Effectiveness of Holistic Community Development on Households` Well-Being and Women Empowerment: Evidence from Panel Data

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Abstract
There has been marked progress on reducing poverty over the past decades. Heifer International Bangladesh has under taken an initiative which provides key income generating inputs to rural poor women. It is important to identify the effectiveness of these intervention programs for further policy intervention. This is the first paper examining the impact of the intervention programs of self help group on households` well-being and women empowerment in Bangladesh for panel data from 2013 to 2016. The We found that the intervention through community development program of self help group is statistically significantly positively associated with households` well-being improvement and women empowerment through participation of different activities. Moreover, we found no significant evidence of difference between male headed and female headed households in terms of intervention effect although there are significant differences among the locations. This indicates that female headed households are equally likely to adopt the intervention technologies.

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1. Introduction

There has been noticeable advancement on reducing poverty over the past decades in the developing world. About 795 million people of the 7.3 billion people in the world, or one in nine, were suffering from chronic under nourishment in 2014-2016. Almost all the hungry people, 780 million, live in developing countries, representing 12.9 percent, or one in eight, of the population of developing counties and there are 11 million people undernourished in developed countries (FAO, 2015). Around one-third of the population lives below the poverty line and a significant proportion of them live in extreme poverty in Bangladesh. The poverty rate is highest in rural areas at 36 percent, compared with 28 percent in urban areas. More than 76 percent of the nation's 161 million people live on less than $2 a day and about 41 percent of Bangladeshi children are under weight (BDHS, BBS 2011).

For more than 40 years, microfinance has been portrayed as a key strategy and programme inter-vention for poverty alleviation and 'scaling up' local economic, social and environmental development. But there are numerous discussions and debates under way among the experts concerning micro-credit. The micro credit has developed women's micro entrepreneurship in rural Bangladesh and has increased their family income and standard of lives, increased awareness, developed capabilities and empowered women to contribute socio-economic status of individuals, groups and the nation as a whole (Sultana et al., 2010). The positivists have acknowledged that micro-credit provides an effective mechanism for alleviating poverty, improving women's status and empowering them by creating an environment for small businesses (Pitt and Khandker, 1996; Mayoux, 1999; Littlefield *et al*., 2003; Lakwo, 2006). Despite the success stories, some studies have reported that the credit institutions do not much care about the extreme poor (Sultana et al., 2010). Moreover, they cite the high rates of interest charged by the credit institutions, less/un-successful at reaching the vulnerable poor, little or no control over loans of women borrowers, unchanging levels of poverty, etc. (Mallick, 2002). However, among academics, there is thus far no consensus on the impact of microcredit on income improvement and poverty reduction (Banerjee et al., 2009).

Heifer International Bangladesh believes that if inclusive communities receive Heifer's values-based holistic community development trainings, along with value chain and cooperative development trainings, the communities will be able to overcome food insecurity and poverty with dignity and social harmony as well as be empowered to advance their economic

development. Heifer International Bangladesh has under taken a pilot project which provides key income generating inputs to rural poor women such as poultry, seeds, equipment and training in sustainable agriculture for improving the situation of food insecurity and poverty through women empowerment.

Among the 'Sustainable Development Goals' (SDGs) adopted by the United Nations in September 2015, SDG Target No. 6.2 is, 'By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations'. Bangladesh has made significant progress in reducing open defecation, from 34 percent in 1990 to all most hundred percent of the national population in 2015. However, the current rate of improved sanitation is 61 percent, growing at only 1.1 percent annually (WB, 2016). Still, the quality of sanitation coverage is an emerging area of concern, with more than 40 percent of all latrines classified as 'unimproved.' Unimproved latrines include so-called hanging latrines and other types which pose the same health risks as open defecation. Improve latrine pit contents must be separated from the environment with a fully intact cover, such as a water-seal, and the latrine may be used by no more than two households, ten people at most. Bangladesh's achievements in increasing household latrine use have resulted from a combination of different forces including holistic community development approach. It is widely agreed among development policy actors and many feminist activists and scholars that Bangladeshi women have made considerable gains since national independence in 1972. But there have also been attacks on women's rights and reversals in gender equity. Women's economic participation and empowerment are fundamental to strengthening women's rights and enabling women to have control over their lives and exert influence in society. The ever-increasing contribution of women is clearly evident in every spheres of the society. Their increasing active participation in all sectors ranging from agriculture to politics has made great impact to the national development. The visible changes in women's political and economic participation throughout the country testify the government commitment and to people's aspiration to a more equitable society. The empowerment of women has been characterized by considering a multidimensional issue which can be indicated by the participation of decision making process of household, impression and view of man to women, freedom of women to do different activities.

The authors use household surveys to assess the economic and social impacts including sanitation technology adaption and women empowerment of intervention program of self-help groups in Bangladesh. The estimation of mean impact suggests positive effects on female empowerment, nutritional status, and poverty alleviation in program areas overall (Sarker et al., 2013). How effective these intervention programs have been in achieving their targets is not clear. Unlike social programs targeting individual households, few intervention programs have been rigorously evaluated although based on cross section data. This is the first study, using three rounds of household-level panel data (2013, 2014 and 2016) out of four rounds of data from 2013 to 2016 to estimate the welfare of intervention program in Bangladesh. The paper contributes to the growing body of knowledge on the subject through panel data analysis with due consideration for observed and unobserved heterogeneity within the sample. A disaggregated analysis of male-headed versus female-headed households and locational variation enables us to test whether or not the impact of intervention is regional and gender neutral. This selection issue might be explained by observed differences that might be fixed in time or not such as household education, location. Second, unobserved factors might affect the outcomes. Some of these factors can be considered as being fixed in time such as household ability and some of these can also be changing over time such as local government policy and facility. These two forms of endogeneity have been largely documented and need to be accounted for.

We make use of the panel nature of our data to address them by estimating Difference-in-Difference (DiD) models in OLS and Fixed-Effect (FE) settings. We can fully control for selection on observables as well as unobserved time-invariant characteristics. The objectives of the present study (1) to estimate the impact on sanitation technology adaption and women empowerment of rural vulnerable households (2) to identify the determinate of the shifting for better sanitation and women empowerment and (3) to investigate the distributional effects of the intervention program by looking at impacts across gender and location.

2. Study Location, Data Source, Sampling and Variable Description

2.1 Study area and locations

The study area of this investigation is North-West and North-East regions of Bangladesh. The study was done at three pre-selected districts of Rajshahi, Natore and Kishorganj. The study is

based on primary data from four different study locations across a total of three districts. The majority of households are small, with marginal or small holdings. Over 11% of the population is without any land. The main occupation of the villagers is traditional agriculture with low productivity. Farmers produce paddy, sugar cane, wheat, potatoes, vegetables, chilies, onions, garlic, other spices, jute, pulses, oil seeds, betel leaves, and others. Various fruits (mangoes, jackfruits, guava, litchi, etc.) are grown in the district. Mango and litchi are famous throughout this region and are grown in abundance in Rajshahi and Natore districts. Along with the high incidence of poverty 36.6% (HIES, BBS 2010) the maternal mortality ratio and infant mortality rate of the Rajshahi district was 2.39 and 41, respectively, per 1000 live births (BBS, 2014). Almost half of children under 5 are severely malnourished and 41% are moderately malnourished stunted nationally (BDHS, BBS 2011). The maternal mortality ratio and infant mortality rate of the Kishorganj district was 2.91 and 48 per 1000 live births (BBS, 2014). Literacy rate is 40.9%.

The area of the present study is four NGOs' commanding area--Wave Foundation (WF), Ashrai, Jagoroni Chakra Foundation (JCF) and Pally Bikash Kendra (PBK). Four Upazilas under four NGOs from three districts-- Paba and Tanore Upzillas of Rajshahi, Baraigram Upzilla of Natore and Bhairab of Kishoreganj district. The upazila is the lowest tier of administrative government in Bangladesh. The districts of Bangladesh are divided into sub-districts called Upazilas (Sarker, 2010). There are very limited organized community groups or institutions providing technical support. There are no major NGOs providing development interventions except microfinance institutions in the proposed project area. The project area is home to the highest percentage of people living under poverty line in Bangladesh.

2.2 Classification of respondents

There are two types of research groups/respondents on the basis on intervention such intervention group and control group.

2.2.1 Intervention group: Heifer's Values-Based Holistic Community Development (VBHCD) approach is the foundation of the process of building social capital. Heifer's methodology addresses total development of each individual, the Self-Help Groups (SHGs) and their larger communities. Heifer has demonstrated that social capital and women's development have an

exponential multiplier on the impact in the socioeconomic development of the communities it works in as postulated by Heifer's theory of change. Heifer BD believes that if inclusive communities receive Heifer's values-based holistic community development trainings, along with value chain and cooperative development trainings, the communities will be able to overcome food insecurity and poverty with dignity and social harmony as well as be empowered to utilize microfinance to advance their economic development.

2.2.2 Control group: The control group is defined as the group in an experiment or study that does not provide any intervention by Heifer International Bangladesh or other organization(s) and is then used as a benchmark to measure how the other tested subjects do. Social capital building process is not included for poverty alleviation. However, the starting socio-economic condition of this group is more or less homogeneous with intervention group.

2.3 Sample size and sampling technique

For any type of research work, representativeness of collected information must be ensured so that valid and dependable conclusions can be drawn. The present evaluation study has no exclusion. Thus, in order to ensure representativeness of the data and information were collected, we used the probabilistic sampling strategy. In total sample size was five hundred (500) individuals for Heifer approach group. One hundred and twenty five respondents were selected from each NGO. Four NGOs are located at different sub-districts. The respondents were selected by using simple random sampling technique. Firstly, required number of SHGs was selected randomly and all the families within the selected SHGs were interviewed, so randomization was done at the SHG level rather than the family level. We assume that the socio-economic characteristics of all families within the SHG are similar. We collected the data only from the original intervention group/original placement families. The sample size for control group participants was two hundred and forty (240).

2.4 Data and variables description

Data for our study are taken from a field survey under the research project ''Elimination of Extreme Poverty and Food Insecurity through Community Empowerment'' (BD2011HIBD00). This project aims at theoretically and empirically advancing the concept that if inclusive communities receive Heifer's values-based holistic community development trainings, along

with value chain and cooperative development trainings, the communities will be able to overcome food insecurity and poverty. Although Self Help Group (SHG) definition very country to country. In our case, the SHG is a small voluntary association of poor people, preferably from the same socio-economic background who provide mutual support for each other. They come together for the purpose of solving their common problems through self-help and mutual help. The SHG promotes small savings among its members. The savings are kept with a bank. This common fund is in the name of the SHG. SHG is a group formed by the community, which has specific number of members like 15 to 25. Usually, the number of members in one SHG does not exceed twenty five.

The research team was conducted the study throughout the project cycle to document and disseminate the results of this intervention program. The study considered the household level data from 2013 to 2016 in four upzilas across 3 districts of Bangladesh, namely Rajshahi, Natore and Kishorganj and thereby representative of the both intervention and control groups. In response to this requirement, the research team has competed four surveys such as baseline survey (2013), two annual surveys in 2014 and 2015 and final survey in 2016 for intervention group and three surveys such as baseline survey in 2013 and one annual survey in 2014 and final survey in 2016 for control group. The results presented in this study are based on the data collected from 4 (four) locations under four NGOs' commanding area using the survey method. This paper capitalizes on the panel data produced during the research period of this project of which some methodologically potential points should be emphasized.

The questionnaire is used to collect data for both intervention and control groups, with the aim of capturing the multiple components of rural livelihoods. The household level questionnaire is used to collect information in 7 broad sections and 340 variables representing the basic demographic, livelihood activities, assets, women empowerment and outcomes of the surveyed households. More specifically, section one covers respondents personal information and section two cover household basic information such age, sex, education, occupation of household members. Section three encompass the income, expenditure and assets of household, it consists with eight subsections. Section four on food security and nutrition which compose with seven subsections. Section five covers women empowerment with 21 questions. Section six consists with eight subsections and section seven on environment related which encloses five subsections.

The variables used in the present study are defined in this section. A brief description of the variables and their priors are given below. The main interest of this paper is sanitation improvement and women empowerment.

2.4.1 Women Empowerment

Empowerment is defined as the process of expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them (Kabeer, 2001). This definition introduces an element that gives a unique meaning to women empowerment: the idea of a process or a change from a condition of lack of empowerment. The definition of women's empowerment may vary for different agendas but there is consensus on few key concepts defining empowerment: options, choice, control and power. These terms most often refer to women's ability to make decisions and affect outcomes of importance to themselves and their families (Malhotra, Schuler, & Boender, 2002). Ibrahim and Alkire (2007) identified more than 20 definitions of "empowerment" in the literature. Furthermore, empowerment is generally conceptualized as a process, where, over time, an individual moves from a lesser state to higher one (Rowlands, 1995). Heifer's interventions intend to bring female project participants on the pathway of having the ability to make strategic decisions and affect outcomes of importance for themselves and their families. Women's empowerment is an active process that has been quantified, measured, and described in multidimensional ways. One problem is that empowerment is a latent phenomenon that is not directly observable which is difficult to examine. It is aggregate results or effects may be visible although it cannot be quantified absolutely but only in relative terms. It is clear from the literature on gender and empowerment that the role of gender in development cannot be understood without understanding the socio-cultural contexts in which development takes place. We measure women empowerment by asking questions in the participation on household decision making process, access to community services and group activities, perception of men to women, leadership and freedom of mobility.

2.4.2 Income and Assets

The goal of the project in the category of evidence income and assets is to take project participants on the pathway of having sufficient income and assets to meet basic needs such as

housing, food, nutrition, clothing, education, health services and access to more viable social and political institutions. Under the category of income and assets, the variables included in this study are log cultivable land area, log average monthly income and value of assets. Income is a key indicator of individuals' well-being. For households and individuals, income is the sum of all the wages, salaries, profits, interest payments, rents and other forms of earnings received in a given period of time (Case & Fair, 2007). Household income was calculated based on respondents' self-report. Income is not always a reflection of individual's access to economic resources. The assets value accounts for a household's total wealth, and not just the current income level. It provides a more accurate description of a household's true financial state. Wealth leads to increased economic security and assets create a form of security during hardship. One can use assets to pay for further education, better housing, or to maintain a certain standard of living after retirement. Households lacking sufficient assets are forced to live from paycheck to paycheck and face economic hardship when changes in income occur. Those who lack adequate assets are unable to seek a better lifestyle and improve their quality of life. The agricultural assets used in constructing the agricultural capital index include large (four-wheel) tractors, small (two-wheel) tractors (or power tillers), power threshers, irrigation equipment, and water pumps. The business assets used in constructing the commercial capital index include commercial cooking equipment, commercial sewing equipment, commercial carpentry equipment, and other commercial equipment.

2.4.3 Household consumption expenditure

Consumption expenditure is probably the most common and preferred welfare indicator of a household. Average monthly expenditure of the families on basic needs means monetary value of food and other goods purchased. Generally, the figures obtained in expenditures are more accurate than figures obtained when collecting income data. Therefore, it is recommended to collect expenditures to obtain a more realistic scenario of the beneficiaries' conditions. Consumption included: 1) food consumption, 2) non-food items (including health, education and other non-food expenditures), 3) housing expenditures (including rent and utilities) and 4) consumer durables.

2.4.4 Cereal food availability from own production

Availability is achieved when sufficient quantities of food are consistently available to all individuals of household. The months of cereal food availability from own production (MCFAOP) are defined as the average number of months in a year in which a family has the ability to meet the food grain needs from their own farm. While the goal of a project should be to increase the months of food availability from own production, it is important to understand the situation that the project participants face throughout the year. All most of all of the poor households of Bangladesh feel happy, if they can manage the sufficient amount of rice for their family members.

2.4.5 Household characteristics related variable

This group includes household size (number of person in the family), mean age of household head and mean age^2 (mean age-squared) of household head, average education of household head, highest education of household, gender of household head (equals 1 if female; 0 if male), dependency ratio and cultivable land holdings. Education level measures in year of schooling. Dependency ratio is defined as the ratio of household members below the age of 15 and above 65 to productive part makes up the population in between, ages 15 – 64, i.e. quantify of the number of young and old people that probably require to be supported by adult family members. The most essential productive asset in rural Bangladesh is land. Householders' land holdings are typically small which is measured in decimal.

2.4.6 Location variables

It is clear from the literature that the welfare of particular community cannot be understood without understanding the socio-cultural (as well as political and economic) contexts in which development takes place. There are four study locations under four Non-Government Organizations (NGOs).

2.4.7 Social capital

Social capital has been defined by the World Bank as institutions, relationships, and customs that shape the quality and quantity of a society's social interactions (The World Bank, 2013). Heifer's model assumes social capital is a key multiplier for exponential impact, therefore, the interventions intend to build social capital through institutions, relations and norms that can

support economic prosperity and sustainable development. Structural social capital is defined as the composition and practices of local level institutions, formal and informal, that serve as instruments of community development. The structural dimension of social capital facilitates collective action through established roles and social networks supplemented by rules, procedures and precedents. Heifer's 12 Cornerstones plays a vital role in changing the attitude of the project participants. Regular participation group meeting and other group activities such as training, exposure visits, group monitoring, action planning and group fundraising activities are observed as social capital of the SHG members that shows the motivational force they got from Cornerstones training. Male counterparts have changed drastically after getting the Cornerstones training and Gender and Justice training and they became more supportive of their women counterparts. This group includes the membership of organizations, awareness of government safety net program and group savings variables.

To estimate the number of membership of cooperatives, small, marginal entrepreneurs (SMEs) and group formed, the respondents were asked the question "Do you member of any cooperative, SME and group formed?" If yes, then again asked "What are the name of cooperative, SME and group formed?" then we count the frequency from the name. Awareness of government safety net program was evaluated by asking the question "Do you have any idea about government safety net program? If yes, "What are the names of program?" If any respondent was able to say at least three safety net program names and purpose then he or she was evaluated as aware and group savings has been considered as an important financial service provider in many of the rural areas in developing countries. Moreover it has powerful social impact. Group savings counted in Taka.

2.4.8 Environmental variable

The goal of interventions is that the participants reach a good quality of life and opportunities to enhance their economic conditions while improving the quality of the natural environment. The projects and interventions towards improving the environment are mainly driven by promoting agro-ecological practices in the project communities. Therefore, the impact of implementing agro-ecology practices can be measured and observed. The implementation of agro-ecological practices must be relevant to the area, therefore, not necessarily all practices must be implemented in all areas. The variables access to improve sanitation facilities, perception of

integrated pest management (IPM) and number of tree plantation are used as proxy variable for environment. Both access to improve sanitation facilities and perception of IPM are another indicative dummy variable which takes the value 1 if improve sanitation facilities available to use and 0 if do not available and takes the value 1 if respondent has clear perception regarding IPM and 0 otherwise.

3.1 Estimation Technique

As stated in the introduction, this paper assesses: (1) the impact of holistic community development program on rural vulnerable households' sanitation shifting and women empowerment (2) estimate the determinants of sanitation technology adaption and women empowerment and (3) investigate the distributional effects of the intervention program by looking at impacts across gender and location. Our purpose in this first section is to estimate the causal effect of holistic community development program of self-help groups on sanitary improvement and the women participation in decision making process. There are some challenges in estimating the models for the effectiveness the community development program particularly regarding how the unobserved heterogeneity and potential endogeneity of some of the variables are addressed. Below we discuss the estimated models and how these issues are addressed in this analysis. The methodology we use to assess these effects is referred to as a difference-in-difference model, or a before and after comparison with an untreated comparison group (Meyer 1995). For both the control and experimental groups we calculate the change in the average level of each outcome from the year before intervention (2013) to three years later 2016 "the first difference" and then compare the changes between the two groups—"the second difference." When using the difference-in-difference approach in the context of an experiment, one randomly assigns cases to two different conditions and compares the before experiment/after experiment differences. Since the cases are randomly assigned, the two groups have similar characteristics and so there is no need to control for differences in characteristics between the two groups.

In the present analysis, however, although we have randomly assigned groups, we cannot assume that the two groups still have similar characteristics at the time of the intervention under consideration. In order to compare the changes from before to after the intervention, we need to control for these differences. Therefore we present alternate estimates of the difference-in-

difference estimator which show the effects of controlling for experimental-control differences in increasingly more stringent ways for each outcome. The first estimate shows the straightforward difference in difference with no controls as a point of reference. This estimate is calculated as:

$$\left(\overline{Y}^{Post}_{Intervention} - \overline{Y}^{Pre}_{Intervention}\right) - \left(\overline{Y}^{Post}_{Control} - \overline{Y}^{Pre}_{Control}\right) \tag{1}$$

The second estimator uses a multivariate model which predicts outcomes in both the year 2013 and the final year 2016, with controls for Pre/Post, Intervention/Control, and the interaction of the two. The coefficient for the interaction term is equivalent to the first estimator, but the model allows us to add several controls to improve the precision of the estimates. Consider a general model for individual i in time t which relates outcomes Y to observable firm attributes and an indicator variable for participation in an intervention program ID:

$$Y_{it} = \beta_1 ID_{it} + \beta_2 X_{it} + \varepsilon_{it} \tag{2}$$

If program participants are randomly assigned to the treatment and control groups, then the treatment and the control groups have similar distributions of the non-observed attributes. In this case, OLS can be used to estimate (2) from post-program cross-sectional data to get an unbiased estimate of β_1 for the net effect of the program. The major challenge is to estimate the net impacts of intervention program participation free of bias from self-selection of individual household into programs based on their observable and unobservable attributes. We rewrite (2) separately for the intervention and control groups to investigate the scenario:

$$E\left[Y_{it}^{Intervention} / X_{it}^{Intervention}, ID = 1\right] = \beta X_{it}^{Intervention} + \beta_1 + E\left(\varepsilon_{it} / ID = 1\right)$$

$$\tag{3}$$

$$E\left[Y_{it}^{Control} / X_{it}^{Control}, ID = 0\right] = \beta_2 X_{it}^{Control} + E\left(\varepsilon_{it} / ID = 0\right)$$

We get an expression for β_1 as in (4) from the difference of two equations.

$$E\left[Y_{it}^{Int} / X_{it}^{Int}, ID = 1\right] - E\left[Y_{it}^{Con} / X_{it}^{Con}, ID = 0\right] = \beta_2(X_{it}^{Int} - X_{it}^{Con}) + \beta_1 + E\left(\varepsilon_{it} / ID = 1\right) - E\left(\varepsilon_{it} / ID = 0\right) \tag{4}$$

The equation (4) identifies two potential sources of bias from non-random part such as (a) endogeneity bias and (b) unobserved heterogeneity bias. These two primary econometric problems can potentially produce biased estimates.

3.1.1 Eendogeneity bias:

It is due to differences between intervention and control groups in observed attributes $X(X_{it}^{Int} - X_{it}^{Con})$. This bias can be minimized by careful matching of the control group to the treatment group in terms of observables. If the cases are randomly assigned, the two groups have similar characteristics and so there is no need to control for differences in characteristics between the two groups. When using the difference in difference approach in the context of an experiment, one randomly assigns cases to two different conditions and compares the before experiment/after experiment differences. In the present analysis, however, although we have randomly assigned groups, we cannot assume that the two groups still have similar characteristics at the time of the intervention. Therefore, the present studies sought to address these potential selection biases through difference in difference estimates. This model controls for the time period of assignment, location, demographic and educational, social capital and environmental variables. To measure the effect of the intervention program on outcome controlling for other covariates, we run the following regression to obtain difference in difference (DiD) or double-difference estimates;

$$Y_{it} = \alpha + \beta_1 T_{it} + \beta_2 ID_{it} + \beta_3 \left(T_{it} * ID_{it}\right) + \beta_4 X_{it} + \varepsilon_{it}$$

(5)

where Y_{it} is the bivariate outcome of interest (sanitary latrine shifting status of household and women participation of decision making process and freedom of activities). For the independent variables, T_{it} is a time dummy, ID_{it} is a dummy variable representing the intervention group (treatment/program group), X_{it} is a matrix of the vector of the explanatory and control variables measured at time t, ε_{it} is the idiosyncratic error term and β_4 is the parameter of interest to be estimated which reflects whether household characteristics, social capital and environmental variables had any causal effect on sanitary improvement and women empowerment over the study period during 2013-2016. The effect we want to estimate is then β_3, coefficient of the interaction term between time and treatment.

For sanitary latrine upgrades, we estimate the probability of one of our household improving from a lower option to better option of sanitary latrine in the health point of view and we estimate the probability of women to participate the household level decision making process and freedom of wearing and engage to outside activities. Probit and logit models are commonly used for estimations in cross-sectional qualitative estimations and sometimes in panel data, but

we favor the linear probability model, which has become increasingly used in panel data estimations, since as a linear estimator it produces more robust estimates when implemented with fixed-effects estimations (Chamberlain, 1980; McIntosh et al., 2007). Estimations are conditional, of course, upon a household not previously having made the particular type of sanitary improvement.

The regression model (5) is simple and easily implementable by parametric methods to evaluate the impact of interest, but have several obvious limitations. First, the parametric specification of the outcome is supposed to be linearly dependent on the covariates. The unobserved residual has allegedly an additive and separable form. Thus, even if one has a complete and relevant set of control variables, the estimated average effect of the treated (ATT) will be biased if the real specification of the interest variable is not linear. Secondly, it is sensitive to the distribution of covariates among treated and non-treated, since it is based on a linear extrapolation to build a counterfactual.

3.1.2 Unobserved heterogeneity bias:

It is due to differences between intervention and control groups in the non-observed attribute ε, $E(\varepsilon_{i1}) \neq E(\varepsilon_{i0})$. However, the unobserved heterogeneity bias due to u still remains. It is an important issue is how to handle the unobserved effect to estimate the panel models. One partial solution is to include a lot of observable variables that are correlated with the outcome of interest. This reduces the residual variance, and allows one to determine how much selection on unobservable there would have to be in order to overturn the direction of program impact obtained when assuming selection on observables (Altonji, Elder and Taber, 2005). If we are prepared to assume that the time invariant unobserved heterogeneity is not correlated to any of the other covariates (strict exogeneity assumption), we can consider the error terms as a composite error and estimate the model as a random effect model. However, this assumption is very strong as there is no assurance that the unobserved heterogeneity will be orthogonal and uncorrelated to the other covariates. The Fixed Effects model allows correlation between the individual effects and the explanatory variables, which can be differenced out in the estimation process. Therefore, the problems of endogeneity because of an incomplete specification that could lead to omitted variable bias can be solved to a reasonable extent by employing fixed effects estimation. The second DiD specification introduces fixed effects (FE) in order to control

for endogeneity linked to time-invariant unobservable factors, such as household's ability. We denote the individual fixed effect α_i and re-write the previous model (5):

$$Y_{it} = \alpha_i + \beta_1 T_{it} + \beta_2 ID_{it} + \beta_3\left(T_{it} * ID_{it}\right) + \beta_4 X_{it} + \varepsilon_{it} \tag{6}$$

4. Results and Discussion

4.1 Attrition rate and distribution of panel units

The survey was designed to examine the effects of a holistic development program on vulnerable rural households. For the present study, we use data from four survey waves from 2013 through 2016, drawing a balanced sample of households from four upzilla. Where panel data are available in developing countries, there is often a non-trivial issue of respondent attrition, which can be problematic when those who leave the sample are differently vulnerable from those who remain in the sample (Kamanou & Morduch, 2005). There are some households who leave the panel in different waves for systematic reasons which are called attrition. If attrition arises due to migration or unwillingness to continue intervention program or other reason, resulting estimates will be biased in one direction or another. There are a few possible routes that could be followed in this regard. First, one could simply treat the data as repeated cross-sections. The problem with this, of course, is that this approach imposes strong distributional assumptions on the error terms, cannot control for unobservable sources of heterogeneity, and assumes that inter temporal variation in income is reasonably proxied by cross-sectional variation. A second approach is to use the unbalanced panel to form pseudo-panels, (e.g., Zhang & Wan, 2006). A final approach which we ultimately chose to use a balanced sample of households those appear in each survey wave. Reducing the total sample into a balanced panel requires tradeoffs between the number of households observed and the length of time over which each household is observed. Table 1 shows the distribution of respondent according to location and program intervention.

Table 1. Distribution of panel units by region and program

Location	Name of NGOs	Panel unit		
		Intervention	Control	Total
Baraigram	Jagorani Chakra Foundation (JCF)	118	55	173 (*3)
Paba	Wave Foundation (WF)	118	55	173 (*3)
Tanore	Ashrai	118	53	171 (*3)
Bhairab	Pally Bikash Kendra (PBK)	118	55	173(*3)
	Total (2013, 2014 and 2016)	**472(*3)**	**218(*3)**	**690(2070)**

We were able to extract a balanced sample of 690 households which consist with 472 from intervention group and 218 from control group that remained as survey respondents from 2013, 2014 and 2016, yielding 2,070 total observations. Of the 740 households in revisited in four study regions, 690 were attended for re-interview up to 2016 which gives us an attrition rate of 6.76% from 2013 to 2016.

4.2 Descriptive statistics of variables in the econometric analysis

Table 2 provides descriptive statistics for the control variables employed in the models for econometric analysis. These statistics provide median, arithmetic mean and standard deviation.

Table 2. Descriptive statistics of control variables used in the econometric analysis

Variables	2013			2014			2016		
	Median	**Mean**	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**
Household size	4.00	4.27	1.11	4.00	4.28	1.09	4.00	4.30	1.06
Age of head	37.00	39.04	10.82	38.00	40.04	10.82	40.00	42.04	10.82
Age of head squared	1369.00	1641.17	930.36	1444.00	1720.26	951.74	1600.00	1884.43	994.53
Avg. education of HH	5.00	6.18	5.02	6.00	7.18	5.02	6.00	7.18	5.02
Highest education of household	8.00	9.56	4.76	8.00	9.56	4.76	8.00	9.56	4.76
Female-headed	0	0.063	0.24	0	0.063	0.24	0	0.063	0.24
Dependency ratio	0.75	0.775	0.09	0.74	0.773	0.10	0.74	0.774	0.10
Cultivable land (decimal)	3.00	16.13	31.70	3.00	17.81	35.50	3.00	20.19	35.06
Ln (Cultivable land decimal)	1.10	1.79	1.23	1.10	1.87	1.28	1.10	1.99	1.33
Paba (yes=1)	0	0.25	0.43	0	0.25	0.43	0	0.25	0.43
Tanore (yes=1)	0	0.25	0.43	0	0.249	0.43	0	0.249	0.43
Baraigram (yes=1)	0	0.25	0.43	0	0.25	0.43	0	0.25	0.43
Bhairab (yes=1)	0	0.25	0.43	0	0.25	0.43	0	0.25	0.43
Membership of Organization	0	0.728	1.02	1.00	1.53	1.07	2.0	1.66	1.08
Awareness of government safety net program (yes=1)	0	0.32	0.47	1.0	0.76	0.43	1.0	0.91	0.29
Group savings	0	0	0	1079.00	785.97	567.84	3357.00	2607.07	1883.91
Access to improve sanitation	0	0.12	0.33	0.0	0.15	0.36	0.0	0.38	0.48
Perception of IPM (yes=1)	0.0	0.02	0.13	0.0	0.12	0.32	0.0	0.36	0.48
No of tree plantation	0.0	0.97	1.72	0.0	1.15	1.61	1.00	1.43	1.61

Source: Own computation from data.

4.3 Comparison of household well-being of intervention and control group

Respondents of intervention group earn significantly more income than control group (Table 3). They earn about 42% more in total family or household income due to program intervention. Table 3 shows that the expenditure and the value of household assets also high for program participant. Our data show that most of the households reported to have no enough food consumption the last 12 months. This indicates that these households are unable to produce enough food to meet their subsistence needs. Staple food from households' own production last only 3-5 months but the food available from own production of intervention group are lasts longer than that of control group. Households' own evaluations of their well being suggest that the program participants of self help group may be better off. The positive correlation we see between program intervention and wealth outcomes. If intervention of self help group indeed makes a difference for well-being, households with equal resources should experience different well being outcomes depending on whether or not they participate in the intervention program.

Table 3. Comparison of household well-being for intervention and control group, 2016

Well-being indicator of household	2016		
	Intervention Group	t- test	Control Group
Household income (TK.)	9182	***	6461
Consumption expenditure (TK.)	7395	***	6040
Value of assets (TK.)	16319	*	14432
Cereal food availability from own production (Month)	4.74	*	3.86

***p<1%, **p<5% and *p<10%

4.4 Who benefits more from intervention program to adapt the sanitation improvement?

We present a disaggregated estimation of the sanitary latrine adaption to compare male-headed households with female-headed households and four study locations. Table 4 reports the results from a separate Fixed Effects estimation of sanitary improvement for female headed and male headed households. The estimated coefficients show that the intervention program increases the probability of a household to switch from lower to better sanitary latrine for all households regardless of the gender of the household head. Although the probability of sanitation improvement was slightly higher for female headed households, perhaps it is due to more

involvement of household head with intervention program. Given that we found no evidence of household-head gender difference in the probability of sanitation technology adoption, it seems that all households have a potential to capture the same benefits from intervention program.

[Table 4 will be here]

Results from estimation of sanitary latrine shifting at four different study locations are reported in Table 5. The results show that the households located in the Bhairob has higher probability than other three locations to shifting from present to improve sanitary latrine. Although the probability of sanitation improvement of Baraigram is very close to Bhairob. The results indicate that the probability of sanitation technology adoption is positively and significantly correlated with program intervention at all study location. This shows that households of Bhairob and Baragram are likely to benefit more in terms of upgrading of sanitation from intervention. It seems that the households of Bhairob and Baraigram are more potential to capture the benefits from intervention program.

[Table 5 will be here]

4.5 Effect of a holistic community development program on participation of women to take decision for loan

Women's participation in the decision making process over loan taking indicated their level of empowerment. Almost all households take loans from different formal and informal sources. Descriptive results reveals that almost all cases dominance of husband in the decision making process over loan has decreased significantly among the entire intervention group. This trend might be a significant progress towards women empowerment as women participants of intervention groups are saving money under group saving funds and have already started taking loans from the group fund. Husbands might be also happy as their wives are capable of earning and saving money that can be used for family purposes. Table 6 presents difference-in-difference estimates of the effect of intervention program on participation of women to take decision for loan by using DiD-OLS and DiD-FE specifications. Our interaction variable of time and project intervention has a constant positive effect on our performance measure. It is significant at 5% level when using DiD-OLS, and 1% when including DiD-FE. We obtain all most the same

magnitude of coefficients with both specifications, which indicates that selection on time-invariant unobservable factors is limited. The probability of a women participation to take decision for loan is increase around 52% due to intervention. This transformation is mainly effect of the program activities as women became directly involved in productive work and well-trained. On the other hand, the Heifer has also provided training for the husbands that might have played a key role to enhance interaction between husband and wife. The results show that the highest education of family members, log income, membership of organizations and access to improve sanitation have a positive impact and on the other hand, only the household size has a negative impact on the probability of women participation to take loan.

[Table 6 will be here]

4.6 Effect of a holistic community development program on participation of women to take decision for agricultural production

Most of the households are involved in agricultural production directly or indirectly at small scale or large scale. Women's participation in the decision-making process of crop production indicates their level of empowerment. They can play a vital role to increase the agricultural production. Table 7 presents difference-in-difference estimates of the effect of intervention program on participation of women to take decision making process for agricultural production by using DiD-OLS and DiD-FE specifications. The results show the probability of a women participation to take decision making process for agricultural production is increase around 45% to 54% due to project intervention. It indicates that the probability of only husband decision making process over agricultural production has decreased significantly over time. It is important to remark that the probability of wife only and both husband and wife in decision-making process over agricultural production have increased remarkably over time due to intervention. This implies that the intervention program encourages women to be engaged in productive activities such as kitchen gardening and poultry rearing.

[Table 7 will be here]

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4.7 Effect of a holistic community development program on participation of women to take decision for child education

Education is the backbone of the nation but the rate of literacy is very low in the study area. Women's role in the decision making process to send children to school is one of the indicators of women empowerment. We study discrete changes in the probability of women participation to take decision for child education. Table 8 presents difference-in-difference estimates of the effect of intervention program on participation of women to take decision making process of child education by using DiD-OLS and DiD-FE specifications. The results show the probability of a women participation to take decision making process for child education is increase around 39% to 51% due to project intervention. It indicates that the probability of only husband decision making process over child education has decreased significantly over time. It is important to remark that the probability of wife only and both husband and wife in decision-making process over child education have increased remarkably over time due to intervention. It indicates that male dominance on decision-making over children's education has reduced significantly among the intervention households. The significant controls variables are same as earlier women empowerment determinants.

[Table 8 will be here]

4.8 Effect of a holistic community development program on freedom of women for wearing of clothes

The impression of the male counterparts regarding the women's activities plays an important role in women empowerment. Freedom in their wardrobe is one of the indicators for women's empowerment. What is the men perception to wear the clothes of women is very import to women empowerment. Table 9 presents difference-in-difference estimates of the effect of intervention program on freedom of women for wearing of cloths by using DiD-OLS and DiD-FE specifications. We obtain all most the same magnitude of coefficients with both specifications, which indicates that selection on time-invariant unobservable factors is limited. The results show the probability of freedom of women wearing of cloths is increasing around 48% to 49% due to project intervention. It indicates that the probability of motivation of husband, wife get freedom for wearing her cloths is increase due to intervention. The results suggest that

the highest education of family members, log income, awareness of government safety need program and access to improve sanitation have a positive impact on the probability of women freedom to wear of clothes. The results show that the highest education of the family members is important matters, not the education of the household head for women empowerment. This is in line with the expectation that educated peoples are more receptive to any social intervention program and perhaps have a better capability to utilize and manage such opportunity. The results indicate that controlling for other factors, 1 year increase the highest education of household is associated with 1% increase the probability of women freedom to wear clothes. Household size and dependency ratio have negative impact on the probability of women freedom to wear of clothes although the impact of dependency ratio is not statistically significant.

[Table 9 will be here]

4.9 Effect of a holistic community development program on freedom of women to go outside to join social activities

Participation of women in social activities in the rural area of Bangladesh is not satisfactory. Freedom of women to go outside for social activities is the sign of modern society. Table 10 presents difference-in-difference estimates of the effect of intervention program on freedom of women for going outside to join social activities using DiD-OLS and DiD-FE specifications. The results show the probability of freedom of women going outside for social activities is increasing around 57% due to project intervention. It indicates that the probability of motivation of husband to allow his wife to go to outside for social activities. It indicates that the women of intervention area enjoy comparatively more freedom to engage in social activities than other women because of the awareness building activities of intervention project. The results suggest that the highest education of family, log income, log cultivable land area, awareness of government safety need program and access to improve sanitation have a positive impact on the probability of women freedom to go outside for joining the social activities. The results show that the highest education of the family members is important matters, not the education of the household head for women empowerment. Education is important, it does not matter household head or other member. The fixed effect estimates show that controlling for other factors, in a household 1 unit of increase log cultivable land area is associated with an increase of the probability of freedom to join in the social activities. As would be expected, households who have larger land holding have higher

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probability to get freedom to go outside for cultural activities. Household size and dependency ratio have negative impact on the probability of women freedom to join the social activities like other indicator of empowerment although the impact of dependency ratio is not statistically significant.

[Table 10 will be here]

4.10 Whether or not the impact of intervention on women participation of decision making process of agricultural production is regional and gender neutral

The results from the Tables 6 to 8 suggest that the intervention has positive impact on the women empowerment in the decision making process although the significant control variables are more or less same across the indicators. Considering the impact of intervention program and R square value, we select women participation in the decision making process for agricultural production for further investigation for compare male-headed households with female-headed households and among four study locations. Further evidence is reported in Table 11 and 12 for the testing of hypothesis that the equality of impact of women empowerment across the gender and locations. We present the estimated coefficients of disaggregated fixed effects estimation to compare male-headed households with female-headed households in the Table 11. The estimated coefficients show that the intervention program increases the probability of a women to participate the decision making process for agricultural production for all households regardless of the gender of the household head. Although the probability of participation of women as slightly higher for male headed households. There is no evidence to find that the household-head gender difference in the probability of women empowerment, it seems that all households have a potential to capture the same benefits from intervention program regarding the women empowerment.

[Table 11 will be here]

Results from the disaggregated fixed effects estimation of women participation to take decision for agricultural production at four different study locations are presented in Table 12. The results show that the households located in the Bhairob has higher probability than other three locations to women empowerment. The results indicate that the probability of women empowerment through participation of decision making process for agricultural production positively and significantly correlated with program intervention at all study location. The results show that the households of Bhairob is likely to benefit more in terms of women empowerment from

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intervention. It seems that the households of Bhairob are more potential to capture the benefits from intervention program, then Baraigarm, Paba and Tanore.

[Table 12 will be here]

5. Conclusion

This research has been conducted between two groups of peoples. One is control group another is intervention group. Control does not receive any kind of input and training. However, intervention group received key income generating inputs such as poultries, seeds, equipment and training for sustainable agriculture and livelihood improvement. The project initiatives towards peoples' participation and group activities have played as a push up factor for development of the less privileged, marginalized and poorest segment of the population. Most of them are excluded from government safety net and other development programs as well as ignored by the existing microcredit program due to their economic and social vulnerability. Heifer International Bangladesh has successfully targeted the population who deserved to participate in the development process. It is a unique initiative to enhance home-based production systems to upscale the food security, nutrition including health environment and empowerment with sustainability through community participation, group-based training, initial goods for production and pass on the gifts to members of other self-help groups. These efforts have potentially improved the situation of poorer segment of the population. In this study, difference in difference fixed effect models were estimated to explore the impact of intervention and to identify the determinates of sanitary improvement and women involvement in decision making process. Five control variables household size, highest education of household member, income, group saving and number of tree plantation are significantly related to sanitary improvement. This study is the first use panel data to evaluate such type of program intervention in Bangladesh. These results provide strong evidence that intervention program has significant positive impact on sanitation improvement and women empowerment. It is an encouraging result, especially in view of the finding that male and female headed households are equally likely to use sanitation technology adaption and women empowerment although there are locational variations. The male dominance regarding the decision-making process has also reduced in the intervention group. Additionally, wives in the intervention group have remarkably up-scaled their capacity in the decision-making process over loan, use of loan, agricultural production, sale

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of product, child education, children's marriage, medical care and family planning. Moreover, women of intervention groups achieve reasonably higher levels of freedom regarding the clothing choice, engagement in cultural functions, and engagement in group activities and leaving the home for social activities compared to the control group due to intervention. The holistic nature of program, development and implementation process has been successfully bringing about changes in the lives of people who received cornerstone training and inputs and significantly contributes to eliminate hunger and poverty. The results in this study taken together lend evidence that this intervention program is good for improving the socio-economic environment of rural poor household. The effective rural development policies that help enhance access to and bridge the technology gap can significantly contribute toward improved their vulnerable situation. A disaggregated analysis of male-headed versus female-headed households and locational variation enables us to test whether or not the impact of intervention is regional and gender neutral.

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Table 4. Comparison of the Fixed Effects model estimations of sanitary latrine adaption for male-headed and female-headed households

Control Variables	Female headed households		Male headed households	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.092	0.137	0.076	0.092
Interaction/DiD (ID*TD)	0.548***	0.211	0.534***	0.198
Household Characteristics:				
Household (hh) size	-0.197**	0.099	-0.175**	0.076
Age of hh head	0.068	0.128	0.059	0.094
Age squared of hh head	0.0005	0.0014	0.0002	0.0004
Ln (income)	0.253***	0.068	0.294***	0.093
Ln (cultivable land)	0.039	0.061	0.048	0.035
Social Capital:				
Membership of organization	0.059	0.106	0.047	0.038
Group savings	0.0002**	0.0001	0.0001***	0.0000
Environmental variables:				
Perception of IPM	0.025	0.018	0.019	0.015
No of tree plantation	0.006**	0.003	0.005**	0.002
Rho	0.726		0.752	
Observations	141		1929	
R square	0.546		0.523	

***$p<1\%$, **$p<5\%$ and *$p<10\%$; Standard error is robust standard error.

Table 5. Comparison of the Fixed Effects model estimations of sanitary latrine shifting at four study locations

Control Variables	Locations			
	Bhairob	Baraigram	Paba	Tanore
Time (TD)	0.083	0.040	0.101	0.041
	(0.081)	(0.104)	(0.269)	(0.121)
Interaction/DiD (ID*TD)	0.620***	0.583***	0.476**	0.453**
	(0.217)	(0.208)	(0.218)	(0.227)
Household Characteristics:				
Household (hh) size	-0.125***	-0.102**	-0.096**	-0.142***
	(0.034)	(0.050)	(0.046)	(0.051)
Age of hh head	0.023	0.053	0.041	0.074
	(0.069)	(0.075)	(0.072)	(0.098)
Age squared of hh head	-0.0007	-0.0010	-0.0008	-0.0007
	(0.0007)	(0.0007)	(0.0007)	(0.0008)
Ln (income)	0.101***	0.311***	0.139***	0.349***
	(0.036)	(0.102)	(0.054)	(0.079)
Ln (cultivable land)	0.099	0.089	0.067*	0.053
	(0.074)	(0.088)	(0.040)	(0.070)
Social Capital:				
Membership of organization	0.0619	0.033	0.059	0.039
	(0.071)	(0.065)	(0.074)	(0.086)
Group savings (Tk.)	0.0002**	0.0004**	0.0002**	0.0003***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Environmental variables:				
Perception of IPM	0.140	0.073	0.126	0.081
	(0.106)	(0.098)	(0.087)	(0.063)
No of tree plantation	0.003**	0.006**	0.004**	0.005**
	(0.0016)	(0.0029)	(0.002)	(0.0021)
Rho	0.484	0.477	0.520	0.522
Observations	519	519	519	513
R square	0.551	0.584	0.473	0.482

***p<1%, **p<5% and *p<10%; Robust standard error in the parentheses.

Table 6. Effect of a holistic community development program on participation of women to take decision for loan

Control Variables	DiD –OLS		DiD –FE	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.068*	0.038	0.027	0.042
Treatment (ID)	-0.164**	0.081	dropped	
Interaction/DiD (ID*TD)	0.457**	0.221	0.510***	0.172
Household Characteristics:				
Household (hh) size	-0.030***	0.008	-0.163***	0.038
Age of hh head	0.0009	0.0048	0.042	0.026
Age squared of hh head	-0.00003	0.00005	-0.0001	0.0002
Education of hh	0.002	0.002	dropped	
Highest education of hh	0.007**	0.003	dropped	
Dependency ratio	-0.154	0.130	-0.468	0.401
Ln(income)	0.269***	0.075	0.121***	0.033
Ln (cultivable land)	0.003	0.006	0.030*	0.018
Social Capital:				
Membership of organization	0.013**	0.006	0.017**	0.007
Awareness of govt. safety net program	0.043	0.046	0.037	0.031
Environmental variables:				
Access to improve sanitation	0.061***	0.034	0.043**	0.021
No of tree plantation	0.006	0.005	0.003	0.009
Observations	2070		2070	
R square	0.566		0.493	
Rho			0.949	

***$p<1\%$, **$p<5\%$ and *$p<10\%$.

Table 7. Effect of a holistic community development program on participation of women to take decision for agricultural production

Control Variables	DiD –OLS		DiD –FE	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.115***	0.023	0.070*	0.036
Treatment (ID)	-0.107***	0.038	dropped	
Interaction/DiD (ID*TD)	0.452***	0.145	0.543***	0.156
Household Characteristics:				
Household (hh) size	-0.013**	0.007	-0.073**	0.037
Age of hh head	0.0008	0.0048	0.034	0.029
Age squared of hh head	-0.00002	0.00005	-0.0005*	0.0003
Education of hh	0.001	0.002	dropped	
Highest education of hh	0.006**	0.002	dropped	
Dependency ratio	-0.171*	0.122	-0.221	0.247
Ln(income)	0.215***	0.056	0.134***	0.032
Ln (cultivable land)	0.008	0.007	0.014	0.016
Social Capital:				
Membership of organization	0.018***	0.007	0.022**	0.011
Awareness of govt. safety net program	0.057	0.065	0.028	0.034
Environmental variables:				
Access to improve sanitation	0.060***	0.0220	0.047***	0.017
No of tree plantation	0.008	0.006	0.003	0.012
Observations	2070		2070	
R square	0.511		0.552	
Rho			0.903	

***p<1%, **p<5% and *p<10%.

Table 8. Effect of a holistic community development program on participation of women to take decision for child education

Control Variables	DiD –OLS		DiD –FE	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.012	0.041	0.026	0.043
Treatment (ID)	-0.236***	0.040	dropped	
Interaction/DiD (ID*TD)	0.392**	0.185	0.506***	0.151
Household Characteristics:				
Household (hh) size	-0.051***	0.009	-0.115***	0.039
Age of hh head	0.0086*	0.0051	0.016	0.027
Age squared of hh head	-0.00010*	0.00006	-0.0002	0.0002
Education of hh	0.002	0.003	dropped	
Highest education of hh	0.007***	0.002	dropped	
Dependency ratio	-0.119	0.218	0.173	0.222
Ln(income)	0.361***	0.106	0.246**	0.117
Ln (cultivable land)	0.017*	0.009	0.009	0.014
Social Capital:				
Membership of organization	0.010**	0.005	0.014**	0.006
Awareness of govt. safety net program	0.055***	0.019	0.124***	0.032
Environmental variables:				
Access to improve sanitation	0.063***	0.023	0.106***	0.033
No of tree plantation	0.007	0.005	0.004	0.010
Observations	2070		2070	
R square	0.477		0.524	
Rho			0.828	

***$p<1\%$, **$p<5\%$ and *$p<10\%$.

Table 9. Effect of a holistic community development program on freedom of women for wearing of clothes

Control Variables	DiD –OLS		DiD –FE	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.059	0.041	0.072	0.058
Treatment (ID)	-0.166***	0.040	dropped	
Interaction/DiD (ID*TD)	0.467***	0.147	0.490***	0.149
Household Characteristics:				
Household (hh) size	-0.031***	0.009	-0.105***	0.039
Age of hh head	0.0034	0.005	0.038	0.027
Age squared of hh head	-0.00002	0.00006	-0.0001	0.0003
Education of hh	0.003	0.004	dropped	
Highest education of hh	0.010***	0.003	dropped	
Dependency ratio	-0.151	0.118	-0.193	0.138
Ln(income)	0.310***	0.118	0.198***	0.034
Ln (cultivable land)	0.011*	0.007	0.017	0.018
Social Capital:				
Membership of organization	0.014	0.009	0.008	0.025
Awareness of govt. safety net program	0.167**	0.019	0.071**	0.031
Environmental variables:				
Access to improve sanitation	0.049**	0.023	0.231***	0.033
No of tree plantation	0.004	0.005	0.001	0.010
Observations	2070		2070	
R square	0.532		0.563	
Rho			0.961	

***$p<1\%$, **$p<5\%$ and *$p<10\%$.

Table 10. Effect of a holistic community development program on going outside to join social activities

Control Variables	DiD –OLS		DiD –FE	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.071*	0.042	0.109*	0.066
Treatment (ID)	-0.186***	0.040	dropped	
Interaction/DiD (ID*TD)	0.459***	0.148	0.573***	0.152
Household Characteristics:				
Household (hh) size	-0.039***	0.009	-0.127***	0.041
Age of hh head	0.002	0.005	0.042	0.029
Age squared of hh head	-0.00002	0.00006	-0.0003	0.0003
Education of hh	0.001	0.004	dropped	
Highest education of hh	0.012**	0.003	dropped	
Dependency ratio	-0.817	0.563	-0.954	0.736
Ln(income)	0.214***	0.057	0.118***	0.036
Ln (cultivable land)	0.021*	0.011	0.012*	0.020
Social Capital:				
Membership of organization	0.026	0.028	0.011	0.026
Awareness of govt. safety net program	0.054***	0.0192	0.069**	0.033
Environmental variables:				
Access to improve sanitation	0.091***	0.023	0.255**	0.035
No of tree plantation	0.006	0.005	0.004	0.012
Observations	2070		2070	
R square	0.522		0.505	
Rho			0.963	

***$p<1\%$, **$p<5\%$ and *$p<10\%$.

Table 11. Comparison of the Fixed Effects model estimations of women participation to take decision for agricultural production for male-headed and female-headed households

Control Variables	Female headed households		Male headed households	
	Coefficients	Standard error	Coefficients	Standard error
Time (TD)	0.119	0.196	0.096	0.064
Interaction/DiD (ID*TD)	0.413***	0.117	0.438***	0.156
Household Characteristics:				
Household (hh) size	-0.263**	0.127	-0.184**	0.084
Dependency ratio	-0.163	0.277	-0.143	0.270
Ln(income)	0.153**	0.069	0.183**	0.092
Ln (cultivable land)	0.081	0.067	0.052	0.061
Social Capital:				
Membership of organization	0.013**	0.006	0.018**	0.008
Awareness of govt. safety net program	0.035	0.128	0.027	0.093
Environmental variables:				
Access to improve sanitation	0.182	0.165	0.154	0.207
No of tree plantation	0.001**	0.0005	0.002	0.0009
Observations	141		1929	
Number of group	43		605	
R square	0.551		0.512	
Rho	0.975		0.893	

***$p<1\%$, **$p<5\%$ and *$p<10\%$.

Table 12. Comparison of the Fixed Effects model estimations of women participation to take decision for agricultural production for four study locations

Control Variables	Locations			
	Bhairob	Baraigram	Paba	Tanore
Time (TD)	0.042	0.038	0.032	0.086
	(0.107)	(0.075)	(0.054)	(0.129)
Interaction/DiD (ID*TD)	0.573***	0.420***	0.385***	0.373***
	(0.213)	(0.135)	(0.146)	(0.093)
Household Characteristics:				
Household (hh) size	-0.141**	-0.160**	-0.122**	-0.107**
	(0.071)	(0.068)	(0.058)	(0.052)
Age of hh head	0.065	0.031	0.056	0.041
	(0.089)	(0.050)	(0.073)	(0.062)
Age squared of hh head	-0.0006	-0.0008*	-0.0006	-0.0002
	(0.0006)	(0.0005)	(0.0006)	(0.0005)
Ln (income)	0.273***	0.296***	0.276***	0.335***
	(0.055)	(0.086)	(0.078)	(0.107)
Ln (cultivable land)	0.013	0.021	0.023*	0.018
	(0.035)	(0.069)	(0.033)	(0.047)
Social Capital:				
Membership of organization	0.031***	0.021**	0.027**	0.020**
	(0.012)	(0.009)	(0.013)	(0.009)
Awareness of govt. safety net program	0.069	0.051	0.074	0.058
	(0.077)	(0.136)	(0.069)	(0.119)
Environmental variables:				
Access to improve sanitation	0.078***	0.094**	0.051**	0.064**
No of tree plantation	(0.029)	(0.045)	(0.025)	(0.030)
	0.019	0.029	0.033	0.024
	(0.026)	(0.037)	(0.026)	(0.029)
Rho	0.701	0.687	0.728	0.580
Observations	519	519	519	513
R square	0.552	0.485	0.6035	0.5395

***p<1%, **p<5% and *p<10%; Robust standard error in the parentheses.