Socio - Economic Characteristics of Farmers Influencing Adaptation to Climate Change: Empirical Results from Selected Homegardens in South Asia with Emphasis on Commercial Orientation[1]

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Abstract

Climate change is considered one of the most challenging current global issues. Adaptability to changes is considered as one of the two major approaches to face the impact of climate change. This study examined the type of adaptation strategies used by the homegardeners in selected locations of South Asia and evaluated the extent to which the choices of such strategies are influenced by the socioeconomic characteristics of the homegardeners. Data for 368 homegardens in five locations in Bangladesh, India and Sri Lanka were collected through a household survey. Commonly used adaptation strategies by the farmers were examined to identify the level of adaptability of homegardeners to the probable impacts of climate change. A binomial probit model was estimated using pooled data to identify the factors determining the probability of adoption, considering the tree crop diversity of the garden, ownership of livestock, perceptions on climate

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1 This paper identifies the influence of Socio-economic determinants on the adaptability of homegardeners to the changes in climate in selected locations of Bangladesh, India and Sri Lanka.

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change, level of education, number of years living in the village, experience in farming, location and commercial orientation as the explanatory variables. The results of the estimation revealed that commercial orientation, perceptions on climate changes, years of experience of the homegardeners, and location significantly influence the probability of adoption of a strategy. The results indicate that the policies and programs to improve adaptation to climate change should consider location specific and household specific characteristics.

Key words: Adaptation - Characteristics of Farmers- Climate Changes- Homegarden - Socio-economic

Introduction

South Asian Agriculture is characterized by a large number of small farmers of which majority live under poverty. Approximately 125 million holdings are operating in an area of around 200 million hectares, with an average size of 1.6 hectares in the region. Of these, more than 80% are extremely small, with an average size of less than 0.6 hectares (Marambe et al., 2012a) a significant component of the small holdings in the region is represented by homegarden farming systems (Pushpakumara et al., 2012) "Homegarden" (HG) is a complex sustainable land use system that combines multiple farming components, such as annual and perennial crops, livestock and occasional fishing, in the homestead and provides environmental services, household needs, and employment and income generation opportunities to the households (Weerahewa et al., 2012).

Climatic changes are predicted to have adverse effects on food production, in varying degrees, in different eco-systems, and HGs are no exceptions. The extents to which the impacts of climate change are felt depend largely on the extent of adaptation. Homegardeners could a significant role in adaptation to climate change i.e. change the microclimate, provide permanent cover, diversify the agricultural systems, improve resource use efficiency, improve soil fertility, reduce carbon emissions and increase sequestration, and enrich in biodiversity (Marambe et al., 2012b).

The extent to which homegardeners have adapted to climate change has been reported in recently concluded studies (Pushpakumara et al., 2012; Weerahewa et al., 2012). The present study assessed the factors affecting the choice of adaptation strategies of different HG systems in South Asia under changing

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climates with special emphasis on the commercial orientation of the homegardeners.

The paper is organized as follows. The next section provides a summary of related studies done in the past, followed by the conceptual and empirical approach adopted in this study. The next section presents the data source used in this study and the basic characteristics of the sample. The adaptation strategies used by the farmers and the determinants of the same are presented thereafter. The paper ends with concluding comments.

Past Studies

The important food crops cultivated in South Asia and Southern Africa will be likely to suffer from negative impacts of changing climates thus, affecting the livelihood of population in these two regions (Lobell et al., 2008). Uncertainties vary widely by crop and most effective benefits come from costly investments such as developing crops and expanding irrigation. Prioritizing the investments is important and it will depend on the risk attitudes of investment institutions. Policy measures that focus on enhancing market orientation of pastoralists can contribute to the adaptation of pastoralists in Ethiopia to climate change (Tessema et al., 2011).

The adaptation strategies to climate change by farming community have been categorized into four groups namely, technological developments (crop development, weather and climate information systems, resource management innovations, farming practices etc.), government programs and insurance (agricultural subsidy and support programs, private insurance, resource management programs etc.), farm practices (farm production, land use, land topography, irrigation, timing of operations, etc.), and farm financial management (crop insurance, crop shares and futures, income stabilization programs, household income, etc.) (Smit & Skinner, 2002). In South Asia, introduction of short cropping varieties, diversification of crops, introduction of heat/moisture tolerant seed varieties, increase soil organic content / low tillage agriculture, water conservation crop management practices, tree planting to provide shade for changes in rainfall patterns and / or seasonality have been identified as the common strategies used by farmers (Sterrett, 2011). In Africa, the adaptation occurs mainly on those sites that are already marginal and planting different varieties, and the changing dates of

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planting, move from farming to non-farming activities, increase water conservation, use of shading and sheltering technique are the key strategies used by the farmers (Maddison, 2007). The perceptions on climate changes and adaptation to climatic conditions in Africa have separately being modelled using a Heckman's sample selectivity probit model, where the results revealed that experience, institutional arrangements, access to input and output markets, and security of tenure are the key determinants(Sterrett, 2011).

In Ethiopia, the use of different crop varieties, tree planting, soil conservation, early and late planting, and irrigation were identified as the key strategies used by farmers, where the level of education, gender, age, and wealth of the head of household, access to extension and credit, information on climate, social capital, agro-ecological settings are the factors affecting the use of such adaptation strategies (Deressa et al., 2008). A Heckman probit selection model was used to model the decision of farmers in Ethiopia to adapt and the age of the household head, wealth, information on climate change, social capital, and agro-ecological settings have been found to have significant effects on farmers' perceptions of climate change. A study that used a probit model to assess the type of adaptation strategies and determinants of the South Africa and Ethiopia has revealed that the use of different crops or crop varieties, planting trees, soil conservation, changing planting dates, and irrigation are the key adaptation strategies (Bryan et al., 2009), whereas the barriers to adapt are lack of access to credit in South Africa and lack of access to land, information, and credit in Ethiopia. The factors influencing adaptation included wealth, and access to extension, credit, and climate information in Ethiopia, and wealth, government farm support, and access to fertile land and credit in South Africa (Bryan et al., 2009). Farmers were more likely to adapt if they had access to extension, credit, and land. Food aid, extension services, and information on climate change were found to facilitate adaptation among the poorest farmers. A study that used a heuristic post-structural approach revealed that the factors influencing adaptation include credibility of government, opinion on science, availability of comprehensible scientific information and interactions between farmers' knowledge and science are important determinants of adaptation to climate changes by the dairy farmers in Australia (Evans et al., 2011).

In a recently concluded study in selected HGs in Sri Lanka (Weerahewa et al., 2012) and in Sri Lanka, Bangladesh and India

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(Marambe et al., 2012b) reported that the changes in planting dates, agronomic practices, use of soil and water conservation measures and technology such as use of new varieties and irrigation equipments were the most commonly used adaptation strategies. By using a probit analysis, it has been reported that the type of employment, age, sex, education level of household head, experience in farming, homegarden size, diversity of homegardens measured by the Shannon Weiner Index (SWI), and perceptions towards climate change have significantly influenced the decision to adopt a given strategy by homegardeners in selected parts of South Asia (Weerahewa et al., 2012; Marambe et al., 2012b).

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Conceptual and Empirical Approach

In this study, the probability of adapting a strategy was hypothesized to be influenced by the intrinsic characteristics of the homegarden and the socio-economic characteristics of the homegardeners paying a special emphasis on the commercial orientation of the homegardeners. Accordingly, a probit model was used to analyze the factors which influence the decision to adapt a climate changes (Deressa et al., 2010). The dependent variable was treated as one if a certain farmer adopted a strategy and 0 otherwise. The independent variables included diversity of the homegarden (Shannon-Winner Index), status of the employment (number of individuals employed in farming and off-farming), education level of the household-head (a dummy variable = 1 for primary and above = 0 otherwise), household size, age of the household head (number of years), homegarden size, experience in agriculture, number of years living in the village, perceived change in temperature (a dummy variable = 1 for perceived change, = 0 otherwise), ownership of animals (a dummy variable = 1 for owned livestock, = 0 otherwise) and commercial orientation of the homegardeners (ratio of income drawn from the homegarden as a proportion of the total household income).

Adapting to climate changes by a profit maximizing farmer is described using discrete choice models. The data set was pooled across locations and a variety of models was estimated treating different sub-sets of socio-economic variables as explanatory variables. The best model was selected based on the statistical criteria of the estimations (such as pseudo R-squared and statistical significance of the coefficients). In the standard probit model the adaptation is treated as a binary dependent variable where y= 1 (using any 1 strategy) and 0 (not adapting). Adapting to climate changes can be given by the following function (Wooldridge, 2002).

Latent variable y_i^* can be given by the equation below.

$$y_i^* = x_i\theta + e_i \qquad e_i \sim N(0,1)$$

Where e_i is independent of x_i (which is a *1°K* vector with first element equal to unity for all i). Above equation can be written as follows for binary response variable.

$$y_i = 1[y_i^* > 0]$$

Log likelihood function for the i^{th} observation of probit model is given by the equation below.

$$l_i(\theta) = y_i \log \emptyset\,(x_i\,\theta) + (1 - y_i)\log[1 - \emptyset(x_i\theta)]$$

Data and Data Collection

Data for the analysis was gathered from a multi-country project carried out in Sri Lanka (project proponent), India and Bangladesh. The data set covered three project sites in Sri Lanka and one each from India and Bangladesh. Among the three project sites selected in Sri Lanka, two were from areas in the Low Country Dry Zone with considerable fluctuations in rainfall intensity and distribution pattern, and one site from an area in the Mid Country Wet Zone with a modest variation in rainfall intensity and distribution pattern. The three sites were also selected to represent different temperature regimes. Similar criteria were used in selecting one site each from Bangladesh and India where areas with comparable climatic conditions to that of the Sri Lankan sites were given priority to facilitate direct comparison of information generated across partner countries. The site selection process was finalized at the Project Inception meeting held in Dambulla, Sri Lanka in November 2009 and the 8-point criteria adopted are given in Figure 1 (Marambe et al., 2012a) whereas the details of site characteristics and the sample size of each site are given in Table 1.

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Figure 1: Criteria Adopted for Selecting Project Sites

1. Availability of Home Gardens (HG) to suit the definition

2. Key characteristics of HG
   Extent (< 0.5 ha)
   Maturity (at least 20 yrs)
   Composition (Trees and annual are a must, domesticated animals are preferable)
   Structure (at least a 3-tiered plant structure)
   Sites not subjected to significant man-made changes (i.e., construction of roads, establishment of irrigation reservoirs and development of market places)

3. Access to background information on factors other than the climate change, affecting HG

4. Climatic regions
   Mid country (300 – 900 m amsl) Wet Zone (> 2500 mm/year)
   Low country (< 300 m amsl) Intermediate Zone (1750-2500 mm/year)
   Low country (< 300 m amsl) Dry Zone (< 1750 mm/year)

5. Availability of climatic data (from Meteorological Department)

6. Easy Access to HG

7. Number of homegardens surveyed per country should be a minimum of 100.
8. Commonness among south Asia

Source: Compiled by the authors

Table 1: Characteristics of the Study Sites

Country and Villages	Agro - Climatic/ Climatic Zone	GPS Locations of the Study Sites	Number of Homegardens Surveyed
Sri Lanka			
Keeriyagaswewa	Low Country Dry Zone	7.86° N, 80.65° E	59
Siwalakulama	Low Country Dry Zone	7.95° N, 80.75° E	30
Pethiyagoda	Mid Country Wet Zone	7.27° N, 80.60° E	59
India			
Ledagamar Keshia	Sub-Humid	22.80° - 22.83° N 87.32° - 87.32°E	100
Bangladesh			
Borjona, Nakasini, Koroli, Goshaigao, Tatulia and Charbaria	Subtropical Monsoon Region	24.3° - 24.16° N 90.3° - 90.42° E	120

Source: Compiled by the authors based on the background study

Results and Discussion

Socio-economic Characteristics of the Households

The socio-economic characteristics of the study sites are presented in Table 2. The largest extent of the homegardens surveyed was recorded in Sri Lanka (average 0.29 ha) followed by India and Bangladesh (0.07 ha and 0.12 ha, respectively). The household economy and food security information are shown in Table 3. The percentage income contribution of respective HGs studied (based on survey data) in Bangladesh was 0.18%, India 0.04%, and Sri Lanka: Keeriyagaswewa (KG) 0.05%. Siwalakulama (SW) 0.01% and Pethiyagoda (PG) 0.04%, without considering the value of the products from HGs consumed at the household level. The highest contribution to household food security from HGs was reported from the Bangladesh study sites. The average food ratio in Sri Lanka was higher compared to the study sites in India and Bangladesh.

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Table 2: Socio-Economic Characteristics of the Households

Attribute	Category	Bangladesh Sites	Indian Sites	Sri Lankan Sites		
				Keeriyagaswewa	Siwalakulama	Pethiyagoda
Size of the Household (Number)	Average Range	5.0 2-10	5.9 2-15	4.0 1-8	3.5 1-5	4.1 1-7
Age of the Household Head (HH) (Years)	Average Range	51 20-90	55 22-85	55 30-83	58 30-86	54 26-78
Sex of the HH (% in Each Category)	Male Female	97.5 2.5	84.0 16.0	86 14	80 20	81 19
Education Level of the HH (% in Each Category)	No Schooling Up to Primary Secondary & above	14.2 48.3 37.5	29 22 49	5.1 84.7 10.2	1.3 83.3 13.3	1.7 86.4 11.9
Occupation of the HH (% in Each Category)	House work Farming Farming and other* Non-Farming Not Responded	0.0 93.3 0.0 6.7 0.0	13.0 65.0 11.0 11.0 0.0	0 78 0 15 7	3.3 93.3 0 3.3 0	8 28 0 50 14

*Note: * Number of respondents who are engaged in farming and other occupations*

Source: Compiled by the authors based on the statistical estimates of household survey

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Table 3: Household Income and Expenditure and Food Security

Attribute	Bangladesh Sites (BDT Per Month)	Indian Sites (INR Per Month)	Sri Lanka Sites (LKR Per Month)		
			Keeriyagaswewa	Siwalakulama	Pethiyagoda
Average Income	11,172.50	5,075.97	23,216.02	23,531.33	26,195.76
Average Expenditure	8,926.75	4,065.72	14,166.10	8,466.67	18,603.45
Average Expenditure on Food and Drinks	5,217.50	1,954.50	6,179.80	3,766.67	10,909.09
% Contribution from the HG to the Monthly Income	1,981.25	192.48	1,154.74	222.22	969.77
Average Food Ratio*	0.48	0.39	0.51	0.1**	0.58
% Contribution From HG as a Ratio of Total Expenditure on Food and Drinks	67.44	17.66	16.6	0**	28.81

Notes: USD 1 = LKR 127 = INR 51.4 = BDT 81.7

** Total Expenditure on food and drinks as a ratio of total household income*

*** A Result of missing data*

Source: Compiled by the authors based on the statistical estimates of household survey

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Utilization of Tree Species from Homegardens

Conventionally the HGs are rich with food trees and serves as primary food source of direct access to the rural families. Homegardeners obtain nutrients from these crops, naturally grown plants and trees via two channels namely, parts or trees consumed directly, and parts consumed by livestock and their products available to family. In Sri Lanka, Coconut (*Cocus nucifera* L.), Mango (*Mangifera indica* L.), Jackfruit (*Artocarpus heterophyllus* Lam.) and Guava (*Psidium guajava* L.) are the most commonly found food tree species in the three study sites shown in Table 4. In Keeriyagaswewa) in Sri Lanka, 70 % of the total coconut nuts harvested are used for home consumption. Moreover, the harvests of 14 food tree species out of 19 are largely used for family consumption purposes. The main income generating food tree species is Tamarind, where 86 % of the total harvest was sold. In Siwalakulama, the coconut harvest is largely being used for income generation i.e. 66 % of the harvest was sold. Moreover, the harvest of five food tree types out of 10 in SW site are largely (>50%) sent to market than consumed or gifted. In Pethiyagoda, too, four out of nine food tree species found in the homegardens are largely for income generation purpose.

In Indian study sites shown in Table 4, the prominent food tree species were Mango, Jackfruit, Coconut and Guava (in descending order), and in the Bangladesh study site, Jack, Mango, Coconut and Litchee (*Litchi chinensis* Sonn.) (in descending order). Homegardens in the Bangladesh study site were more commercially oriented than India and Sri Lanka. In Bangladesh more than 85 % of the total Date palm (*Phoenix dactulifera* L.), Hog plum (*Spondias mombin* L.) and Litchi harvest, was sold. The harvest of Black berry (*Rubus fruticosus* L.), Guava and Jarul [*Lagerstroemia speciosa* (L.) Pers.] contributed most for the family nutrition.

Perceptions of Homegardeners on Climate Change

In the three study sites in Sri Lanka, respondents have perceived different levels of changes in rainfall, and day and night temperatures. In the Keeriyagaswewa site, the majority of the respondents perceived reduced amount of rainfall, changed onset of the rains, and increased day/night temperatures. In the Siwalakulama study site, the majority of the respondents have not perceived a change in the amount of rainfall or onset of the rains or day/night temperatures, while in Pethiyagoda, the majority of the respondents have perceived reduced amount of rainfall, changed onset of the rains and increased day/night temperatures shown in Table 5.

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Table 4: Produce of Tree Species utilized in the Homegardens

Trees Local Names	Bangladesh Sites			Indian Sites			Sri Lankan Sites								
							Keeriyagaswewa			Siwalakulama			Pethiyagoda		
Tree Species[1]	Con*	Gift	Sold	Con*	Gift	Sold	Con*	Gift	Sold	Con*	Gift	Sold	Con*	Gift	Sold
Belli							68.6	31.4	0	60	40	0			
Katu Anoda							74.1	25.9	0				25	0	75
Weli Anoda							70.9	29.1	0	100	0	0			
Bread fruit							60	40	0	57.1	42.9	0	33.3	21.2	45.5
Jackfruit	35.7	9.6	54.7	62.4	18.3	19.3	68	32	0	100			37	7.4	55.6
Lawalu							100	0	0						
Peni Dodan							63	37	0	81.3	18.8	0	100		
Coconut	22.8	9.2	68.1	70.1	8.5	21.4	81.2	8	11	40.5	1.3	58.2	82.1	0	17.9
Woodapple	27.1	3.7	69.3	45.3	15.6	39.1	66.7	33.3	0	28.4	16.1	55.5			
Mango	37.9	10.5	51.7	58.4	12.8	28.8	60.9	29.2	9.9	34.3	15.8	49.9	68.8	35.2	0
Guava	49.2	2.8	48	58.7	25.3	16	68.8	31.3	0						
Tamarind							10.2	3.5	86	8.6	5.7	85.7			
Avocado							50	50	0				85	15	0
Durian													7.1	7.1	85.7
Rambutan													50	50	0

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Blackberry	78	0.4	21.7												
Date Palm	4.3	1.3	94.4	70.4	16.2	13.3									
Hog Plum	3	1.2	95.8												
Jarul	38.8	7.2	53.9												
Jujubi	30.3	19.2	50.5												
Litchee	9.8	3.2	87												
Olive	26.2	23.1	50.7												
Pumello	35.2	26.1	38.2												
Jamboline			41.8	13.2	45										

Notes: [1] *Botanical names and families of species are : Belli=Aegle marmelos* (L.) Correa *(Rutaceae); Katu Anoda=Annona muricata* L. *(Annonaceae); Weli Anoda=Annona reticulata* L. *(Annonaceae); Bread fruit=Artocarpus incisus* L.f. *(Moraceae); Jackfruit=Artocarpus heterophyllus* Lam. *(Moraceae); Lawalu=Chrysophyllum roxburghii* G. Don. *(Sapotaceae); Peni Dodan=Citrus sinensis* (L.) Osbeck *(Rutaceae); Coconut=Cocos nucifera* L. *(Arecaceae); Woodapple=Limonia acidissima* L. *(Rutaceae); Mango=Mangifera indica* L. *(Anacardiaceae); Guava=Psidium guajava* L. *(Myrtaceae); Tamarind=Tamarindus indica* L. *(Fabaceae); Avocado=Persea americana* Miller *(Lauraceae); Durian=Durio zibethinus* Murr. *(Bombacaceae); Rambutan=Nephelium lappaceum* L. *var. lappaceum (Sapindaceae); Blackberry, Madan=Syzygium cumini* (L.) Skeels. *(Myrtaceae); Date Palm=Phoenix sylvestris* (L.) Roxb. *(Arecaceae); Hog Plum=Spondias dulcis* Soland ex. Par. *(Anacardiaceae); Jarul=Lagerstroemia speciosa* (L.) Pers. *(Lythraceae); Jujubi=Zizyphus jujuba* Miller. *(Rhamnaceae); Litchee=Litchi chinensis* Sonn. *(Sapindaceae); Olive=Olea europaea* L. *(Oleaceae); Pumello=Citrus grandis* (L.) Osbeck *(Rutaceae); Jamboline=Citrus grandis* (L.) Osbec *var. grandis (Rutaceae).*

* *Consumption*

Source: Compiled by the authors based on the statistical estimates of household survey

In the Bangladesh study site, the majority of the home gardeners experienced a decline in rainfall, delay in the onset of rains, and increase in the day/night temperatures shown in Table 5. However, in India all the respondents have perceived increased day/night-time temperatures and decreased amount of rainfall.

Table 5: Perception on Climatic Changes during the Past Twenty Years As a Percentage of the Total Respondents in Each Category

Incident	Nature of Perception	Bangla-desh Sites	Indian Sites	Sri Lankan Sites		
				Keeri-yagas-wewa	Siwal-akula-ma	Peth-iya-goda
Amount of Rainfall	Increased	7.7	0	13.6	30	68
	Decreased	69.2	100	66.1	16.7	8.5
	Fluctuate	23.1	0	8.5	6.7	3.4
	No change	0	0	11.9	43.3	20
	No idea	0	0	-	3.3	-
Rainy Period	Onset Changed	84	<1	81.4	40	53
	Fluctuate	7.7	99	5.1	3.3	25
	No change	7.7	0	13.6	53	20
	No idea	0	0	-	3.3	1.7
Day Temperature	Increased	92.3	99	71.2	23	64
	Decreased	0	<1	3.4	26.7	5.1
	Fluctuate	7.7	0	1.7	3.3	5.1
	No change	0	0	23.7	43.3	24
	No idea	0	0	-	3.3	1.7
Night Temperature	Increased	92.3	99	66.1	13.3	64.4
	Decreased	0	<1	8.5	30	5.1
	Fluctuate	7.7	0	1.7	6.7	5.1
	No change	0	0	23.7	46.7	23.7
	No idea	0	0	-	3.3	1.7

Note: Only valid observations were considered. Missing data are not included in "No Idea" category

Source: Compiled by the authors based on the statistical estimates of household survey

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Use of Adaptation Strategies

The HGs across study sites in Sri Lanka and those in Bangladesh study site showed that changing technology is the most commonly adapted coping strategy for climate change, while in India soil and water conservation methods were much popular. In the study sites in Bangladesh, India and Sri Lanka, over 90%, 85% and 55% of the homegardeners surveyed, respectively, have changed the technology adapted in homegardens during the past twenty years. In the Bangladesh study site, the use of the adaptive strategies such as changing planting dates, changing technology used and changing agronomic practices, were found to be higher compared to those of the study sites in India and Sri Lanka.

Determinants of Adaptation Strategies

The results of the probit estimation indicate that the coefficients of monthly income contribution from homegarden, perception on changing temperature, number of years lived in the village and experience in agriculture, and location have statistically significant effects on the likelihood of adapting a strategy. Ownership of livestock, Shannon-Weiner index for tree crops, extent, level of education, or employment did not have statistically significant effects. Results of the econometrics model are summarized in Table 6.

The results further indicated that those who extract relatively a larger proportion of income from the homegarden tend to use more adaptation strategies. This infers that those who are commercially-oriented are more cautious about the environment than the others, possibly because it is their livelihood. Interestingly, the households that are settled in the village over a longer period of time are less likely to use adaptation strategies yet the experienced farmers are likely to adapt more. Those who perceived a changing climate are more likely to adapt suggesting that programs to enhance awareness would increase the probability of using adaptation strategies. The results clearly showed that there are significant differences in probabilities of adaptation across different locations.

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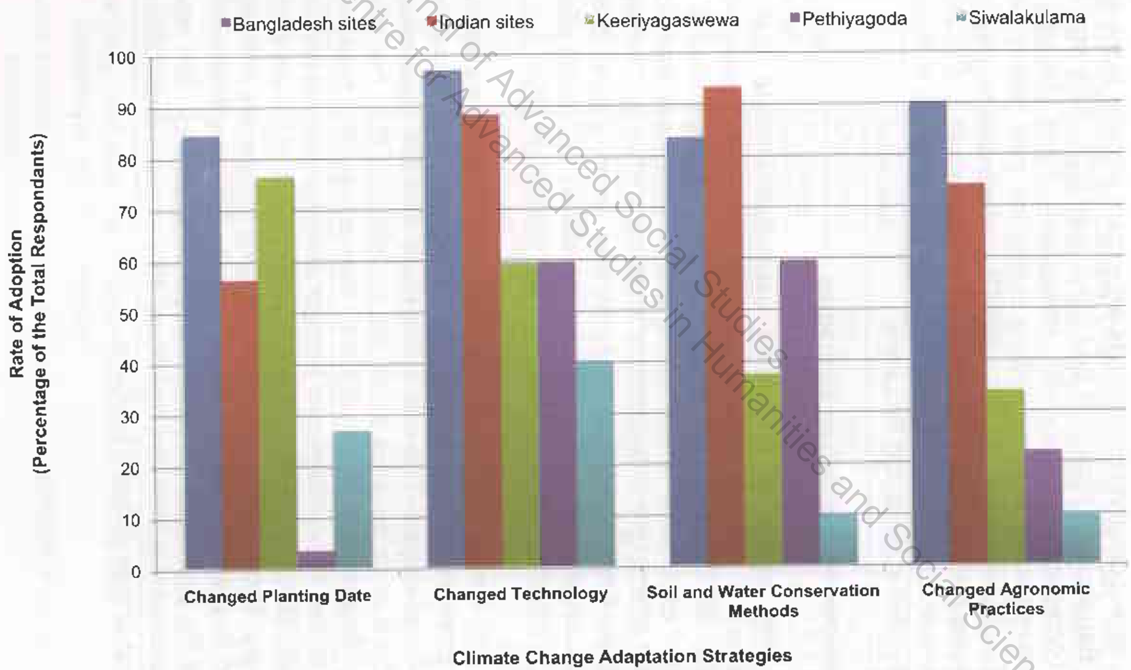
Figure 2: Types of Adaptation Strategies Used



Source: Compiled by the authors based on the statistical estimates of household survey

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Table 6: Results of the Probit Estimation

Explanatory Variable	Description	Coefficient	Marginal Probability (%)
Constant		2.756 (1.290)	
Employment	Number of Family Members in Farming Employment	0.065 (0.163)	0.020 (0.000)
	Number of Family Members in non-Farming Employments	-0.108 (0.158)	-0.033 (0.000)
Exposure	Number of Years of Experience in Agriculture Mean=31.505	0.026* (0.014)	0.008 (0.000)
	Number of Years Living in the Village Mean=47.488	-0.0187** (.009)	-0.005 (0.000)
	Dummy Variable for Awareness on Climate Changes =1 if Respondent aware of a Change =0 otherwise	1.019*** (0.367)	0.333 (0.006)
	Dummy Variable for the Education Level of Household Head =1 if primary and above, =0 otherwise	0.925 (0.819)	1.077 (0.026)
Commercial Orientation	Income from Homegarden As a Proportion of Total Household Income Mean = 0.10	14.379** (5.928)	4.456 (0.077)

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Location	Dummy Variable for Location D1=1 for Bangladeshi, 0 otherwise	3.824*** (1.234)	12.389 (0.171)
	Dummy Variable for Location D3=1 for Keeriyagaswewa, 0 otherwise	0.622 (0.488)	0.135 (0.003)
	Dummy Variable for Location D4=1 for Pethiyagoda, 0 otherwise	0.913** (0.594)	0.130 (0.002)
Ownership of Livestock	Dummy Variable for Livestock Farmers, =1 if Owned Livestock, =0 otherwise	-0.345 (0.689)	-0.110 (0.003)
Homegarden Characteristics	Shannon Weiner Index for Tree Crops in HG Mean= 1.543	0.406 (0.408)	0.125 (0.002)
	Homegarden Extent, Acres Mean= 0.423	0.530 (0.546)	0.164 (.003)
	R-Squared		44.7%

Notes: Figures in parenthesis are Standard Errors
**Significant at p=0.1*
***Significant at p=0.05*
****Significant at p=0.001*

Source: Compiled by the authors based on the statistical estimates of household survey

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Conclusions

The use of specific adaptation strategies by the homegardeners in five locations was found to be highly location specific. The results revealed that commercial orientation; perceptions on climate changes, years of experience of the homegardeners, and location significantly influence the probability of adoption of a strategy indicating the need to consider location specific and household specific characteristics in designing climate change policies.

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