic Initiative; set up hoarding boards for raising awareness; develop resource center; operate Farmer's Field School (FFS); technology

development and transfer; and other extension services (SECARD-Nepal, 2011). Thus, these three VDCs were chosen as research sites.

Organic farming, in this study, implies a farming system in which use of agro-chemical is completely excluded but rely on livestock manure as a fertilizer and bio-pesticides for pest management. Conventional farming, on the other hand, is a farming system in which farmers rely on various chemical inputs in addition to livestock manure. Chemical fertilizers like urea, phosphorus and potassium; pesticides such as insecticide, weedicide and fungicide; and micro-nutrients such as zinc, vitamin, plant hormone and boron were found to be used by conventional farmers. However, the nature of conventional farmers is such that they do not use such chemical inputs on all the crops they cultivate, but on the basis of necessity. The most common characteristics of such farmers are segregating farmland for the purpose of organic and conventional farming. This is generally true for vegetable farming which farmers grow organically only for home consumption and is mainly done on a small portion of their land but use chemical fertilizers and pesticides on cereal crops which is rather produced on a larger area such as rice, maize, wheat and oat; and even oil seed crop such as mustard. For some it is difficult to grow certain crops, at least during the time of the survey, without the use of pesticides. For example, most farmers faced the problem of late blight disease in potato for which using pesticide was inevitable. Other such crops are tomato, kidney bean, spinach, cowpea and mustard greens. For others, they chose to grow commercially viable crops like carrot through conventional means for easier management of weeds and pests as well as to intensify production.

The survey was conducted in two phases. The first phase of field survey was done from February, 2013 till March, 2013 to collect household data using small-scale individual household survey and to observe first-hand the status quo of the organic farming. A sample of 300 individual households (initially to choose equal number of organic and conventional farmers) were selected using stratified sampling method with group membership as strata and were interviewed through semi-structured questionnaire (after excluding the outliers, 285 respondents were taken for the analysis).

In all three VDCs, a group has been established particularly for the purpose of organic farming. In Phoolbari VDC, a cooperative has been formed with currently 125 members whereas in rest of the two VDCs, an informal group has been formed with 44 members in Shivanagar VDC and 90 members in Mangalpur VDC which consists of three groups with 30 members in each. The members of such formed groups thus became our potential respondents, under the hypothesis that all farmers belonging to such group would be organic farmers. Likewise it was also assumed that all farmers not belonging to such group (non-members) would be conventional farmers. However, during the field survey it was realized that not all the farmers belonging to such group are actually practicing organic farming. Similarly just because a farmer is a non-member, did not mean that all of them practiced conventional farming. To make better comparison of farmers' behavior within and outside such group, non-member farmers were selected randomly based on close geographical proximity with those respondents belonging to a group. The follow-up survey (second phase) to gather additional information through participatory methods such as focal group discussion and key-informant interview was done from October, 2014 till November, 2014. Focal group discussions were conducted three times in Phoolbari VDC because of the comparatively higher number of member farmers, once in Shivanagar VDC and again three times in Mangalpur VDC (once for each group established for the purpose of organic farming) to get collective opinions. Key-informant interviews were conducted with representatives from government and non-government officials, certifiers, traders, retailers and local leaders.

The final sample based on three VDCs, farming systems and group-membership is provided in Table 1. As a result, 32% of respondents are organic farmers and 68% are conventional farmers. About 50% of the respondents were selected from Phoolbari VDC because of comparatively higher number of member farmers. Accordingly, 47% of the respondents belonged to a group while 53% are non-group members. Within Phoolbari VDC, 55% are members and 45% are non-member farmers (Table 2). Similarly, 35% and 65% in Shivanagar VDC and 40% and 60% in Mangalpur VDC are group and non-group members, respectively.

4. Descriptive analysis

The descriptive analysis through chi-square test of 285 households' various demographic and farm characteristics (categorical variables) has been provided in Table 3. It is found that only 8% of the households are female-headed which is comprehensible as Nepalese society is mainly patriarchal-based. Head of households (HHHs) are those who are responsible for making key decisions in the family matters. Some 7% of HHHs do not have any educational background or are illiterate[1], 30% of them identified themselves as having only a basic[2] education, 41% had education till secondary and below[3], 11% had higher secondary[4] education, 9% had bachelor's degree and only 3% of them had master's level education.

The majority (58%) of HHHs still recognize farming as their primary occupation. Most of the households owned the land but about 21% of the farmers either rented in for cash or crop sharing, or mortgaged in the land for farming in addition to their owned land. Some 21% of the farmers derived income solely from the farm activities while others derived from various non-farm activities such as wage labor, service, business, rent, remittance and pension. Therefore, it can be implied that most of the households have other sources of income besides farming. Most of the households have livestock while 13% do not have any. About 47% of the respondents belong to in/formal group formed for the purpose of organic farming. Some 44% of the households have received training related to organic farming which is mainly provided by these groups but not confined within it. About half of the respondents are from Phoolbari VDC because of comparatively higher number of member farmers within it. Only 10% of the farmers have taken credit for the purpose of farming from various in/formal sources. Some 23% of the farmers know the final price at which consumers buy their produces while 77% of them sell through middlemen and thus do not have any direct interaction with consumers.

Table 4 provides descriptive analysis of (continuous) variables through t-test. The average age of HHH is 50 years old. The average education attainment of HHH is 7 years. The organic farmers have on average 3 years of organic farming experience which means that most of the farmers have recently converted to organic farming. On average farmers have received training related to organic farming ateast once. There is a significant difference between organic and conventional farmers receiving such training. Labor availability is calculated as labor force unit (LFU)[5] which is a standard unit for calculating labor force. In this study, LFU excludes the household member/s who have migrated whether temporarily or permanently and reflects only those who are available in the household. As a result, households have LFU less than 5 on average. Likewise, livestock unit (LSU)[6] is a standard way of measuring livestock holding. In this study, households have 1.94 LSU on average. Respondents have on average 0.5 hectare (ha) land area which means that most of the farmers in the study areas are smallholders. Farmers earned higher non-farm income on average than from farm activities. There is not a significant difference in distance to facilities such as agrovet and market, between and within farmers of two categories of farming systems because the samples are confined within adjoining VDCs.

The commercialization rate is calculated as total crops sold to those produced. On average, farmers have 0.71 commercialization rate. There is a significant difference in cash income between these two farming systems. Conventional farmers have on average higher cash income than organic farmers. Finally, Shannon diversity index (SHDI) has been used to calculate crop diversity index which captures both richness and evenness of species diversity. Richness implies the number of species cultivated whereas evenness refers to how evenly the cultivated area is distributed to various species. Species richness is the simplest way to measure the diversity but evenness captures a broader picture by taking relative abundance of species that enriches diversity (Zhang, et al., 2012). Wilsey and Potvin (2000) found that species evenness has more linear relationship with total productivity than with species richness. Including these two variables can give better understanding of the status of diversity. SHDI has been used in different studies for assessing

diversity of numerous kinds (Sipiläinen, Marklund, & Huhtala, 2008; Edesi, Malle, Adamson, Lauringson, & Kuht, 2012).

5. Expected relation of selected variables

The primary issue of this paper is to analyze how cash income from organic farm would compare with conventional farm. As mentioned above, premium price is the most attractive feature for organic farmers but from the field survey it is known that the premium market for organic products in the local area is non-existent. However, some farmers are able to export their produces in other cities such as Kathmandu and Lalitpur (Figure 1) where premium market does exist (Table 5). Such market is only limited to cereal crops such as rice, maize, wheat and buckwheat, and other non-perishable or with longer shelve life crops/product like kidney bean, carrot and honey. Most vegetables, as of present, could not be exported due to its easily perishable nature and lack of other facilities to maintain its quality. Thus, currently only 7% of the crops produced organically are sold in the premium market. As for the rest, they are sold in the local market at the same price as conventional products. With this scenario, it is expected that organic farmers could have either higher or lower cash income compared to conventional farmers (Table 6).

Several literatures were reviewed to hypothesize the influence of selected demographic and farm characteristics related variables on the cash income. Since Nepalese society is patriarchal-based, it is expected that male-headed households are more willing to be involved in the market and earn higher cash income therein. With age comes experience (Alexopoulosa, Koutsouris, & Tzouramani, 2010) and thus it is also expected to have positive impact on cash income as well as they will have more knowledge on the marketable crops and marketing skill. Education might have a negative impact on a farm cash income, but probably not on the total income since more educated people switch occupation to be better compensated for their work. On the other hand, it could also have impacted positively on agricultural productivity and indirectly as an external source of

income for risk aversion and to overcome credit constraints in farming (Mahmudul, Ishida, & Taniguchi, 2003; Weir, 1999). Similar relation of non-farm income to cash income from farm activities is expected, that is it could either reduce the significance of having to earn through farm activities or it could actually contribute as a credit relief or financial support for expanding the marketing activities. Family size has positive effect on income, as it indicates labor availability for performing farming activities including those realted to marketing and hence increases the farm productivity and cash income (Adil, Badar, & Sher, 2004; Parvin & Akteruzzaman, 2012). Livestock has positive effect on cash income as it is meant to improve productivity and hence making available excess amount for marketing (Adil, Badar, & Sher, 2004). Farm size also has positive relationship to cash income as people who have more land can produce more crops and earn more money from selling the crops (Rahman, 2010; Mahmudul, Ishida, & Taniguchi, 2003). Farm income represents both monetary and non-monetary valuation of farm outcome and it is expected that it has positive relation to earning cash income. Although it largely denotes farm size by indicating that crops are cultivated on a non-subsistence basis, it also includes the issue of cultivating high-market value crops, thus motivating selling more crops. Those who have rented the farm land could have either positive or negative relation to cash income because it either triggers farmers to generate more income for having to pay out rent or restrict such activity because of limited amount left for selling after paying the rent especially in case of crop sharing.

Various other factors such as membership and training are expected to complement the capacity, skill and information required for improving cash income as shown by Adil, Badar, & Sher (2004) that complementary factors like seed, fertilizer and irrigation cost can have positive effect on income of farmers. In this regard, agrovet and market are also important associations through which farmers can improve their farming output by purchasing various inputs and marketing performance through information and knowledge generation and hence the cash income. An agrovet is a place where products for agricultural inputs (seeds, fertilizers, pesticides, etc.) and equipment, and livestock such as veterinary medicine could be found. Thus, farther these centers are to the farm household, lower the cash income is to be expected. Farmers who used the credit

facility (borrowed the money) allocated more land to different crops and fruit varieties compared to non-borrowers. This had a positive effect on crop yield and thus increased income significantly (Shah, Khan, Jehanzeb, & Khan, 2008). It is also expected to have similar impact on cash income by intensifying the marketing activities. Besides these, other variables considered are experience of practicing organic farming, primary occupation of household head and knowing the price paid by the consumers for various agricultural products, all of which are expected to have positive relation to cash income. It is assumed that those having longer experience of practicing organic farming would have generated the knowledge on marketable values of organic products and would be involved more into selling. Farmers who rely on farming as their primary occupation would be more determined to earn higher income. On the other hand, farmers who know the price of crops paid by the consumers is expected to make informed decision on which crops to produce and market.

This study takes the rate of diversification and commercialization at the household level to assess their impact on cash income. A study by Padmavathy & Poyyamoli (2012) showed that organic farm will have higher gross income because of higher diversity of saleable crops and so crop diversification or higher SHDI is expected to have positive impact on the cash income. Commercialization is expected to have positive impact on the cash income as well, as the main purpose of it is to reduce cost and increase income. Finally Phoobari VDC is expected to have higher cash income compared to farmers in other VDCs because the intensity of activities through the group is found to be more during field survey.

6. Empirical model

This study assesses gross farm cash income at individual household level. The sample is such that there are number of households who are not engaged in selling their farm products, meaning they utilize their produces solely for own household consumption. As a result, although ordinary least

square (OLS) is the most frequently used model for fitting the regression line, it could give biased parameter estimates arising from a missing data problem. The Heckman selection model has been introduced to address this problem of sample selection where only partial observation is made from the outcome variable (Heckman, 1979). It estimates a two stage model. The first one is called selection equation (or probit model) which shows the impact of explanatory variables on probability of whether household earns cash income or not from selling crops. The second one is called outcome equation (or OLS model) that predicts the impact of explanatory variables on the degree to which households are able to earn as a result of selling crops. The second stage also includes an additional (control) variable called the inverse Mills ratio that is derived from the probit estimate (or the first model). An inverse Mills ratio or lambda is the ratio of the probability density function to the cumulative distribution function of a distribution and is used to reflect the issues of possible selection bias.

As per the regression rule, first the diagnostic tests were carried out to check the problem of multicollinearity and heteroskedasticity in the data (Annex I). To see if there is a problem of multicollinearity, Variation inflation factor (VIF) and correlation coefficient test were carried out. VIF gave a value of 1.55 which is below 10 suggesting that multicollinearity among the variables does not exist. Likewise, variables with high correlation coefficient are dropped accordingly in the model. Breusch-Pagan/Cook-Weisberg test, on the other hand, rejected null hypothesis of homosckedasticity, meaning that there are linear forms of heteroskedasticity. An extended form of Breusch-Pagan/Cook-Weisberg test, White's test, was also conducted to see if there are other forms of heteroskedasticity besides the linear form. The result showed insignificant P-value, accepting the null hypothesis of homoscedasticity. To correct heteroskedasticity of any kind, following Nhemachena and Hassan (2007), model estimation was conducted using robust standard errors. Using robust standard errors, it neither changes the significance of the model nor the coefficients, but gives relatively accurate P values and is an effective way of dealing with heteroskedasticity (Wooldridge, 2006).

The final model was chosen by selecting the variables that best explains the dependent variable. When Heckman selection model was applied in our data, it gave lambda value of -7523.596 with insignificant p-value (0.635). Since lambda is a product of rho and sigma (where rho is the correlation between the errors in the selection and outcome equations and sigma is the error from the outcome equation), it can be implied that the problem of sample selection bias remains minimal. According to Kennedy (1998), the trivial correlation between errors of the outcome and selection equations is one of the reasons why the Heckman model does not perform well. In such case with no selectivity bias, the two methods can be analyzed separately (probit for the probability of being selected and OLS on the non-censored observations).

7. Result and Discussion

The P-value for the regression as a whole is highly significant at 1% for both probit and OLS model which supports the existence of a relationship between explanatory and dependent variables. The Pseudo R2 and R2 value suggests that 25% and 55% of the total variation in the values of dependent variables is explained by the independent variables in probit and OLS model, respectively (Table 7).

Most of the variables showed expected direction of sign except for some, among which are gender of HHH, labor availability, livestock holding and membership in a group formed for the purpose of organic farming. It decreases the probability of selling crops by 9%, 2%, 2% and 8%, respectively. The negative impact of male-headed households on the probability of being involved in the market is because they choose other profession as their main occupation. Also it is males who migrate to other cities or countries for better opportunities. In such cases, females take over as a care taker of day-to-day household activities including farming. Similar rationality can be applied to labor availability. However, including migration, the younger generation are more attracted to other profession. This implies that labor force is being directed more towards non-farm

activities rather than complementing as an investment for farm activities such as marketing. Livestock rearing takes space and time which might have led to reduced share of land for crop cultivation and less time available for marketing the crops.

Farmers who are member of a cooperative or informal group have received training related to market promotion and network development but is mostly related to basics such as proper presentation of organic products for visual attraction, informing potential consumers of the health benefits of consuming organic and information of few premium market that exists in other cities which is outside their jurisdiction. In this case, forming market linkage has been particularly challenging for farmers. The limited access to premium market is a result of years of associating with various stakeholders which too comes with challenges of limited demand for crop varieties and quantities because of limited dealers, quality control as there has been cases of dealers mixing organic products from this area with conventional products for more profit and delaying to pay back the cash which is a sensitive matter for farmers as they have to rely on cash income from one season for investment in another season. This is also the reason why many farmers hesitate to participate in the premium market and have relied on few trustworthy dealers for selling their products. During the field survey in 2014, an influx of shops in the local area selling organic or eco-friendly agro-products could be observed but so far majority of farmers of our study area are not aware of it.

Having rented in farm decreases the probability of being involved in the market by 14% which means that farmers have to pay back either in kind or cash leaving them with no excess produces for marketing. Farm size increases probability of being involved in the market by 19%. As mentioned by Rahman (2010), and Mahmudul, Ishida and Taniguchi (2003), higher the farm size, higher will be the chances of producing excess of the household requirement which could be sold in the market. Farm income increases probability of being involved in marketing by 12%. Higher farm output valuation means cultivation of higher market-value crops which encourages farmers to be involved in the market. Credit increases the probability of being involved in the market by

10%. In this case, farmers have taken credit for investing in highly commercial crops such as carrot and kidney bean, livestock rearing or for irrigation purpose. Knowing the crop price at which consumers buy increases probability of being involved in the market by 15%. Those farmers who are updated about the information on final price at which their products are sold to consumers shows that they are more interested in selling.

The OLS result shows that compared to organic, conventional farmers tend to earn NRs.[7]13,250/ha more, significant at 5%. In this case, organic farmers have less production/ha in all crop categories except fruits (Figure 3), the commercialization rate for conventional farm is higher except for cereals (Figure 4) and price/kg is also lower for organic crops except for oil crops (Figure 5). Thus, those 7% of organic crops which are sold in the premium market at the premium ranging from 9-140% (Table 5) is not able to make any significant impact on the cash income earned by organic farmers.

Those who have rented in the land in addition to farming in their own land has cash income less by NRs.12,393/ha compared to those who are farming in owned land only. One unit increase in LFU decreases cash income by NRs.2,459/ha. This also supports the fact that labor is directed more towards non-farm sectors. A percent increase in market value of farm (income) increases cash income by NRs.17,933/ha, significant at 1%. Farmers from Phoolbari VDC earn NRs.9287/ha more than farmers from the rest two VDCs. This can be attributed to factors such as experience of organic farming, training and crop diversity being higher in Phoobari VDC (Table 8). Finally, knowing price of the crops at which consumers buy and a unit increase in commercialization rate increases cash income by NRs. 11,412/ha and NRs.49,291/ha, respectively.

8. Conclusion and recommendation

Unlike the previous assumption, that labor supply positively influences intensity of farm activities including the decision to be involved in marketing the crops, this study shows that labor is not any more the defining factor because it is being diverted to non-farm sector. Similar reasoning could be applied to male-headed households as it is male who is engaged in other non-farm activities in local area or abroad, leaving females with the responsibility of taking day-to-day activities including those related to farming. Livestock holding and rented farm land decreases the probability of being involved in marketing the crops as they consume resources that could have been used for marketing. On the other hand, farm size and commercialization increases probability of being involved in the market and increases cash income, respectively. Increasing farm size through merging and collaboration can boost cash income from selling crops. Credit and knowing final price at which the consumer buys agro-products increases probability of marketing and its intensity, respectively. This this regard, providing credit facilities and market information can play a vital role in improving farm households' cash income.

Conventional farmers earn higher income than organic farmers because production per hectare, commercialization rate and price at which the crops are sold per unit is higher for conventional products. At present access to the premium market is very limited and has not been able to make any significant contribution in organic farmers' income. Monetary benefit can attract farmers to divert their labor force in farming activities and specifically to boost organic farming, making access to premium market should be very effective. Organic farmers should be linked with potential sellers not just in other cities but an effort towards market development in strategic places of the local area should be developed or linking farmers with sellers of emerging new markets within the local area should be made, so that the farmers would have more control over the price and quality check of their products and would contribute in long-term sustainability of farmer-seller relation.

Equations

The empirical specification for probit model can be given by:

$yi^* = xi\dot{\beta} + ei$

$yi = \begin{cases} 1 \; if \; y^* > 0 \\ 0 \; \text{otherwise} \end{cases}$ ... (Equation 1)

where i is number of observations, y* is the unobservable latent variable, y is binary variable of whether a household earns cash income from selling crops or not, x is explanatory variables, β is parameter to be estimated and e is the normally distributed error term.

Marginal effect for probit model is given by:

$\frac{\partial P\,(y_i=1/x_i)}{\partial x_i} = \varphi\,(x_i\beta)\beta$ ... (Equation 2)

where φ is distribution function for the standard normal random variable.

OLS model can be expressed as:

$yj' = zj\,\alpha j + \mu j$ … (Equation 3)

where yj' = observed values of gross farm cash income, zi = explanatory variables, j = number of observations, α = parameter to be estimated, and μ = error term.

The empirical specification for probit model can be given by:

Gross farm cash income = β0 + β1 HHHgender + β2 HHHedu + β3 HHHprimary_occu + β4 rent + β5 LFU + β6 LSU + β7 farm_size + β8 ln_farm_income + β9 membership + β10 credit + β11 final_price + e ... (Equation 4)

where ln is log.

The empirical specification for OLS model can be given by:

Gross farm cash income = β0 + β1 farm_system + β2 rent + β3 LFU + β4 ln_farm_income + β5 VDC + β6 market + β7 final_price + β8 commercialization + μ ... (Equation 5)

Footnotes

[1]Illiterate: Cannot read or write at all

[2]Basic: Can do simple reading and writing

[3]Secondary and below: Attained formal education of 10th grade and below

[4]Higher Secondary: Attained formal education of 11th and 12th grade

[5]Labor force unit (LFU) is the standard unit of labor force which takes people aged 14-59, irrespective of their sex, as 1 and those below 14 and above 59 as 0.5

[6]Livestock unit (LSU) is aggregate of different types of livestock kept at household in standard unit which is calculated as: 1 adult buffalo = 1 LSU, 1 immature buffalo = 0.5 LSU, 1 cow = 0.8 LSU, 1 calf = 0.4 LSU, 1 pig = 0.3 LSU, 1 sheep or goat = 0.2 LSU and 1 poultry = 0.1 LSU (CBS, 2003)

[7]NRs. stands for Nepalese Rupees, US$1 = NRs. 98.56 (Source: Nepal Rastra Bank, March 31, 2013)

Tables and Figures

Table 1. Distribution of respondents belonging to two farming systems across VDCs and based on group membership

Variables	Farming systems		Total (n=300)	P-value
	Organic (n=95)	Conventional (n=205)		
VDCs				
Phoolbari	64 (67.37)	87 (42.44)	151 (50.33)	**0.000*** **
Shivanagar	15 (15.79)	37 (18.05)	52 (17.33)	
Mangalpur	16 (16.84)	81 (39.51)	97 (32.33)	
Membership				
Yes	71 (74.74)	69 (33.66)	140 (46.67)	**0.000*** **
No	24 (25.26)	136 (66.34)	160 (53.33)	

Source: Field survey (2013)
Note: Figure in parenthesis indicate column percentage
*** 1% level of significance

Table 2. Distribution of respondents across VDCs and based on group membership

Membership	VDCs			Total (n=300)	P-value
	Phoolbari (n=151)	Shivanagar (n=52)	Mangalpur (n=97)		
Yes	83 (54.97)	18 (34.62)	39 (40.21)	140 (46.67)	**0.012** **
No	68 (45.03)	34 (65.38)	58 (59.79)	160 (53.33)	

Source: Field survey (2013)
Note: Figure in parenthesis indicate column percentage
** 5% level of significance

Table 3. Descriptive analysis of (categorical) variables across two different farming system

Variables	Farming system		Total (n=285)	P-value
	Organic (n=91)	Conventional (n=194)		
Gender of HHH				
Male	82 (90.11)	180 (92.78)	262 (91.93)	0.440
Female	9 (9.89)	14 (7.22)	23 (8.07)	
Education of HHH				
Illiterate	4 (4.40)	16 (8.25)	20 (7.02)	0.497
Basics	25 (27.47)	60 (30.93)	85 (29.82)	
Secondary and below	38 (41.76)	79 (40.72)	117 (41.05)	
Higher Secondary	10 (10.99)	21 (10.82)	31 (10.88)	
Bachelors	10 (10.99)	15 (7.73)	25 (8.77)	

Masters	4 (4.40)	3 (1.55)	7 (2.46)	
Primary occupation of HHH				
Farming	50 (54.95)	114 (58.76)	164 (57.54)	0.543
Others	41 (45.05)	80 (41.24)	121 (42.46)	
Ownership				
Owned + Lent in	20 (21.98)	41 (21.13)	61 (21.40)	0.871
Owned	71 (78.02)	153 (78.87)	224 (78.60)	
Income source				
Farming only	40 (20.62)	20 (21.98)	60 (21.05)	0.793
Farming + Non-farming	154 (79.38)	71 (78.02)	225 (78.95)	
Livestock holding				
Yes	85 (93.41)	164 (84.54)	249 (87.37)	**0.036 ** **
No	6 (6.59)	30 (15.46)	36 (12.63)	
Membership				
Yes	69 (75.82)	66 (34.02)	135 (47.37)	**0.000 *** **
No	22 (24.18)	128 (65.98)	150 (52.63)	
Training				
Yes	70 (76.92)	55 (28.35)	125 (43.86)	**0.000 *** **
No	21 (23.08)	139 (71.65)	160 (56.14)	
VDC				
Phoolbari	61 (67.03)	80 (41.24)	141 (49.47)	**0.000 *** **
Others	30 (32.97)	114 (58.76)	144 (50.53)	
Credit				
Yes	9 (9.89)	18 (9.28)	27 (9.47)	0.869
No	82 (90.11)	176 (90.72)	258 (90.53)	
Final price				
Yes	22 (24.18)	44 (22.68)	66 (23.16)	0.780
No	69 (75.82)	150 (77.32)	219 (76.84)	
Selling crops in market				
Yes	70 (76.92)	155 (79.90)	225 (78.95)	0.566
No	21 (23.08)	39 (20.10)	60 (21.05)	

Source: Field survey (2013)
Note: Figure in parenthesis indicate column percentage;
*** 1% and ** at 5% level of significance

Table 4. Descriptive analysis of (continuous) variables across two different farming system

Variables (Measurement)	Farming system						Total Mean± SD	T-test (P-value)
	Organic (n=91)			Conventional (n=194)				
	Min.	Max.	Mean± SD	Min.	Max.	Mean± SD		
Discrete								
HHHage	30	72	48.23± 9.81	26	84	50.30± 12.26	49.64± 11.56	0.159
HHHedu	0	17	7.37± 5.58	0	17	6.43± 5.37	6.73± 5.45	0.177
org_exp	1	55	**10.17± 10.25**	-	-	-	3.25± 7.48	**0.000 *****
org_training	0	12	**2.60± 2.66**	0	8	**0.56± 1.17**	1.21± 2.02	**0.000 *****
Continuous								
LFU	1.5	10	4.28± 1.84	1	11	4.29± 1.85	4.28± 1.84	0.961
LSU	0	12.7	2.12± 1.67	0	13.7	1.85± 1.75	1.94± 1.72	0.219
farm_size	.02	2.37	0.49± 0.39	.01	2.7	0.51± 0.41	0.50± 0.40	0.633
farm_income	1820	1014245	186717 ± 170360	2850	994692	197400± 186134	193989± 181016	0.643
non-farm income	0	960000	221715 ±220117	0	1080000	192911± 190825	202108± 200702	0.259
agrovet	.01	9	1.58± 1.34	.01	15	1.79± 1.89	1.73± 1.73	0.323
market	.04	15	3.07± 3.63	.01	15	2.73± 3.30	2.84± 3.40	0.426
commercialization	0	4.76	0.66± 0.75	0	3.99	0.74± 0.66	0.71± 0.69	0.371
cash_income	0	226648	**48999± 54685**	0	234669	**64359± 59887**	59455± 58621	**0.039 ****
SHDI	2.05	3.88	3.15± 0.38	1.72	3.81	3.11± 0.38	3.12± 0.38	0.349

Source: Field survey (2013)

Note: *** at 1%, ** at 5% and * at 10% level of significance

Table 5. List of organic products sold by a cooperative in Phoolbari VDC in 2069 B.S. (April-May 2012/ March-April 2013)

SN	Item	Quantity sold (kg)	Price (NRs./kg)	Total production (kg)*	Sold (%)	Regular price (NRs./kg)	Premium (%)
I.	**Cereals:**						
1	Chamal (Husked Rice)	1850	57	100866	6	50	14
2	Dhan (Unhusked Rice)	4000	22			20	10
3	Makai (Maize)	500	31	19932	3	18	72
4	Gahu (Wheat)	1450	30	2440	59	18	67
5	Fapar (Buckwheat)	1200	60	1595	75	25	140
II.	**Pulses:**						
6	Rajma (Kidney bean)	605	120	2053.5	29	70	71
III.	**Vegetable:**						
7	Gajar (Carrot)	5000	12	78407	6	11	9
	Total	**14605**	**-**	**205293.5**	**7**	**-**	**-**
IV.	**Others:**						
8	Maha (Honey)	121.5	300	(no data)	-	-	-

Source: Field survey (2014)

Note: Total production (kg)* signifies total amount of respective crops produced organically by only those (organic) farmers who are member of the cooperative through which they are sold at the premium market in other cities.

Table 6. Definition and measurement of selected variables along with their hypothesized relation to cash income

Variables	Definition and Measurement	Expected sign
Categorical		
farm_system	Farmers practicing organic farming; 1=yes, 0 otherwise	+ve/-ve
HHHgender	Male-headed household; 1=yes, 0 otherwise	+ve
HHHprimary_occu	Primary occupation of HHH; 1=farming, 0 otherwise	+ve

rent	Farmers renting by paying either cash or through crop sharing or mortgaging in farm land; 1=farming, 0 otherwise	+ve/-ve
membership	Being a member of in/formal group formed for the purpose of organic farming; 1=yes, 0 otherwise	+ve
VDC	Belonging to Phoolbari VDC; 1=yes, 0 otherwise	+ve
credit	Credit taken for farming related activities; 1=yes, 0 otherwise	+ve
final_price	Know price of one or more crops at which it is sold to consumers; 1=yes, 0 otherwise	+ve
Discrete		
HHHage	Age of HHH; in years	+ve
HHHedu	Education of HHH; in years	+ve/-ve
org_exp	Experience of practicing organic farming; in years	+ve
org_training	Organic farming related training; number of times	+ve
Continuous		
LFU	Labor force available in HH; in Labor force unit (LFU^2)	+ve
LSU	Livestock holding in HH; in Livestock unit (LSU^3)	+ve
farm_size	Operational farm size; in ha	+ve
farm_income	Income from farm activities; in NRs.	+ve
nonfarm_income	Income from non-farm activities; in NRs.	+ve/-ve
agrovet	Distance to nearest agrovet; in km	-ve
market	Distance to nearest market; in km	-ve
commercialization	Commercialization rate (total quantity of crops sold/total produced)	+ve
cash_income	Income from selling crops; in NRs./ha	-
SHDI	Shannon Diversity Index4	+ve

Source: Field survey (2014); own elaboration based on literature review

Table 7. Result from Probit and OLS model

Variables	Selection equation (Probit model)			Outcome equation (OLS model)	
	Coefficient	P-value	Marginal effect	Coefficient	P-value
farm_system				**-13250**	**0.019****
HHHgender	**-0.54**	**0.145**	**-0.09**		
HHHedu	0.03	0.143	0.01		
HHHprimary_occu	0.27	0.264	0.058		
rent	**-0.56**	**0.010*****	**-0.14**	**-12393**	**0.036****
LFU	**-0.10**	**0.050****	**-0.02**	**-2459**	**0.062***
LSU	**-0.11**	**0.071***	**-0.02**		
farm_size	**0.90**	**0.053***	**0.19**		
ln_farm_income	**0.54**	**0.000*****	**0.12**	**17933**	**0.000*****
membership	**-0.37**	**0.050****	**-0.08**		
VDC				**9287**	**0.100***
market				-1340	0.113
credit	**0.65**	**0.096***	**0.10**		
final_price	**0.89**	**0.011****	**0.15**	**11412**	**0.086***
commercialization				**49291**	**0.000*****
constant	**-4.95**	**0.001*****		**-170857**	**0.000*****
No. of observation	285				225
Wald chi2 (11)	55.96				
Log pseudo likelihood	-109.94				
Prob > chi2	**0.000*****				
Pseudo R2	0.2505				
F (8, 216)					40.53
Prob > F					**0.000*****
R-squared					0.5474
Root MSE					38496

Source: Field survey (2013)

Note: *** at 1%, ** at 5% and * at 10% level of significance

Table 8. Commercialization rate across VDCs

Variables	VDC (Mean±SD)			T-test
	Phoolbari	Others	Total (n=285)	
HHHage	50.55±11.96	49.32±11.74	49.97±11.85	0.440
HHHedu	7.38±5.53	6.44±5.48	6.94±5.52	0.201
org_exp	**5.06±8.95**	**1.5±5.82**	**3.38±7.83**	**0.001*** **
org_training	**1.62±2.23**	**0.73±1.73**	**1.2±2.05**	**0.001*** **
LFU	4.11±1.78	4.44±1.84	4.26±1.81	0.174
LSU	2.12±1.93	1.80±1.48	1.97±1.73	0.163
farm_size	0.58±0.46	0.51±0.38	0.55±0.42	0.167
farm_income	12.00±0.84	11.94±0.74	11.97±0.79	0.552
non-farm income	8.98±5.41	9.38±5.06	9.17± 5.24	0.565
agrovet	**2.12±1.66**	**1.47±1.84**	**1.81±1.77**	**0.006*** **
market	**3.57±3.31**	**2.38±3.45**	**3.01±3.42**	**0.009*** **
commercialization	0.94±0.73	0.86±0.57	0.90±0.66	0.159
SHDI	**3.26±0.31**	**3.02±0.41**	**3.15±0.38**	**0.000*** **

Source: Field survey (2013)
Note: *** at 1%, ** at 5% and * at 10% level of significance

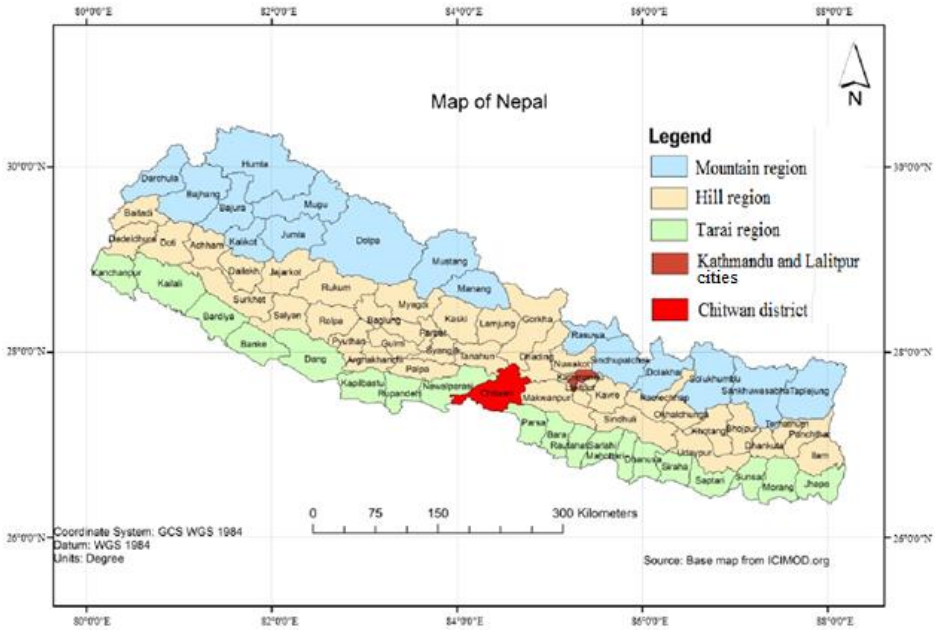


Figure 1. Map of Nepal
Source: Government of Nepal
(http://reliefweb.int/map/nepal/nepal-ecological-zone-map-2000)

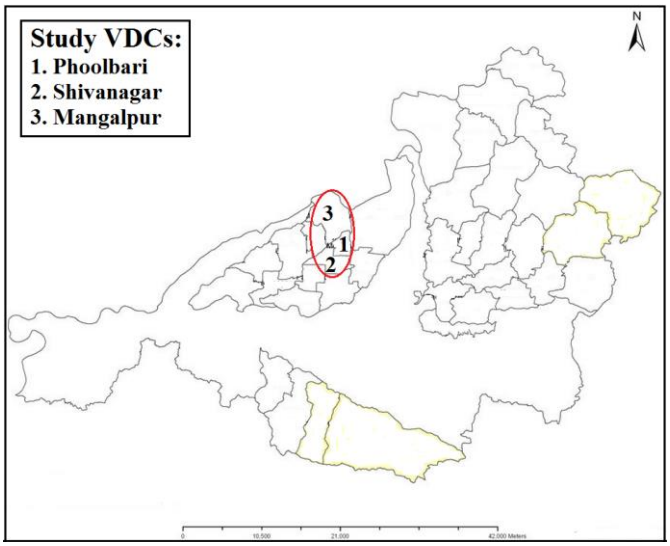
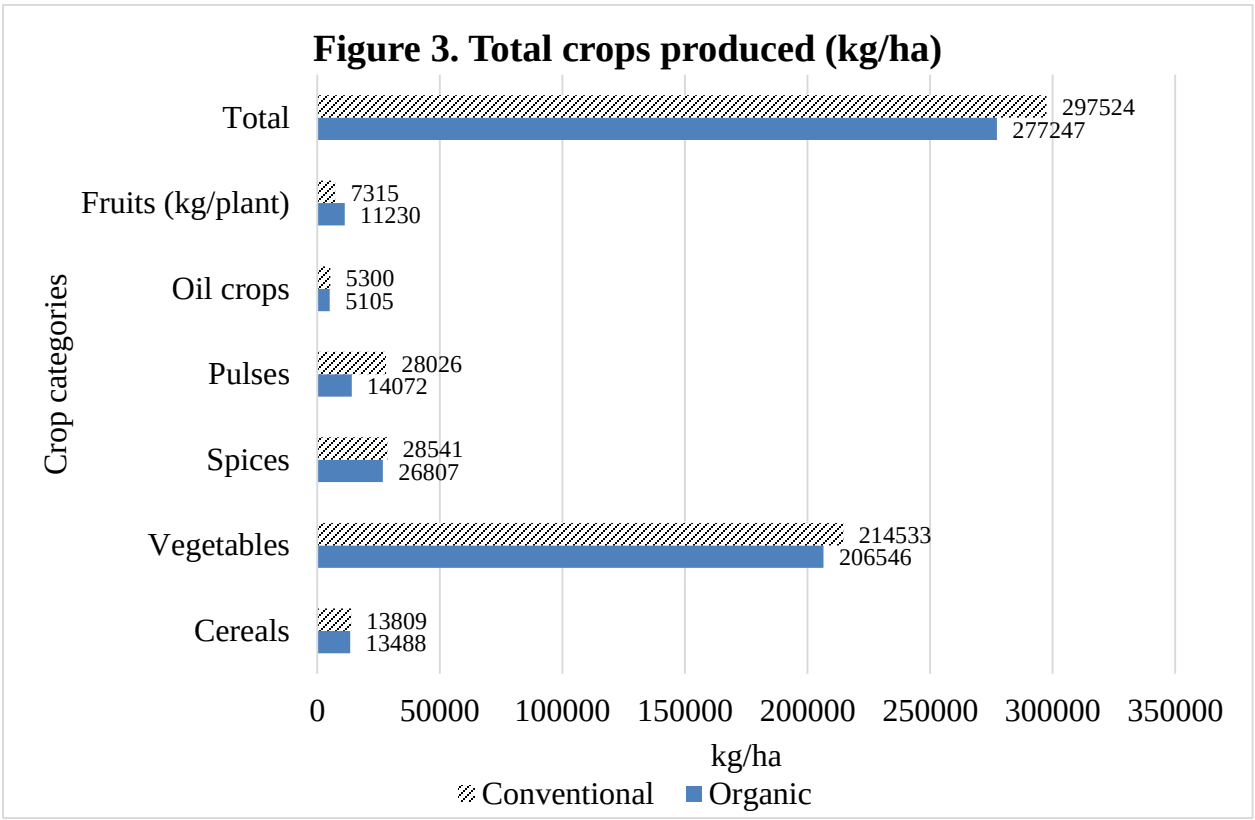
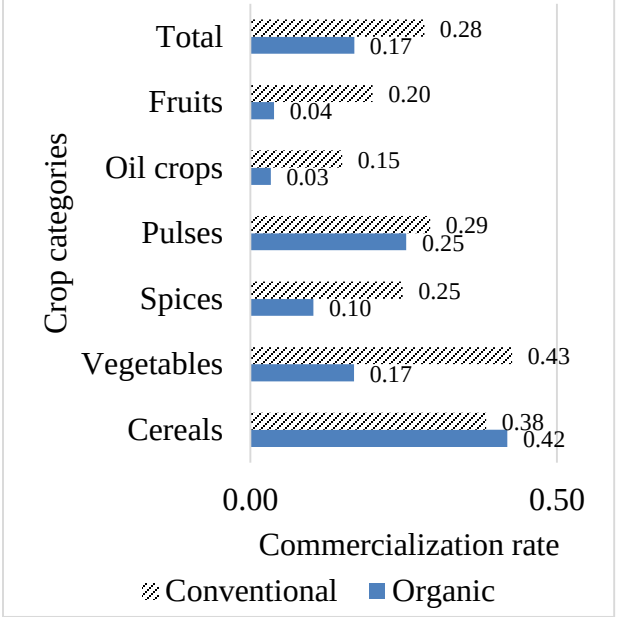


Figure 2. Map of study VDCs in Chitwan district
Source: NEWAH M&E MIS Division as cited in www.newah.org.np/map/Chitwan



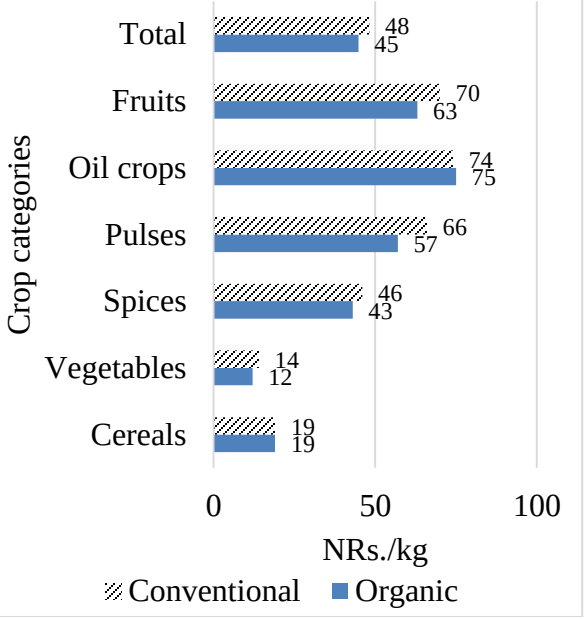
Source: Field survey (2013)

Figure 4. Commercialization rate



Source: Field survey (2013)

Figure 5. Price per unit (NRs./kg)



Source: Field survey (2013)

Annex I. Regression model for testing multicollinearity and heteroskedasticity

. *(22 variables, 285 observations pasted into data editor)

. xi:regress farm_system i.hhhgender hhhage hhhedu i.hhhprimary_occu org_exp lfu lsu farm_sizeha ln_farm_income ln_nonfarm_income i.member_cooperative orgtraining i.vdc agrovet mkt_distance i.credit i.final_price commercialization cash_incomeha shdi i.rent

i.hhhgender	_Ihhhgender_0-1	(naturally coded; _Ihhhgender_0 omitted)
i.hhhprimary_~u	_Ihhhprimar_0-1	(naturally coded; _Ihhhprimar_0 omitted)
i.membership	_Imember_co_0-1	(naturally coded; _Imember_co_0 omitted)
i.vdc	_Ivdc_0-1	(naturally coded; _Ivdc_0 omitted)
i.credit	_Icredit_0-1	(naturally coded; _Icredit_0 omitted)
i.final_price	_Ifinal_pri_0-1	(naturally coded; _Ifinal_pri_0 omitted)
i.rent	_Irent_0-1	(naturally coded; _Irent_0 omitted)

Source	SS	df	MS	Number of obs = 285
Model	33.4918631	21	1.59485062	F(21, 263) = 14.74
Residual	28.4519965	263	.108182496	Prob > F = 0.0000
Total	61.9438596	284	.218112182	R-squared = 0.5407
				Adj R-squared = 0.5040
				Root MSE = .32891

farm_system	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_Ihhhgender_1	-.064415	.0768736	-0.84	0.403	-.215781	.086951
hhhage	-.0034518	.0020379	-1.69	0.091	-.0074644	.0005608
hhhedu	.001513	.0046051	0.33	0.743	-.0075545	.0105805
_Ihhhprimar_1	.0106201	.0515983	0.21	0.837	-.0909782	.1122183

org_exp	.0327028	.002924	11.18	0.000	.0269454	.0384601
lfu	-.0014365	.011613	-0.12	0.902	-.0243028	.0214298
lsu	.0262308	.0124941	2.10	0.037	.0016296	.050832
farm_sizeha	.0252664	.0583523	0.43	0.665	-.0896307	.1401635
ln_farm_income	.0011604	.0296125	0.04	0.969	-.0571474	.0594682
ln_nonfarm_income	.0062272	.0046555	1.34	0.182	-.0029396	.0153941
_Imembershi_1	.1188527	.0512158	2.32	0.021	.0180076	.2196979
orgtraining	.0475599	.013211	3.60	0.000	.0215472	.0735726
_Ivdc_1	.1156296	.0462335	2.50	0.013	.0245946	.2066646
agrovet	-.0271575	.0126427	-2.15	0.033	-.0520512	-.0022637
market	.0021388	.0064179	0.33	0.739	-.0104983	.0147758
_Icredit_1	.0635212	.072487	0.88	0.382	-.0792075	.2062499
_Ifinal_pri_1	.0168436	.0534597	0.32	0.753	-.08842	.1221071
commercialization	.0308879	.0458532	0.67	0.501	-.0593982	.121174
cash_incomeha	-1.17e-06	5.65e-07	-2.07	0.039	-2.28e-06	-5.81e-08
shdi	-.1655732	.0603663	-2.74	0.007	-.2844359	-.0467105
_Irent_1	.0378608	.050596	0.75	0.455	-.061764	.1374856
_cons	.7129402	.3352452	2.13	0.034	.052834	1.373046

Variation inflation factor (VIF)

. vif

Variable	VIF	1/VIF
cash_incom~a	2.88	0.346649
commercial~n	2.63	0.380388
ln_farm_in~e	1.92	0.519876
orgtraining	1.87	0.535305
_Imembersh~1	1.72	0.580456

_Ihhhprima~1		1.71	0.583583
hhhedu		1.65	0.605948
hhhage		1.46	0.686979
farm_sizeha		1.45	0.687625
ln_nonfarm~e		1.44	0.696853
shdi		1.41	0.708558
_Ivdc_1		1.41	0.710405
_Ifinal_pr~1		1.34	0.746380
agrovet		1.25	0.797428
org_exp		1.25	0.797494
market		1.25	0.798240
lsu		1.22	0.821288
lfu		1.20	0.830398
_Icredit_1		1.19	0.842361
_Ihhhgende~1		1.15	0.865802
_Irent_1		1.13	0.881438
Mean VIF		1.55	

Correlation coefficient

. corr

(obs=285)

	sn	farm_s~m	hhhgen~r	hhhage	hhhedu	hhhpri~u	rent	org_exp	lfu	lsu	farm_s~a	ln_far~e	ln_non~e	member~p
sn	1.0000													
farm_system	-0.2699	1.0000												
hhhgender	0.1584	-0.0458	1.0000											
hhhage	-0.0476	-0.0836	-0.1288	1.0000										
hhhedu	-0.1333	0.0802	0.2485	-0.3704	1.0000									
hhhprimary~u	0.0566	-0.0360	-0.1502	0.3411	-0.4578	1.0000								
rent	0.0931	0.0096	0.0290	-0.0823	-0.1285	0.0155	1.0000							
org_exp	-0.2055	0.6355	0.0046	0.0375	0.0716	0.0156	-0.0677	1.0000						
lfu	0.1355	-0.0029	0.0070	0.2104	-0.1324	0.2050	0.0338	0.0349	1.0000					
lsu	-0.0799	0.0731	0.0683	0.0381	0.0989	0.0136	-0.0371	0.0380	0.1061	1.0000				
farm_sizeha	-0.1535	-0.0284	0.0572	0.2074	0.0053	0.1398	0.1174	-0.0028	0.2306	0.1431	1.0000			
ln_farm_in~e	-0.0569	-0.0272	0.0858	0.1518	0.0577	0.2380	0.0483	0.0385	0.1422	0.3423	0.4235	1.0000		
ln_nonfarm~e	0.0714	-0.0057	-0.0765	-0.0721	0.1248	-0.3822	-0.0181	-0.0443	0.0214	-0.0541	-0.2299	-0.2419	1.0000	
membership	-0.2082	0.3903	-0.0027	-0.1226	0.0824	-0.1092	-0.0325	0.2252	-0.0482	-0.0062	-0.1080	-0.0822	0.0649	1.0000
orgtraining	-0.2762	0.4724	-0.0133	-0.0436	0.1193	0.0102	-0.0384	0.3939	-0.0281	-0.0134	0.0063	0.0969	-0.1927	0.5547
vdc	-0.8662	0.2405	-0.1191	0.0706	0.1134	0.0123	-0.1057	0.2315	-0.0680	0.1358	0.1272	0.1103	-0.0679	0.1576
agrovet	-0.1474	-0.0587	0.0542	0.0238	0.0780	-0.0191	-0.0458	0.0904	-0.0007	0.1935	0.0410	0.1291	0.0147	-0.1742
market	-0.0969	0.0473	0.0526	-0.0522	0.0656	-0.0082	-0.0302	0.0735	-0.0041	0.1345	0.0012	0.2063	-0.1189	-0.0962
credit	0.0011	0.0097	0.0519	-0.0127	-0.0744	0.1082	0.1233	-0.0123	0.0024	0.0458	0.0385	0.1380	-0.1095	-0.0429
final_price	-0.0861	0.0165	0.1016	-0.1573	0.0883	0.1013	0.0583	0.0387	0.0671	0.1312	0.0858	0.2166	-0.1390	-0.1043
commercial~n	-0.1402	-0.0532	0.0560	-0.0722	0.0696	0.1675	-0.0423	0.0163	-0.0416	0.0842	0.2364	0.4077	-0.2295	-0.1351
cash_incom~a	-0.1336	-0.1224	0.0335	-0.0059	0.0859	0.1330	-0.0884	-0.0143	-0.0599	0.1034	0.2921	0.4732	-0.1763	-0.1560
shdi	-0.2500	0.0556	0.0507	-0.0339	0.2781	-0.0881	-0.1056	0.1298	0.0226	0.1952	0.0180	0.2597	0.0791	0.2131
_Ihhhgende~1	0.1584	-0.0458	1.0000	-0.1288	0.2485	-0.1502	0.0290	0.0046	0.0070	0.0683	0.0572	0.0858	-0.0765	-0.0027
_Ihhhprima~1	0.0566	-0.0360	-0.1502	0.3411	-0.4578	1.0000	0.0155	0.0156	0.2050	0.0136	0.1398	0.2380	-0.3822	-0.1092
_Imembersh~1	-0.2082	0.3903	-0.0027	-0.1226	0.0824	-0.1092	-0.0325	0.2252	-0.0482	-0.0062	-0.1080	-0.0822	0.0649	1.0000
_Ivdc_1	-0.8662	0.2405	-0.1191	0.0706	0.1134	0.0123	-0.1057	0.2315	-0.0680	0.1358	0.1272	0.1103	-0.0679	0.1576
_Icredit_1	0.0011	0.0097	0.0519	-0.0127	-0.0744	0.1082	0.1233	-0.0123	0.0024	0.0458	0.0385	0.1380	-0.1095	-0.0429
_Ifinal_pr~1	-0.0861	0.0165	0.1016	-0.1573	0.0883	0.1013	0.0583	0.0387	0.0671	0.1312	0.0858	0.2166	-0.1390	-0.1043
_Irent_1	0.0931	0.0096	0.0290	-0.0823	-0.1285	0.0155	1.0000	-0.0677	0.0338	-0.0371	0.1174	0.0483	-0.0181	-0.0325

	orgtra~g	vdc	agrovet	market	credit	final_~e	commer~n	cash_i~a	shdi	_Ihhhg~1	_Ihhhp~1	_Imemb~1	_Ivdc_1	_Icred~1
orgtraining	1.0000													
vdc	0.1978	1.0000												
agrovet	-0.0550	0.2328	1.0000											
market	0.0513	0.2261	0.1378	1.0000										
credit	0.0489	0.0633	0.2544	0.1403	1.0000									
final_price	-0.0088	0.1721	0.1380	0.2981	0.2200	1.0000								
commercial~n	0.0265	0.1190	0.0868	0.2041	0.1450	0.3041	1.0000							
cash_incom~a	0.0050	0.1549	0.1087	0.1448	0.1669	0.3071	0.7683	1.0000						
shdi	0.2529	0.3112	0.1452	0.1871	-0.0034	0.0965	0.0530	0.0832	1.0000					
_Ihhhgende~1	-0.0133	-0.1191	0.0542	0.0526	0.0519	0.1016	0.0560	0.0335	0.0507	1.0000				
_Ihhhprima~1	0.0102	0.0123	-0.0191	-0.0082	0.1082	0.1013	0.1675	0.1330	-0.0881	-0.1502	1.0000			
_Imembersh~1	0.5547	0.1576	-0.1742	-0.0962	-0.0429	-0.1043	-0.1351	-0.1560	0.2131	-0.0027	-0.1092	1.0000		
_Ivdc_1	0.1978	1.0000	0.2328	0.2261	0.0633	0.1721	0.1190	0.1549	0.3112	-0.1191	0.0123	0.1576	1.0000	
_Icredit_1	0.0489	0.0633	0.2544	0.1403	1.0000	0.2200	0.1450	0.1669	-0.0034	0.0519	0.1082	-0.0429	0.0633	1.0000
_Ifinal_pr~1	-0.0088	0.1721	0.1380	0.2981	0.2200	1.0000	0.3041	0.3071	0.0965	0.1016	0.1013	-0.1043	0.1721	0.2200
_Irent_1	-0.0384	-0.1057	-0.0458	-0.0302	0.1233	0.0583	-0.0423	-0.0884	-0.1056	0.0290	0.0155	-0.0325	-0.1057	0.1233

	_Ifina~1	_Irent_1
_Ifinal_pr~1	1.0000	
_Irent_1	0.0583	1.0000

Breusch-Pagan/Cook-Weisberg test

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho : Constant variance

Variables : fitted values of farm_system

chi2(1) = 64.29

Prob > chi2 = 0.0000

White's test

. imtest, white

White's test for Ho : homoskedasticity

against Ha : unrestricted heteroskedasticity

chi2(245) = 261.92

Prob > chi2 = 0.2185

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	261.92	245	0.2185
Skewness	117.71	21	0.0000
Kurtosis	0.31	1	0.5782
Total	379.94	267	0.0000

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