

Approaches to Sustainable Development

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Inequalities of Hunger in India

Evidences from Secondary Data

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Abstract

The 2017 Global Hunger Index (GHI), released by the International Food Policy Research Institute (IFPRI) reports that India, which has more than a fifth (21 percent) of its children wasted, has ranked to 100th position among 119 countries in the world. IFPRI has termed India's hunger levels as 'serious' and the country ranked lower than all its neighbouring countries - Nepal (72), Myanmar (77), Bangladesh (88), Sri Lanka (84) and China (29) - except Pakistan, in the global hunger list. This leads us to conclude that macro level food self-sufficiency in the country has failed to ensure micro level food and nutritional security of the poor. As a result of which, inequalities of hunger is in yawning shape day by day in India. Close inspection of NSS, NFHS and NCAER data clearly shows that though India had made adequate progress to ensure physical availability of food to the poor people, its economic access, as well as, absorption of food, leading to proper nutritional outcome has not been properly taken care of. The paper suggests that, in order to get rid of hunger inequality, country must have to think for some out-of-the-box policy formulations like reorientation of agricultural production structure through its diversification, region based development plans, strengthening of National Nutrition Mission.

Key Words: Hunger, Malnutrition, Food Production, Consumption Expenditure, Calorie, Protein, Policy Changes

JEL Classification: I32, H55, Q18

1.1 Global Hunger Index and India

Despite steady economic growth and development in India, a significant proportion of the country's population continues to suffer from food insecurity and malnutrition. Information provided though data of International Food Policy Research Institute clearly demonstrates that India persists to have 'serious' levels of pervasive hunger, as a result of which, the country has been ranked 100 among 119 developing countries in terms of Global Hunger Index (GHI) calculated in 2017 (IFPRI, 2017). The significant data casted a reflection on the report stating that India stood at a rank below than all its neighboring countries namely Nepal (at 72), Myanmar (at 77), Bangladesh (at 88), Sri Lanka (at 84) and China (at 29). On the other hand, Pakistan, obtained the rank of 106th position in the global hunger list. The Hunger Index has four magnitude: inadequate food supply measured through undernourishment; child under-nutrition measured through wasting and stunting of under-five children; and child mortality measured through under-five children mortality. The statistics provided by IFPRI illustrates that undernourished population in the country is 15.2 per cent and 4.8 per cent of under-five Indians are mortal. The incidence of wasting is 21.1 per cent for under-five children, while stunting is as high as 38.7 per cent. The report entitled 'State of Food Security and Nutrition in the World 2018', published by United Nations on September 11, 2018, is showing the same grievous situation of India, for which it appears almost impossible to eradicate hunger by 2030 (UN, 2018). Keeping in line, according to 2015-16 National Family Health Survey (NFHS), of Indian children under five, one in three (35.7%) is underweight, one in three (38.4%) is stunted and one in five (21%) is wasted. Thus, nutrition security, especially for under-five children, the future citizens of the country, assumes importance and much effort are needed to ensure it.

Poor nutrition is a key conclusion behind absence of food security. Food insecurity reasons poverty, vulnerability and livelihood insecurity, but, at the same time, is also a result of these circumstances. Hunger and under-nourishment make it extremely difficult for poor people to improve their own well-beings and make it unfeasible for them to contribute towards sustainable and broad-based economic growth. To concentrate on the issue of widespread poverty, vulnerability and food insecurity, the Government of India, since

independence, has planned and implemented multiple development projects. A significant policy lesson has been that macro-level food self-sufficiency has been achieved partly by establishing national system for public grain procurement and distribution, as well as an increasing food production. However, this has proved insufficient to ensure micro level food and nutritional security for the poor, as evident from national and international data.

1.2 Modeling Hunger in India

Food and nutrition security can broadly be characterized with the help of three distinctive aspects: availability of diversified food items; accessibility of those items to the mass, especially poor; and absorption or amalgamation of food people having as their diets (nutritional outcomes). In an effort to attain these, it is almost certain that it will be necessary to innovate and consider out-of-the-box policy options. The role of various stakeholders, public or private and partnerships among them will be critical. In analyzing the recent trends of food and nutrition security status in India, following model may be helpful for its better understanding.

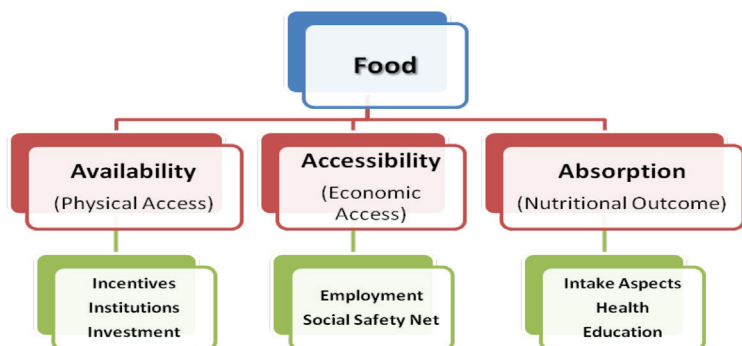


Diagram 1: Modeling Food and Nutritional Situation in India

Source: Adapted from 'Food and Nutrition Security Status in India', ADB Working Paper Series, No. 16, 2010

The procedure adapted to achieve adequately in the amount of food grains in a sustainable manner was achieved through a definite effort led by the national government in collaboration with its domestic partners along with international agencies to keep the technical,

administrative, and financial resources rolling in order to launch the Green Revolution. All-India production of wheat grew at 10.3% in the triennium ending in 1969–1970. India has come forward as the largest producer of milk (more than 146 million tons in 2014-15) and the second largest producer of fruits and vegetables (256.1 million tons in 2014-15). Production of fish has also more than doubled since 1991. A noticeable issues referring to the debate on food security is the per capita availability of food obtained. The scenario in per capita availability of food grains, haven't come up with a steady figure but has been marginally negative (with per capita availability of food obtained gradually came down). It is important to consider availability, along with changing demand patterns, with special focus on diversifying toward high-value commodities needs ample attention too. The food security issue is not only connected with so the availability of food grains but also with the composition of the entire food basket reflected from the changing consumption patterns.

The view comprises in such a way that the rising middle class in India poses an observable change in the consumption patterns and raises the demand for quality food while a large section of the population is still lagging below the poverty line. There is no denying the fact that post-reform period of Indian economy has experience a proportional decline of poor people as evident from secondary data. According to NSSO, in 1973–1974, India was 55 per cent of poor people, which has come down to 21.1% in 2014–15. But, here it is important to note that the rate of decline has somewhat slowed down in the post-reform period and as a result, in our country, more than 25 crores people continue to live in poverty. Food resources sufficiently can match the demands of more than 50% of the monthly per capita expenditure in India as well as including the low income groups. Therefore the poor and vulnerable groups have limited economic access to food. A noteworthy dietary transformation is present consisting of the decline in the consumption of cereals and in a similarly a growth inclination towards high-value food is taking place. The overall, alterations in the consumption pattern towards high value food are not visibly sufficient to generate adequate nutritional outcome to the poor.

1.3 Nutritional Insecurity and Hidden Hunger in India:

Calorie and protein are the two important dimensions of nutrition. Amplifying food supply may guarantee availability of calories in human body, but mere ensuring calories are not sufficient to lead quality life. For that provision of quality food is essential in order to endow with adequate micronutrients which are urgently required for our body, especially to the poor people. In order to improve the quality of calorie basket, more vegetables and fishes are to be added to the diet. The availability of protein, on the other hand, can improve only when foods of animal origin are consumed. Of late, protein supply, especially to the poor households, is in hazard, due to high and rising prices of commodities like pulses, eggs, fishes. According to the World Bank report (2011) – “South Asia still has the highest rates and the largest number of undernourished children in the world”, and also “the high economic growth experienced by South Asian countries has not made an impact on the nutritional status of South Asian children” (Meena et. al., 2016). NSS reports published states that, ‘Nutritional Intake in India’ targets to observe the quantity of energy, measured in kilo calories (kcal) being consumed, consumption of macromolecular nutrients like protein, fat and their sources within various socio-economic classes for India as a whole and also at the state level.

Though many research studies found that the diet in south and Southeast Asia, particularly in India, is mainly cereal-based, the principal source of protein is actually rice, which contributes about 8-10 per cent of an individual’s average protein intake (Thilsted, 2012). This, along with other foods like pulses and milk products, is not often adequate to meet the total protein requirement of an individual, causing wide spread malnutrition and under nourishment in rural India. This is evident from table 1.1. More interesting to note that problem of inadequate calorie intake by rural Indians is much more acute in Eastern and North-Eastern region. Almost 73 per cent of the rural population in eastern India is suffering from inadequate protein intake which is higher than average rural protein intake (68 per cent). Persons having adequate intake of calorie in that region are also lower than average rural Indians. Only 15 percent of rural population in eastern India are having calorie higher than required; whereas 19 per cent of average rural Indian have excess intake of calorie.

Table 1.1: *Distribution of persons by level of calorie intake in rural India (in million)*

Region	Deficient intake	Adequate intake	Excess intake
Eastern	147.3 (73)	23.7 (12)	31.3 (15)
Northern	123.9 (52)	38.7 (16)	73.4 (31.3)
North-eastern	25.5 (74)	4.2 (12)	4.7 (14)
Southern	106.3 (71)	17.3 (12)	25.3 (17)
Western	96.4 (70)	21.2 (15)	20.3 (15)
Rural India	520.4 (68)	96.0 (13)	144.8 (19)

Source: NFHS, Round 4, 2016

No doubt, the overall intake of calorie and protein has increase in India during the period of early 1980's to 2014. Statistics regarding per capita protein and calorie intake through foods and animal origin substantiate the fact. Again, percentage share of those, who are consuming protein from animal origin and also having their calorie intake from it, has increase marginally during that period. The relative share of foods of animal origin in protein intake has increased from 15.6 per cent in 1987-1993 to 19.0 per cent in 2005-2010. The relative share of foods of animal origin in calorie intake has increased from 7.0 per cent during 1987-1993 to 8.7 per cent during 2005-2010. These results of table 1.2 can easily be associated with trends in per capita consumption of major food commodities in India as evident in table 1.3. Actually fact is that, over the years, availability of vegetables, fruits, animal food, including fishes and eggs has increased in our country, which has made Indian diet much more diversified. As a result, Indian rural consumers are moving away from cereals type of food grains to high-value food commodities (NCAER, 2014; Satyarthi and Shukla, 2016). Increase in urbanization and globalization are also two factors which are contributing towards diversification of food consumption pattern in our country.

Inequalities of Hunger in India

Table 1.2: *Per capita protein and calorie intake from animal food and crop in India*

Period	Protein Intake (grams/day)			Calorie Intake (kcal/day)		
	Animal	Crop	total	Animal	Crop	Total
1987-93	8.6 (15.6)	46.6 (84.4)	55.2 (100)	156 (7.0)	2090 (93.1)	2246 (100)
1994-99	9.5 (17.2)	45.9 (82.9)	55.4 (100)	175 (7.7)	2108 (92.3)	2283 (100)
2000-04	9.6 (17.6)	45.1 (82.5)	54.7 (100)	181 (8.0)	2076 (92.0)	2257 (100)
2005-10	10.7 (19.0)	45.5 (81.0)	56.2 (100)	201 (8.7)	2110 (91.3)	2311 (100)

Note: *The figures in the parentheses depicts percentage of respective total*

Source: NCAER, 2014

Table 1.3: *Trends in per capita consumption of major food commodities in India (kg/year)*

Food Commodity	Rural			Urban		
	1987-88	1999-00	2009-10	1987-88	1999-00	2009-10
Rice	83.0	80.0	73.0	64.0	62.0	53.0
Wheat	55.0	54.0	52.0	53.0	54.0	50.0
Pulses	7.9	10.2	7.9	9.04	12.2	9.6
Milk	38.9	46.1	50.1	51.8	62.1	65.2
Eggs	6.3	13.2	21.1	17.4	25.1	32.5
Fish	1.9	2.6	3.3	2.1	2.7	2.9

Source: NCAER, 2014

Further, both rural and urban consumers of the country are shifting their consumption pattern away from rice, wheat and coarse cereals over the past two decades (Table 1). The decline in consumption of coarse cereals, however, has been steeper, in the rural areas. The consumption of pulses increased up to the year 1999-2000 and later decreased in both rural and urban India. There was a steady increase in the consumption of edible oils and food products of animal origin (milk, eggs, fish and chicken) over the years from 1987 to 2010.

Table 1.1: *Production of major food commodities in India*

Food Commodity	TE 1993-94	TE 2003-04	TE 2014-15
Food grains	177.37	200.28	257.94
Cereals	164.66	187.14	239.44
Pulses	12.71	13.14	18.50
Milk	58.07	86.23	138.80
Eggs	1.15	1.98	3.45
Fish	4.35	6.13	9.49

Source: CMIE, *Directorate of Economics and Statistics, 2016*

Another point deserves particular mention here. Protein, as an important source of building block of human body has already been recognized by the scientists. But, by concentrating only on protein, one really misses the point that human body also requires many micronutrients and minerals like calcium and zinc, and vitamins. Though protein is an essential among nutrients, but it is abundantly found within the system. Deficiency in micronutrients in human body is difficult to observe and to anticipate, for which it is sometimes termed as 'hidden hunger'. This problem of disguised hunger is now a big problem in south and Southeast Asian countries like India (Roos *et al.*, 2007). About 250 million children worldwide, for example, are estimated to be at risk of vitamin A deficiency, and an equal or more number of children is at risk of deficiencies of other minerals like iron, zinc and calcium. Deficiency of vitamin A is widespread in India, particularly among women and children. Calcium is an important nutrient for growth in young children, fetal growth and milk production.

Growth of Indian agriculture has gained momentum during past five decades in terms of high levels of production and improved productivity to address food and nutrition security of its 1.3 billion people which is 17.84 per cent of world population in 2016 (CIA, 2016). Though contributing only 15 per cent to India's gross domestic product (GDP), agricultural sector of the country is a source of livelihood for over 55 per cent of the total population. But, unfortunate enough is that agricultural policies in India, while continuing to focus on ways of increasing supply from traditional crop farming, have overlooked the role of diversified production,

employment and income generation on farms in achieving food and nutritional security as well as to mitigate problem of hidden hunger (Ahmed et al., 1999). This view is, however, fast changing. Increasingly being recognized is the role of a balanced nutrition, including critical vitamins and minerals in the diet of the poor, which are related to income and purchasing power improvement, rather than just food production and consumption. Hence, the cereals and crop commodity supply perspective of food security has now changed to include products such as fish and livestock (Ahmed et al., 1999; Misra and Misra, 2014).

1.4 Conclusion and Policy Prescriptions:

India still faces the challenge of ensuring food and nutrition security, given its high poverty and malnutrition levels. Although the poverty level went down in recent years, more than 250 million people still live below the poverty line. While growth alone cannot take care of the vulnerable groups, and social safety net programs are needed, it is also true that higher growth resulting in better employment and income opportunities is a more sustainable solution to ending poverty and hunger. This is coherent with the inclusive growth principle of the country.

But if India were to bring down its hunger and malnutrition level, and that too in a decade as mentioned in Sustainable Development Goals of India, country must have to think some out-of-the-box development policies regarding nutritional enhancement.

There is no hesitation to admit that various government initiatives have been launched over the years which seek to improve the nutrition status in the country. These include the Integrated Child Development Services (ICDS), the National Health Mission, the Janani Suraksha Yojana, the Matritva Sahyog Yojana, the Mid-Day Meal Scheme, and the National Food Security Mission, among others. But cases of malnutrition have persisted in spite of the developments undertaken over the years. Due to the National Nutrition Strategy, which just got released, it compels one to think differently.

The target behind this Strategy is to **reduce all forms of malnutrition by 2030**, focusing on the vulnerable and critical age groups. It also aims to achieve the targets identified as part of the Sustainable

Development Goals concerning nutrition and health. To give it a shape in reality, the Strategy aims to launch a **National Nutrition Mission**, equivalent to the National Health Mission, in order to enable introduction of nutrition-related interventions across sectors like women and child development, health, food and public distribution, sanitation, drinking water, and rural development. But, for that a **decentralized approach** should be promoted with greater flexibility and decision making at the state, district and local levels. Further, the strategy should aim to strengthen the ownership of Panchayati Raj institutions and urban local bodies over nutrition initiatives. This is needed to enable decentralized planning and local innovation along with accountability for nutrition outcomes. Besides these, **Governance reforms** should envisage convergence of state and district implementation plans for ICDS, NHM; should focus on the most vulnerable communities in districts with the highest levels of child malnutrition, and strategies should be based on service delivery models based on evidence of impact.

Food and nutritional security has always ranked a priority on the policy agenda every time, the government has taken several steps to augment domestic production of food grain through various technological innovations and investments in irrigation, infrastructure development, and subsidies. But in Indian, the policy objectives must abide the reorientation of agricultural production structures along with its diversity, since consumption pattern is constantly changing. Social safety nets must be adequately equipped to augment income, like MGNREGA, should also be given priority in policy formulations. Overall it should be admitted that no single actor can achieve as much as the synergy in partnerships that key stakeholders can achieve. These partnerships can be between government and the private sector, or with civil society organizations, or with multilateral agencies.

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Spatial Analysis of Rural-Urban Linkages of Nabadwip Town- An Appraisal

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Abstract

The rural urban interaction is a significant phenomenon. The linkages between the rural areas and the urban centers are harmonious and reciprocal in nature. Thus, the rural-urban linkages may be defined as the two way movement of people, goods, capital, technologies which is functional linkage and structural linkage. Stronger rural-urban linkages could also play a crucial role in poverty reduction in developing countries. Rural-urban linkages play a crucial role in the generation of income, employment and wealth. This paper depicts various types of rural urban linkage between Nabadwip and its surrounding region such as physical, economical etc. The emphasis in this paper is more on a qualitative description of the nature of linkages between urban and rural spaces as complementary to each other. In an ideal situation a town exists because of the countryside and within it. The main objectives of the paper to study the nature and extent of rural-urban linkages in the Nabadwip town. It has been tried to outline almost all the dimensions of such intensive interactions existing in the region.

Keywords: Rural urban linkage, Functional linkage, Structural linkage, Countryside. Qualitative description.

Introduction

The emphasis in this paper is more on a qualitative description of the nature of linkages between urban and rural spaces as complementary to each other. In an ideal situation a town exists because of the countryside and within it. Urban centres have always provided

certain general services which have benefited the surrounding areas. The rural area in turn has provided the urban centres with their basic requirements. Rural and urban areas have thus always been interdependent into each other. In this concept rural extreme has traditionally been identified as an idealized, unchanging peasant society organized in small inward - looking, idyllic communities based on kinship and supported by subsistence agriculture. The rural-urban continuum is seen as a progressive and historical development from rural to urban, mediated by industrialization, division of labour and role differentiation.

Objectives

The main objectives of this paper are as follows:

1. To study the nature and extent of rural-urban linkages in the Nabadwip town.
2. To identify the factors that affects the relationship between rural-urban linkages and level of socio-economic development in the study area.

Methodology

The present study is based on secondary data from municipality and Statistical handbook. The data has been collected for surrounding areas of the Nabadwip town. The secondary data has been taken about agriculture, market, services and other related aspect that links the city with the rural areas. GIS techniques were also used for preparation of Map.

Study area

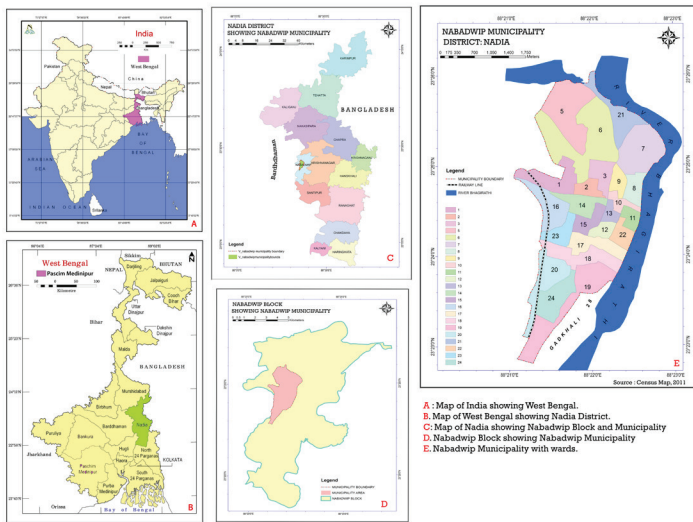
Nabadwip Municipality is located in the western part of Nadia district and river Bhagirathi bound from north to east. Nabadwip Municipality lies between 88°21"E.-88°23'E and 23°23'N.-23°26'N and the town has a total area of 11.66 sq. km. consisting of 24 wards with a population of 125543(2011 Census). The location of the study area is shown in Map no.1.1 and 1.2. Ras Yatra is one of the important festivals to city dwellers. Not only from Nadia but from its surrounding districts, people came here to experience the occasion. Due to such gathering a huge amount of solid waste generate in the city which make the life heal to the city dwellers of Nabadwip. Nabadwip,an old municipal town. It was constituted as municipality in 1869.The

nabadwip police station extended over an area of 2.8 percent of Nadia district which now contains an area of 3927 sq km. It has an average elevation of 14m.

The town originally stood on an island which was called Nabadwip (new island). Nava-dwip a group of nine island which is given by Narahari Das in his “Naabadwip parikrama paddhati”. One of the Sen King of Bengal is induced to transfer his capital there from gaur for sanctity on the sacred Bhagirathi, which gave it impetus for its urban growth. In the “Ain-I-Akbari” it is noted that in the time of Lakshman Sen Nadia (Nabadwip) was the capital of Bengal and abounded with wisdom. With the passage of time, Nabadwip municipality was established in the year 1869 A.D.(Garrett 1910)with 12 commissioners of whom 8 were elected and the remainder nominated. Through-out the 150 years of its urban career, the town has grown in an unplanned manner especially during and after the partition of Bengal in 1947 A.D.

Location Map of Nabadwip Municipality

Map No. 1.1 Location Map of Nabadwip Municipality

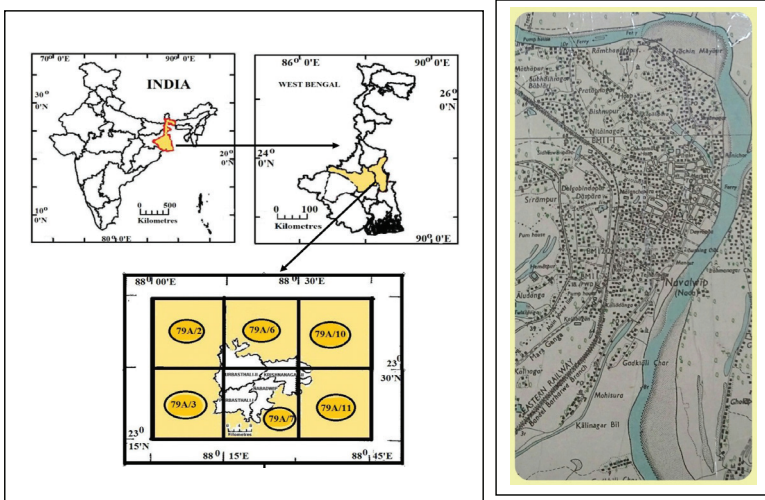


Source- Prepared by researcher

Although the proportion of land for industrial use and commercial use are comparatively less than residential use, but as the degree of urbanization increases gradually with time, the land use pattern has been changed. The low income group of people prefer slum areas due to inadequacy of housing space, the high price of inner town land. Thus urban fabrics of Nabadwip town predominantly attract the rural migrants as well as urban poor in search of work opportunities and other social facilities. The town received the slum dwellers with the rapid growth of urbanization. The town has a long tradition of movement of migrants. The large influx of rural population is the primary ingredient for the development of the town as well as slum in the district.

Topographical Map of The Study Area

Map No. 1.2 Topographical Map of The Study Area



Source: SOI topo sheets of English & Metric scale of the year 1968 and prepared by researcher

Rural-Urban Linkages

The integration of rural and urban areas and their productive activities transforms societies and accelerate modernization (Rondinelli and Ruddle, 1976). The goals of increased productivity, income expansion and greater equity in income distribution can never be attained


without increasing interaction among villages and market towns, and cities and metropolitan areas. For example integration of subsistence communities into the national economy increases incentives and opportunities for commercialization and for distributing services and facilities in rural areas. Again commerce and trade cannot be extended without linking local rural or peripheral markets to major urban centres. Increase in the number and diversity of linkages and the growth or transformation of development centres, either rural or urban, are inextricably related. In some cases new linkages - extension of road networks, river transport or rail connections promote growth and diversification in existing centres. As the development of linkage and nodal centres take place simultaneously. It is extremely difficult to distinguish cause and effect relationships between them.

The varieties of linkages that integrate urban and rural areas into an articulated spatial system are themselves inextricably linked. Development of one linkage may provide a 'cascade effect' making other activities and linkages possible.

In Nabadwip region complex set of linkages together have transformed and integrated rural and urban areas. Following Rondinelli and Ruddle (1976) there have been identified seven types of linkages between rural and urban areas of the region. These are physical, economic, population movement, technological, social interaction, service delivery and political administrative linkages. Each of these linkages is composed of several elements. The types and elements of linkages observed in the region are given in the following table:

Table 10.1 *Different Types of Linkages*

Physical linkages	Road networks
	Railway Networks
	River and water transport networks
Economic linkages	Market patterns
	Raw material and consumption of good flows
	Consumption and shopping pattern
Population movement linkages	Capital and income flows
	Migration-permanent and temporary Journey to work
Social interaction linkages	Visiting patterns

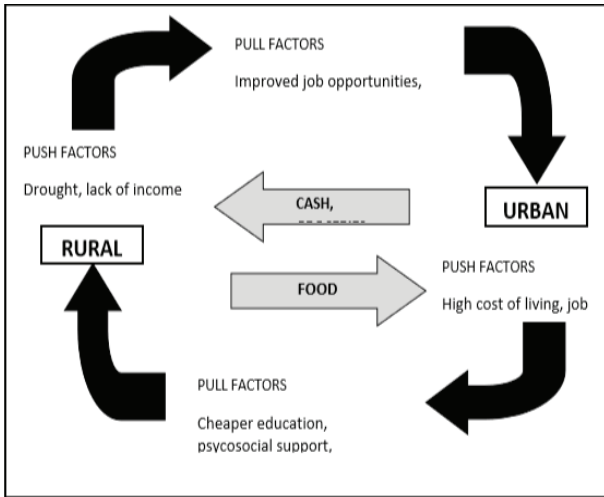
Service delivery linkage  Political and administrative linkages	Credit and financial networks Educational linkages Health service delivery system
	Administrative decision and political decision.

Source: Mukherjee (2011)

Physical Linkages

The spatial interaction of rural and urban areas creates mainly from physical linkages. Physical linkages, composed of man-made transportation networks.

Push and Pull Factors in Rural Urban Linkages



Source: Action Against Hunger, 2012

They reduce lower transport costs, widen marketing, commuting and migration opportunities, initiate agricultural development, allow greater access to non-agricultural employment, improve communications and extend areas of service delivery. Among the various elements of physical linkages there have identified and available three in the region namely road networks, railway networks, and river and water transport networks. These three elements of transportation network operating in the region together have formed an integrated and efficient system of physical linkage. Among these

three elements, road network performs the most significant role covering extensive areas of the region. Besides road network, railway lines and ferry services also provide efficient means of physical linkage in the region.

Road Networks

Owing to physical uniformity of the plain, a high density of population, relative agricultural prosperity and such other factors, Nadia district as well as the town itself have gradually become well-connected by road network with other parts of the state. The road network of our study region is centred on Nabadwip town because of its location at the geographical centre of the region and at the nodal point of several arterial road linkages. Industrial belts on the south eastern and north western directions respectively. State highway SH8 connects Burdwan Town with Birbhum district in the north across the Bhagirathi River.

Major district roads of the region are Nabadwip-Katwa Road, Nabadwip-Kalna Road, Nabadwip-Nadanghat Road, All of these arterial roads and the State Highways were developed in a radial pattern centering on Nabadwip town. Other district roads and rural roads have been developed in a fashion that they can serve the small and medium sized settlements lying between the major arterial roads. The total routes being operated by various private operators in the region have been classified into four sections, namely, Katwa, Katwa-allied, Nadanghat Guskara, and Kalna.

In addition to the bus service, some trekker (van type utility vehicles) services are also operating in more remote parts of the region. Usually trekker services have been developed in the areas of poor availability of bus services and unmetalled roads (such as those along the embankments of the Bhagirathi). It provides an integrated system of rural-urban linkage within an area of about 35 kilometres radius of Nabadwip town initially. The town bus routes were very few in number and of short distances. However, with the passage of time, the number and length of routes have increased to keep pace with the rising demand from the rural dwellers. At present there are 41 buses on 28 routes connecting large and medium size villages with Nabadwip town. The lengths of individual routes vary from 11 kilometres to 35 kilometres. In most cases, there is one or two buses per route plying almost continuously since early morning

till evening. During the last few year town bus service has turned into an efficient transport system linking Burdwan town with its surrounding rural areas. Various urban services like medical, educational, entertainment, administrative, marketing etc. have been accessed by the villagers of the surrounding region with the help of this new transportation service. During their morning trips from villages to Nabadwip town, the town buses usually carry bulk of the fresh vegetables, fish and milk sold in the urban market. These trips practically carry more goods than passengers. Similarly during the afternoon off-peak hours, numerous buckets of country cheese are carried from the villages to meet the growing demand of sweets in Nabadwip town. Families of farmers living in rural areas can now more easily commute to schools, colleges, markets, and banks, public and private health centres including hospitals, private nursing homes and private chambers of specialized doctors in Nabadwip town to meet their daily needs. Moreover, the cost of living is higher in urban areas, so rural-based farmers do not always wish to migrate to Nabadwip. As a consequence, rural to urban migration has been checked to some extent due to the increased accessibility and better commuting facilities. Therefore, it can say that the town bus service in Nabadwip region has strengthened reciprocity in the relationship between rural and urban. In spite of notable improvements in the road there still are some gaps in the network within the region. The road network has not been developed uniformly over the entire region. The Bhagirathi River, with only one bridge over it at Rail gate, still poses a considerable barrier. The western bank, on which side Nabadwip town is located, has a better integrated network of bus system. The Bhagirathi River itself flowing through the middle part of the region is a major physical factor in the development of this dichotomous nature of road networks. Better administrative co-ordination is needed for efficient management of available resources, a comprehensive vision and proper planning on behalf of the district administration would have been able to remove these gaps in the rural-urban linkage of the region.

Railway Networks

Besides the integrated road network in the region, railway network has also played a significant role in the rural-urban linkage of the town. Nabadwip, located on the Eastern Railway main line, is an

important railway junction between Howrah and Katwa. Most of the long distance express or mail trains connecting Calcutta with north India pass through Nabadwip. By express or mail trains it takes approximately two hours to reach Howrah. A large number of commuters both from Nabadwip town and surrounding rural areas commute to these industrial-commercial belts for their daily work. In comparison to the road network both the journey time and fares are much lower in the railway system. However, from the point of view of area served, especially the rural hinterland, roadways provide a more efficient mode of physical linkage in the region. Railway lines still cover a limited portion of the town.

River and Water Transport Networks

The Bhagirathi, passing through the region, was a busy water route till the Mughal period in India. After the introduction of railway line by the British in eastern India between Bandel to Calcutta in 1855 this water route started to decline in relative importance. With the progress of these land routes, waterways lost their importance as means of trade. At present, ferry services across the Bhagirathi in different areas constitute bulk of the water transport network of the region. The Bhagirathi River passes through the region with only one bridge on it connecting the southern part of the region. In the absence of adequate number of bridges on the Bhagirathi River, these ferry services provide important linkages between vast rural areas of the trans-Bhagirathi region.

Economic Linkages

Economic linkages between rural and urban areas are of utmost importance in the spatial integration of any place. Within the economic sphere, many urban enterprises rely on demand from rural consumers, and access to urban markets and services are often crucial for agricultural producers. In addition, a large number of households in both urban and rural areas depend on the combination of agricultural and non-agricultural income sources for their livelihoods. Some of the important economic linkages in the region are market networks, raw material and consumption goods flows, consumption and shopping patterns, capital and income flows. Before analyzing the economic linkages between rural and urban areas of our study region, should look into the nature of economy in

the region. The rural areas of adjacent study region are characterized by a more efficient agricultural economy. The urban centres on the other hand, are characterized by tartarisation of economy. Nabadwip town along with its marketing activities provides all sorts of tertiary (trade, service as well as administrative) services to the surrounding rural areas.

Market Patterns

Broadening the market linkages is a primary force in commercializing agriculture, diversifying production and expanding spatial system of exchange (Skinner, 1964). The vertical coordination of marketing systems provides substantial benefits to the farmers of the region by increasing their bargaining powers through improved price information and increased market competitiveness. The transportation network plays a key role in the development of marketing linkages. It reduces transaction and physical distribution costs and makes market centres more accessible to the producers. The growth of market centres link urban markets strongly with rural hinterlands and encourages growth of manufacturing and commercial services within the town. Backward and forward production linkages widen the market area for rural products and attract part-time workers from surrounding rural areas by providing off-farm employment. Urban-rural production linkages, once established, initiate a 'cascade effect' of investment in industries, services and commercial activities. However, in respect of some activities, like the collection, storage and distribution of potato and paddy for example, these lower order urban centres act independent of Nabadwip town. All these rural market centres are well connected to Nabadwip town on one hand and their smaller hinterland on the other. At the lowest level of market pattern there are a large number of 22 periodic markets (rural haats) providing limited transactions of local agricultural produce. The development of agricultural economy provides three types of economic linkages for regional growth (Harriss, 1987). These are as follows:

1. Backward linkages or the resultants of demand from agricultural sector for intermediate or capital goods;
2. Forward linkages or the resultants of supply of agricultural products to agro processing industry; and

3. Consumption linkages emanating from the expenditure of income obtained from the marketed surplus.

All these three types of linkages have emerged following the agricultural development in the region. Backward linkages have increased demand for capital goods. These capital or intermediate goods in the form of farm machinery and implements. HYV seeds, pesticides, fertilizer etc. are provided both by urban and rural market centres. Among them (for the supply of higher level capital goods, that is, farm implements and machinery) the farmers still depend on the urban market at Nabadwip town. Forward linkage has also been developed with the supply of agricultural products, especially paddy, to the agro-processing units or rice mills located mostly in and around urban centres. On the other hand, the consumption of poorer section of rural people (mostly marginal farmers and landless labourers) is mostly satisfied within the rural market centres. The integrated market system of the region has strengthened the bargaining power of the farmers. Again, the improved transportation network has made the urban markets accessible to the rural producers. As a result, a uniform price level for both agricultural products and consumption goods is found in rural and urban markets. The price fluctuation in accordance with the seasonal demand also takes place uniformly in rural and urban areas. The prices of rice, potato, vegetables, eggs, country cheese etc. are the same in both rural and urban areas. Therefore, it can be stated that a vertically coordinated and well-articulated marketing system significantly displaced conventional rural deprivation in the region. The same is true of consumable goods originating in Burdwan town, such as cooking gas and T.V. that have become more accessible to rural consumers through the economic linkages.

Raw Material and Consumption Goods Flows

Exchanges of goods. Either raw materials or finished products, between rural and urban areas are an essential element of rural-urban linkages. The rural areas usually supply raw materials to the industrial sector in urban areas. The urban manufacturing economy of the region is constituted by agro-processing units the raw materials of which come from the surrounding rural areas. Rice mills are also common in the rural areas of the region located along the main transportation lines. In case of such mills the flow of paddy takes

place over short distances. The total production of paddy in the region does not necessarily go to the manufacturing sector as raw materials. After meeting the local rural demands a major section of surplus paddy goes to the urban market in the processed form as rice. This is because of the significant presence within rural areas of small processing units with a capacity of ten quintals or one thousand kilograms. An improved road network has helped the individual small producers to sell rice in the urban markets. Retail market for rice is also found in different parts of Nabadwip town. Potato is an important agro-product of the region, which comes to the urban market through organized potato trading channels. The potato collection and distribution in the entire region is controlled by potato trading centres. Vegetables are also an important rural product meeting the huge daily needs of urban market. The flow of vegetables to the urban market is not organized and thereby dominated by individual sellers. However, market gardening of commercial scale is yet to develop in the region. Fish and poultry products (egg and meat) sold in the urban market are also supplied from the surrounding rural area. However, the fish market in Nabadwip town has two parallel sections. One is organized fish market which supply fish to urban people imported from other states specially Andhra Pradesh. This market is located in Oladevitala Bazar, the central market area of the town. The other section is informal fish market the supply of which comes from the surrounding rural areas by individual traders. This informal fish market is found in almost all the vegetable markets of the town. The demand for local fish coming from the surrounding areas is also high in the urban market. Therefore, much of the fish products of the rural areas are supplied to the markets of Nabadwip town. Poultry farms have developed in considerable numbers in the rural areas recently. The bulk of the poultry products, mainly meat and egg from the rural areas, meet the urban demands. Dairy products such as milk and country cheese are also important items of consumption goods flow from rural to urban area. The milk supply comes mainly from the adjacent villages by individual milkman. The milkman from the surrounding villages come in the morning with their milk container by town buses. In Nabadwip they have own bicycle in cycle stands by which they supply the milk from door to door. The demand for this local milk is much higher than the organized supply from outside the region because of its purity. However, this poorly organized supply

cannot meet the urban demand. The supply of milk in unpacked condition is also difficult because of its high perishability. To make the local milk supply into viable commercial unit's co-operativization of milkman is an utmost necessity in the region. Country cheese is another important dairy product of the region which have a very high demand in sweet shops of the urban market.

During afternoon hours the buses especially town buses from rural areas carry huge number of buckets of country cheese into Nabadwip town. In the flow of consumption goods, besides rural to urban flow there is a considerable extent of urban to rural flow. Industrial or famished products dominate the flows of urban goods to the rural areas. Some of these goods, mostly capital goods like farm machinery, pumpsets, refrigerator, television, motorbike etc., are directly sold in the urban market. Rural people cannot purchase these goods from the rural market because of the lack of authorized dealers. On the other hand, consumption goods including clothes. Groceries, stationary and luxury items are supplied to the rural areas from the urban market through rural market centres. The improved transportation network has facilitated such exchange in that no additional transport cost is added. Therefore, the prices of these goods are more or less same in Nabadwip town and in rural market centres. The only difference is the varieties and choices, which are still limited in rural market centres.

Consumption and Shopping Patterns

A high degree of rural-urban interaction is noticed. The rural products are supplied to the urban market either by producers themselves or by petty traders. On the other hand, urban commodities, especially consumption goods, are also supplied to the rural markets by rural based businessmen. The shopping, therefore, can be done both by urban and rural dwellers in their own areas. In spite of that, a significant flow of shoppers from the surrounding rural areas comes to Nabadwip town. This trend of shopping pattern has developed after the spectacular improvements in transportation network especially roadways during the 1990s. The surplus income generated by agricultural development has created a rich class of rural people whose consumption power is high. The urban market in Nabadwip provides many options for all sorts of consumption and capital goods. Therefore, rural consumers prefer to have a better option from varieties of goods available, in the urban market for their purchase.

A higher level of accessibility of the surrounding rural areas to Nabadwip town has strengthened the flow of shoppers. The main commercial area of Nabadwip also lies within walking distance of both the central bus terminus and railway station. The attraction for fashion goods and urban entertainment (recreation like movie halls, restaurants, eco-park. etc.) has increased considerably among the rural people. Low travels cost and lesser journey time provided by town bus network have supported the increased flow of rural people. The shopping of heavier goods, for example, capital goods, groceries, food items is usually done by male members of rural families, whereas, the shopping of light consumption and fashion goods is commonly done by women.

Population Movement Linkages

The well being of individuals, families and rural communities depends on their movement to employment and to basic services and amenities (Pacione, 1984). Short-term and permanent migration is a ubiquitous characteristic of development and an important form of urban rural linkage. Temporary migration and journey-to-work depend on transportation and communication linkages. More permanent migration depends on a wider range of economic and social determinants, including the availability of jobs in towns and cities; wage, public service and educational opportunity differentials between cities and villages; and the distance, cost and convenience of moving. In the study region a high degree of accessibility between Nabadwip town and surrounding rural areas has enhanced the movements of population. Not only do people from rural areas come to Nabadwip town but urbanites too move to the rural areas for their daily work.

Migration: Permanent and Temporary

There is a popular notion in Indian urban context that the rural poor are the ones who migrate to urban centres. However, it is not applicable to all urban centres in India. In Nabadwip town, poor class of people does not dominate migration from rural to urban areas. It is mainly the lower and upper middle class people of the rural areas who migrate to Nabadwip town in search of a better standard of living. The unorganized part of the economy (rickshaw-pulling for example) is dominated either by local urban poor or by migrants from outside

the region (such as from poverty stricken areas of Bihar, and districts Murshidabad, Birbhum etc.). On the other hand, those middle class people engaged in tertiary activities usually migrate to Nabadwip town to satisfy their needs for a higher standard of living.

However, agricultural prosperity and associated rural development have brought remarkable changes in rural areas in 1990s. Infrastructural developments (such as transport, tele-communication, education and health) have made these rural areas somewhat more convenient places to live than before. With the development of rural market centres rich farmers started to reinvest their capital in commercial or business activities there. As a result, the trend of rural to urban migration has declined. Therefore, the migration stream at present is dominated by a section of middle class farmers recently transitioned to tertiary activities both in Nabadwip and surrounding rural areas. The higher degree of rural-urban interaction has affected the joint family system in rural areas. Breaking of joint families and the development of nuclear families have also led to migration. As joint families split up, a nuclear section migrates to Nabadwip leaving their rural home. After a period of adaptation to urban life, their preference for urban amenities and comparatively easier life grows. On one hand the self-confidence and self-reliance increase; on the other, they become more individualistic and self-centred. They get, in this process of change, separated not only from the stream of village life, but also from that of their families, due to their changed outlook of life and the way of living. The other family members along with the older parents continue to live in rural areas. However, these migrated class maintain (strong ties) links with their rural counterpart to retain their share of landed property (mostly agricultural land) there (Dasgupta, 1988) because of their partial dependence on the income from landed property in rural areas to supplement urban incomes.

Temporary migration from rural to urban areas especially for job is rather limited within the region. The masons of Murshidabad district dominate the construction of building trade in urban areas. They compose a section of temporary migrants in Nabadwip town. The brick kilns around Nabadwip town also employ temporary migrant workers. All these types of labour circulation originate from outside the region and do not play any notable role in rural urban linkage. One distinctive type of temporary migration is found

among the students of the rural areas of the region to Nabadwip for higher education. Even from areas of inadequate number of higher secondary schools students move to Nabadwip town after passing secondary examination. A section of these migrant students continue to live in Nabadwip.

Journey-to-Work

Journey-to-work is an important component of population movement linkages between rural and urban areas. In the pattern of journey to work both rural to urban and urban to rural movement are found in the region. However, the relative proportion of rural to urban commutation is much higher than the latter. Those living in urban areas but engaged in formal jobs such as government or semi-government services in rural areas and also those in informal itinerant trading activities commute to the rural areas. On the other hand, a large section of rural people commutes daily for their work to Nabadwip town. This stream of rural commuters are chiefly composed of formal workers in service activities and informal workers in commercial activities of Nabadwip town such as working in shops, pathological laboratories, nursing homes etc.

Social Linkages

Social interaction between rural and urban areas is the product of increased physical and economic interaction. Increased transport facilities and consequent physical interaction bring fundamental changes in the social structure of the village and in the interrelations of town and village (Dickinson, 1964). The village community is affected in many ways by the growth and concentration of services in neighbouring rural market centres and towns. Rich farmers are probably the group that can access fully these urban benefits. In the town, a villager gets exposure to the prevailing ideas. Mode of living, fashion trends etc., which in turn affects in varying degrees his/her pattern of life in the villages. Traditional values of life in rural areas change with increasing interaction to urban society (Dasgupta, 1988). Due to the spread of education, adoption of modern ideas, spread of electricity, increased reading habits, and expansion of mass media, older values and social customs such as caste barriers etc. are changing.

In the study region social interaction has increased to such an extent that no clear-cut distinction can be drawn between the urban and rural ways of life. The rural market centres in the region are the focal points for a wide variety of social linkages both with Nabadwip town and their rural hinterlands. These periodic markets also play an important role in the diffusion of information and consequent social interaction in the rural areas of the region. As people made regular visits to the market throughout their lifetime, they came to know almost every other adult in the marketing area. With market expansion and increasing commercialization of agriculture. Periodic markets may evolve into permanent exchange points and diffusing social linkages promote increasing social and spatial integration. The poor, illiterate and uninformed rural people use these market places as aggregated information field.

Visiting Patterns

The frequency of visits to Nabadwip town has increased more or less among all classes of rural dwellers. The purpose of visits are also multiple in nature. A large number of people come from villages to the town for medical treatment. Such visits usually occur in the morning by first trip of buses leaving rural areas. Some visits are to the urban market for shopping and usually take place in the noon hours. Frequent visits to Nabadwip for economic purposes have increased the desire of rural people for attaining urban ways of life. As a result, recreational visits to have increased. The buses packed with school children escorted by their teachers are frequently found visiting the park. The religious festivals and fairs in Nabadwip town are also attended by rural people. Rural people visit the Puja Pandals in Nabadwip during different religious festivals. The Sri Chaitanya temple is visited by a large number of women performing puja rituals like Bipadtarini brata. Annual urban events like the Book fair, Health fair and Children's fair attract large rural visitors from the surrounding areas.

Whatever is the purpose of visit educational, commercial or recreational - the social impact of these visits is very high on the rural people of the region.

Service Delivery Linkages

Increasing physical economic and technological linkages play a critical role in the expansion of service delivery networks within a functional area of any urban centre. To develop spatial integration and linkage between rural and urban areas the distribution of social and commercial services need to be wide to increase the access of rural population to urban amenities. Nearly all kinds of services require the support of a minimum number of people concentrated in a limited geographical area, a threshold population of sufficient size and density to attract enough customers to earn profits for suppliers of commercial and professional services and to allow public services to reach the largest number of people at the lowest cost.

Therefore, in our analysis of service delivery linkages between Nabadwip town and surrounding rural areas the pattern of these three service delivery system are analyzed.

Credit and Financial Networks

The rural prosperity has provided the threshold demand for the development of credit and financial networks in the agricultural areas of the region. These rural branches function under the control of regional branches located in Nabadwip town. They are granting short term loan for production purposes and mid and long term loans for creation of minor irrigation facilities. Dairy, poultry, piggyery. Inland fishery etc. These financial resources in the form of credits to the poorer section of people are usually disbursed through these banks. Grameen banks with an easier process of disbursement and recovery of loan are more accessible to the rural people of the region. The credit flows from urban to rural areas are compensated by reverse financial flows of savings.

Education and Training Linkages

Education is an important service which forms the basic background of all sorts of socio-economic development. The educational services in the region are dominated by government-aided public education system including primary schools. Secondary and higher secondary schools. Degree colleges. Private education system is still limited with few primary and pre-primary schools scattered over the rural

region. However Higher educational service is still under the control of public education system.

The educational services of the region are not distributed uniformly over the entire region thus leading to a higher movement of people to attain these services. Students from surrounding rural areas commute to attain this higher educational service. An improved means of transportation including town bus network has made this commutation easy for the rural students. Primary and secondary schools are not insufficient in number in the rural areas. Brighter students after completing madhyamik (class X) standard migrate to Nabadwip because of better educational opportunities there. The awareness of the need for higher education as a means of employment is increasingly attracting youths from rural areas to Nabadwip especially from the new well-to-do families. The lack of residential facilities has resulted in the mushrooming of a large number of privately run students' hostels. Private and Public training institutes like computer training centres, driving schools, knitting and sewing training centres, motorcycle, radio, T.V. repairing centres and so on are prolific in numbers in Nabadwip town.

Health Services Delivery Systems

Health services are concerned with the provision of facilities for diagnosis, treatment and care of those who become ill and with promoting the health of and preventing disease in the population. A distinction may be drawn between primary health care facilities and secondary health care. Primary health care covers general practitioner service including the work of doctors, dentists, opticians and pharmacists supported by community health services such as clinics for expectant and nursing mothers and the health visitor service. The public has direct access to these services. Secondary health care comprises hospital in-patient and out-patient services and access is normally by referral from the primary sector.

A better access to health facilities has improved the quality of life in rural areas. The rural health services in the region are chiefly composed of government-sponsored public health services. Primary health centres and secondary health centres are the only health services provided by the government in each rural development blocks. Primary health centres are better equipped than secondary

health centres. However both types of centres provide only very basic health services without any specialized treatment. Some of the rural health centres in the region are larger in size and have in-patient beds and a small staff of doctors.

As a result. People in rural areas have lost faith in public health care delivery system and try to obtain diversified. Specialized medical services with sophisticated diagnostic and treatment equipment that are available in Nabadwip town.

Due to the poor maintenance of government health care services private health facilities have mushroomed. Some doctors visit the dispensaries located in rural areas once or twice a week. They are usually full-time practitioners in Nabadwip town and commute to rural areas only on a part-time basis. In the context of health service delivery systems the rural areas are very much dependent on the services provided in Nabadwip town. In this linkage pattern the flow of people is one way, that is, only from rural to urban areas, as against the other kinds of linkages. However, the developed physical linkage network in the region have made it possible to at least obtain the higher level medical services available in Nabadwip town. The demand for higher level health services are growing in the rural areas but the proximity and improved transportation facilities to Nabadwip town with specialized medical services are playing as hindrances to their development in rural areas under private ownership.

Political, Administrative and Organisation

The functional relationships between rural and urban areas are integrated and transformed through a set of political and administrative linkages. These are reflected in formal government structural relationships, flows of public budget resources, administrative authority, transactions, among government jurisdictions, informal political influence and decision chains, and interdependencies among spatially dispersed specialized organizations.

In our study region the government sponsors most of the services in both rural and urban areas. These public sector services are channelled from the district headquarter to the grassroots level through an administrative and political hierarchy. The organizational linkages between political and administrative set up are also efficient, helping to develop a well integrated functional system.

Administrative Decision Chains

In our study region the authority-approval-supervision pattern is totally controlled by district administration of Nadia under the government system of West Bengal. There are different and disparate administrative organizations with their hierarchical levels serving the whole region. The administrative linkages evolve as the government functions, services and resources are fragmented among organizations and jurisdictions.

However, All the municipalities act under the control of district administration. With the growth of these urban centres political and administrative linkages change and functions are transformed within each centre. The number of social functions performed by the government tends to increase as communities grow. The rural areas of the region are under the three-tier system of both administrative linkages and panchayati raj.

Conclusion

In this paper the various aspects of rural-urban linkages. Tried to outline almost all the dimensions of such intensive interactions existing in the region. From this description, it can be stated that a close rural-urban relationship becomes apparent. Much of this linkage is the product of recent times and the gaps now need to be filled to remove the existing disparities between rural and urban. Finally, it should be needed basis for measures that can improve both urban and rural environments as well as livelihoods that occur in both rural and urban areas. Overall, viewing urban development as completely distinct from rural development is no longer valid and vice versa. Urban-rural linkages highlight that development planners and policy makers must increasingly think of the impact of their development interventions in ways that are more integrated and emphasize the importance of analyzing rural and urban economies as a united whole. To remove the urban rural disparity and achieve faster development in countryside as well as in urban areas, governments at the national and local level must recognize the growing importance of the urban-rural linkages and craft policies. On the other hand the policies should be adequate investments in infrastructure, particularly transportation, to improve rural agricultural condition.

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Climate Change and its effects over Livelihood of Rural Communities of North East

A case study on Sikkim

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Abstract

Climate Change; the ultimate weapon of mass destruction and a threat worse than terrorism or nuclear war.

Climate change is a source of concern to both developed and developing worlds in recent times. It has led to changes in temperature, precipitations and frequent extreme weather events. Climate change may be the biggest threats of the 21st century. Climate change is an all-encompassing global problem that is likely to have catastrophic effects on natural and human systems. The IPCC Fourth Assessment Report (2007) has predicted extreme weather conditions and erratic rainfall patterns in various part of the world along with further cascading effects on biodiversity. Projected global mean temperature rise for the end of the century has been revised upwards from 1.8-4.0°C (IPCC 2007) to 2-7°C.

Studies in the “Himalayas, a Global Biodiversity Hotspot” indicate that climatic changes have significantly impacted biodiversity and the people of the region and have shown that indigenous communities have already been adapting to the induced effects of climate change. There has been a steady increase in climate induced extreme events in

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Sikkim. While there is increasing attention of environmental hazards, social vulnerability and destruction of sustainable livelihood within the climate change debate.

Sikkim is a mountainous, landlocked state, rich in biodiversity. Being part of the eastern Himalayas, almost the entire state is mountainous. The state located in the eastern Himalayas is listed as one of the 34 global biodiversity hotspots. Sikkim is India's least populous state. Located in the north-east, Sikkim reported a population of 610,577 in 2011. Sikkim is also the second-smallest state in India after Goain terms of land area.

Sikkim is an agrarian economy with predominantly rural population (about 75%) and two third of the overall work force depend agriculture and allied activities, with only 16% of geographical area available for cultivation. This paper inclusively attempts to explore the major livelihood of Sikkim and how climate change induced the change of livelihood pattern in the rural communities of Sikkim.

Key-words: *Climate change, Environmental Vulnerability, Changing livelihood pattern*

Introduction

Climate change is a source of concern to both developed and developing worlds in recent times. It has led to changes in temperature, precipitations and frequent extreme weather events. Climate change may be the biggest threats of the 21st century. It is an all-encompassing global problem that is likely to have catastrophic effects on natural and human systems. The IPCC Fourth Assessment Report (2007) has predicted extreme weather conditions and erratic rainfall patterns in various part of the world along with further cascading effects on biodiversity. Projected global mean temperature rise for the end of the century has been revised upwards from 1.8-4.0°C (IPCC 2007) to 2-7°C, with an increase of over 5°C seeming most likely given current emission trajectories (Sokolov et al. 2009). Climate change has severe impacts on biodiversity resulting in altered phenology, (Penuelas and Filella 2001; Parmesan and Yohe 2003; Amano et al. 2010; Yu et al. 2010; Visser 2010) and shifts in distribution of species and biomes, (IPCC Techincal Paper V 2002; Bahn and Körner 2003; Parmesan 2005; Chen et al. 2011).

Sikkim is India's least populous state. Located in the north-east, Sikkim reported a population of 6, 10,577 in 2011. Sikkim is also the second-smallest state in India after Goa in terms of land area. The state is spread over 7,096 square kilometres. Under certain conditions and circumstances, governance of such a small population of an equally small geographical area might seem a relative advantage. But in reality, this is not so. Population is unevenly distributed across the state. For instance, North Sikkim reports a population density of only 10 persons per square kilometre, as its population of 43,709 people is spread over 4,226 square kilometres. On the other hand, East Sikkim reports a population density of 297 as 46 per cent of the state's population resides in this district which is spread over 954 square kilometres.

Sikkim is a mountainous, landlocked state. Being part of the eastern Himalayas, almost the entire state is mountainous. The state has 10 mountain peaks that rise above 7,000 metres, 84 glaciers and 315 glacial lakes (including the Tsomgo, Gurudongmar and Khecheopalri). Mount Khangchendzonga (8,586 meters), the world's third-highest mountain peak and revered as a guardian deity, is situated on the border between Sikkim and Nepal. For the most part, it is difficult to come across vast areas of flat land. Rocky and precipitous slopes make agriculture, transportation, and communication difficult. Sikkim is rich in biodiversity. The state located in the eastern Himalayas is listed as one of the 34 global biodiversity hotspots. The state is endowed with rich natural resources, characterized by its huge floral and faunal biodiversity, abundant water resources, streams, rivers and glaciers, and abundant forest cover. Sikkim has over 47 per cent of area under tree cover, which is one of the highest in India, both in terms of proportion to the geographical area of the state and per capita forest cover. Out of approximately 1,200 orchid species found in India, Sikkim is a repository for over 527 species, and is one of the richest hotspots for orchid diversity in the Indian Himalayas. Sikkim is home to 4,458 of the 15,000 flowering plants found in India, and 40 per cent of India's pteridophytes. It boasts over 700 medicinal plant species, and is home to 38 of the 90 Rhododendron species found in the country. Sikkim's diverse fauna includes 125 species of mammals, 574 species of birds and 689 species of butterflies, in addition to many reptiles, amphibians, and insects. Some of the Red

Data Book mammal species found in Sikkim are red panda, snow leopard, clouded leopard, musk deer, Tibetan wolf, red fox, Indian wild dog, hog badger, Tibetan sheep or argali, Tibetan gazelle, serow, goral, and Tibetan wild ass. Sikkim exhibits unusually diverse climatic conditions. It is the only biogeographic zone in India, and perhaps among the few in the world, which exhibits such a wide a range of ecological conditions from tropical moist to temperate and alpine zones in such a small geographical area. The mountainous terrains of Sikkim with their varying altitudes as well as variety in elevation create innumerable pockets of unique micro-climatic conditions, ecology and eco-tones, which nurture wide-ranging physical and climatic scenarios.

Objectives of the Study

1. To assess the climate change and its impact on the study area
2. To know about the basic changes made due to climate change on the Socio-economic pattern and Livelihood of the people living in Sikkim

Methodology

This paper is exclusively based on the various secondary data gathered from authentic sources i.e. government reports, NGO materials, UN publishing etc. also census data was used gathered and used in the paper.

Findings

1. Socio-Economic Status of Sikkim

Table: 1 Demographic features of Sikkim District, 2011

Sikkim	Population			Sex Ratio	Population Density
	Male	Female	Total		
Total	323,070	287,507	610,577	890	86
Rural	242,797	214,202	456,999	882	65
Urban	80,273	73,305	610,577	913	4,015

Source: Census 2011, RGI

Table 2: Population of Sikkim in the Age Group 0-6 years and Sex Ratio (0-6 years) in Sikkim

Sikkim	Population of age group 0-6 yrs.			Sex Ratio
	Male	Female	Total	
Total	32,761	31,350	64,111	957
Rural	25,061	24,157	49,218	964
Urban	7,700	7,193	14,893	934

Source: Census 2011, RGI

Table 3: Literacy Rate and Gender Gap in Literacy Rate in Sikkim

Sikkim	Literacy Rate			Gender Gap in Literacy Rate
	Male	Female	Total	
Total	86.6	75.6	81.4	10.9
Rural	84.6	72.4	78.9	12.2
Urban	88.7	84.7	88.7	7.7

Source: Census 2011, RGI

The population of Sikkim is 610577 (2011 Census) with around 33.3 % Scheduled Tribe population and 4.6 % Scheduled Caste. The population density of the state is 86 persons per square kilometre with 36.55% population below poverty line. 72.8% Sikkimese are literate. From the above tables, an overall gender discrimination is clearly visible. In both case of sex ration for 0-6 year's group and Gender Gap in Literacy Rate, are lower in urban sector.

2. Climate Change and Sikkim

The weather data of 30 years (1981 to 2010) recorded at Tadong meteorological station located in the mid-hill location of Sikkim was analysed. The average annual rainfall of 30 years at Tadong was 3097.78 mm, spread over in 156.90rainy days/year. In the past 30 years, the number of rainy days has increased at the rate of 0.5 days per decade and means annual rainfall has increased at the rate of 41.46 mm per decade. However, if weather data of last two decades (1991-2000 to 2001-10) alone was considered, the number of rainy days as well as the annual rainfall at Tadong has decreased at the rate of 0.72 days/year and 17.77 mm/year, respectively. The mean minimum, mean maximum and average temperature at Tadong was

13.99°C, 23.29°C and 18.64°C, respectively. The difference between mean minimum and mean maximum temperature across months was $9.30 \pm 1.35^\circ\text{C}$. The mean maximum temperature did not exhibit any significant departure from long term average but the mean minimum temperature has increased 1.95°C in 30 years from 1981-2010 (or 0.06°C increase/year). Further, the rate of increase in the mean minimum temperature between the decade 1991-2000 to 2001-10 was greater i.e. $0.81^\circ\text{C}/\text{decade}$ or 0.08°C increase/year. The year 1986, 1988, 1989, 2006 and 2009 had experienced low precipitation (< 2751.62 mm) hence classified as drought years. The years 1990, 1995, 1996 and 2003 received high rainfall i.e. ≥ 3443.94 mm (μ 3097.78 + σ 346.16 mm) hence classified as abnormal year. The remaining 21 years i.e. 1981, 1982, 1983, 1984, 1985, 1987, 1991, 1992, 1993, 1994, 1997, 1998, 1999, 2000, 2001, 2002, 2004, 2005, 2007, 2008 and 2010 were normal years. The mean minimum, maximum and average relative humidity (RH) at Tadong was 51.91%, 6.04% and 70.98%, respectively. The difference between the mean maximum and mean minimum RH was 30.13%. The mean duration of sunshine hours was 3.66 hours/day. The duration of sunshine was low (< 15 hours/week) from 18th July to 5th August. Climate change is a global phenomenon. (Bawa & Ingty 2012)

The average annual maximum temperature since 1981-2010 did not show any significant increase or decrease during the past 30 years which is a good sign of environment stability. Whereas, the average annual minimum temperature has increased 1.95°C in the past 30 years from 1981-2010 (or 0.06°C increase/year) which is a matter of concern. Further, the rate of increase in the mean minimum temperature during 1991-2000 to 2001-10 was greater i.e. $0.81^\circ\text{C} / \text{decade}$ or 0.08°C increase/year. Earlier study by Singh (1999) has also indicated the increasing trend of minimum temperature at the rate of 2°C at Tadong from 1986 to 1997. After analysing the weather data of Gangtok from 1957-2005, Seetharamin2008 reported very marginal decrease in the mean maximum temperature ($-0.003^\circ\text{C} / \text{decade}$) but 0.2°C increase /decade in the mean minimum temperature. The present study is a further confirmation of the increasing minimum temperature in the mid hills of Sikkim. Further probing of data of month-wise minimum temperature from 1981-2010 has revealed that the increase in minimum temperature was high during March

(0.09 °C increase/year) and April (0.05°C increase/year) and again during October (0.04°C increase/year), November (0.07°C increase/year) and December (0.06°C increase/year). Increasing minimum temperature during October and November may affect germination of *Rabi* crops like wheat and barley. Various prediction models on global warming indicate that the global surface temperature, by the year 2030, would increase somewhere between 1.5°C and 4.5°C with an average of 3°C (WHO 1990 and IPCC 1990). This increase would be most marked in the high latitudes as well as in high altitudes. Small changes in temperature in the high-altitude belt would affect drinking water supply and plant growth.

3. Impact on Livelihood

Sikkim is predominantly an agriculture based state and also comprising many other livelihood options i.e. tourism, which is considered as the backbone of Sikkim's economy. It has brought economic prosperity in Sikkim. With the salubrious climate, the natural beauty and the fine cultural heritage of Sikkim, the growth of tourism has immense possibilities. There is large number of places of tourist attraction particularly the snow-clad mountains, the lakes and unspoiled forest areas and valleys of flowers. The advantage of having very fine monasteries in Sikkim can also be taken to attract Buddhist tourists from countries like Japan and the South Eastern countries. (Sikkim Tourism Department, 2016)

The temperature of Gangtok has been rising at the rate of 0.2–0.3°C per decade. Therefore, since 1957 the increase in temperature has been around 1–1.5°C. Annual rainfall is increasing at the rate of nearly 50 mm per decade, except in winter months, which during the period 2006–10 have been exceptionally dry. Comparison of long-term meteorological data available for Gangtok station (1957 to 2005) with the trend over the last few years (2006–09) shows an acceleration of these patterns, with winters becoming increasingly warmer and drier. These changes in snowfall patterns would have an impact on the livelihood of the pastoralist communities and affect the fodder productivity for livestock. A study conducted by the Department of Science and Technology of the East Rathong Glacier in West Sikkim shows that the total recession of the glacier during the last 43 years (1965–2008) is about 1.44 km and the last 9 years (1997–2006) about 320 m, with an average rate of 35.5 m/year. Glacier thinning and

retreat results in formation of new glacial lakes and the enlargement of existing ones, increasing the chance of GLOF (glacial lake outburst flood) events; which therefore will affect the rural livelihood of the poor (Human Development Report, 2014).

Table 4: Distribution of Workers in Sikkim

Distribution of Workers		Census 2001	Census 2011	% Change
Total Cultivators	Total	131,258	117,401	-11%
	Male	70,107	63,323	
	Female	61,151	54,074	
Total Agricultural Labours	Total	17,000	25,986	53%
	Male	8,762	12,883	
	Female	8,238	13,103	
Total Household Industry	Total	4,219	5,143	22%
	Male	2,849	2,947	
	Female	1,370	2,196	
Total Others	Total	110,566	159,608	44%
	Male	83,998	115,201	
	Female	26,568	44,407	

Source: Human Development Report, 2014

From the Table “Distribution of workers in Sikkim”, it is clearly shown that the number of cultivators in the state has decreased by more than 10% between 2001- 2011. However, there has been more than 50 per cent increase in the agricultural labourers and over 44 per cent increase in ‘Other’ workers.

Agriculture is the major economic activity and is practiced on terraced field that has been laboriously created from steep hillsides. There are in all 689 enterprises that have been identified, which are mostly concentrated in rural areas. Sikkim is the largest producer of cardamom and also boasts to utilize largest area for its cultivation. Tea is exported to USSR & Germany. A coffee plantation has also been started at Majitar. Sikkimese economy broadly depends on the agriculture which provides livelihood to the majority of population in the state.

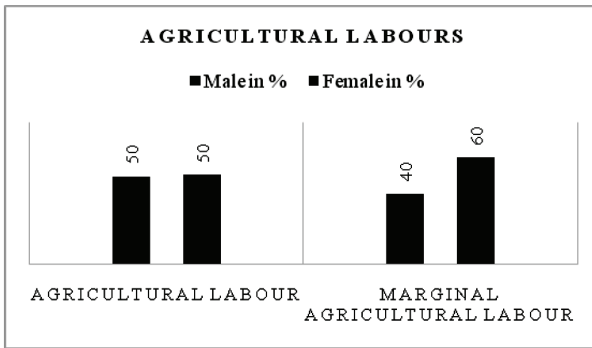
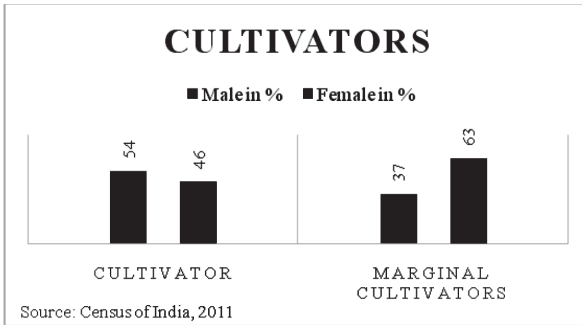
In mountain areas of Sikkim natural ground water recharge is only 10–15%. Most of the rain water just flows away as surface run-off due to the steep terrain causing soil erosion, landslides and floods.

This has worsened due to climate change impacts that are occurring throughout the region. (Human Development Report, 2014)

Out of Sikkim's total rural area of 1633 square kilometres, dry land farming constitutes 53%, 21% is wasteland, 19% is under large cardamom plantations, and 7% is irrigated and is under paddy cultivation. Overall agricultural production is highly dependent on climate in India, considering the sharp decline in large cardamom production, nearly 40% of the private land is non-productive and mostly a waste land as far as rural livelihoods are concerned. 90% of the State population is rural and agriculture is the primary source of livelihood for the villagers. However, the contribution of agriculture to the state GSDP has been showing a declining trend, indicating a stagnation and reduction in incomes due to reduction in productivity and production of the major cash crops, namely, ginger, large cardamom and orange which are facing pathological problems due to climate change leading to low income levels in the villages. The sectorial contribution of agriculture to the GSDP has been declining from 52% (1980-81) to 21% (2004-09). (Rural Management and Development Department, Sikkim and Human Development Report 2001) This significant downfall can be easily correlated with the overall state of climate change and its adverse effects over Sikkim.

Out of 76,813 rural households of Sikkim, 3106 (4%) are vulnerable (vulnerability being defined as Single woman headed household, Old age headed household and Minor headed household), out of which more than half were old aged households. This scenario is an alarming situation for the Sikkim state as the old age and women are always more vulnerable to any kind of natural disaster and change in climatic condition.

From census 2011 it is found that in Sikkim total number of cultivators are mainly men whereas in the marginal cultivators' community it is found that majority of the marginal cultivators are female which easily suggests that women belongs to the marginalised section of the community. Also, from various past studies mentioned here tends not to argue with the fact that women are more vulnerable to the negative impacts of the climate change.



Source: Census of India, 2011

It is also found from census 2011 that total percentages of the Agricultural labours are well spread between both male and female. Now, the same phenomenon is visible in the marginalised agricultural labour section. This graph shows the same Brobdingnagian issue on climate change and its adverse effects to rural livelihood of rural people of Sikkim.

4. Impact on indigenous crops

Both short and long-term variations in climate will continue to be the important determinants in influencing agricultural and livestock rearing activities in Sikkim. Sikkim has five Agro-climatic zones/ crop production systems. The temperate and high-altitude zones are vulnerable to temporal shifts in climate. High altitude beans, apple, many wild edible fruits, cold water fishes, etc which are adopted to temperate zone may not yield or be productive if the threshold temperature is not met. It may affect the food and nutritional security

of people inhabiting this zone. Crop adaptability to an environment is the result of genotype x environment interaction. Hence, the effect of climate change would vary with crop and variety in a given environment. Even in the absence of severe quantitative effects on agriculture, climatic variations are likely to reduce the number of crops or variety to be cultivated in a given region. This would also affect the dietary spectrum. At present, however, little is known about possible changes in temperature and annual rainfall in the temperate zone of Sikkim except a study by Sumi (1994) on the rainfall variation along Teesta valley.

Indigenous livestock rearing and dairy sector also plays a vital part in the rural livelihood of Sikkim with the changing climate and extreme weather events mortality rate of the livestock is getting higher by the time and yielding less productivity from the sector. Climate change leading to degraded biodiversity of forests is likely to impact the quality and quantity of forest products and hence adversely impact the associated livelihoods of communities thriving on the same; the forest products such as eco-tourism, apiculture, sericulture, medicinal plants, cane, bamboo for small scale cottage industries and natural fibres.

According to Human Development Report, Sikkim “in the subtropical zone (less than 1,000 m), the production of important cash crops like ginger, orange, and fruits has declined due to prolonged droughts and outbreak of pests, diseases and weeds. This zone was earlier a productive area with multiple cropping. Now due to less winter rain, only single cropping during the monsoon is possible. Storage and preservation of seeds is also becoming increasingly difficult due to pests, diseases and dry winters.”

Conclusion

An understanding of the past weather phenomenon at the regional or local level would help researchers and planners to predict the possible impact of global warming on agriculture sector and also to plan measures to reduce the ill effects of warming.

Making agriculture sustainable is a great challenge. Sustainability implies that agriculture not only secures a sustained food supply, but that its environmental, socio-economic and human health impacts are recognized and accounted for within the national development plan.

Agriculture exists within a symbiosis of land and water. Therefore, appropriate steps must be taken to ensure that agricultural activities do not adversely affect soil and water quality so that subsequent uses of land and water for different purposes are not impaired. The suggested measures are, i) prevention of soil runoff and sedimentation, ii) proper disposal of sewage and household waste, iii) minimize the adverse effects from agricultural chemicals by adopting integrated pest and disease management. Public awareness should be created on “the causes and impacts” of climate change. Training programmes prepared especially on how best an individual can help in reducing emission of GHGs and educational programmes at school and college levels on climate change would help a lot. Policies in transport sector should aim at reducing GHG emission.

Various types of adaptation strategies has been already taken by the Government of India and Government of Sikkim to mitigate the effects of climate change and some more strategies have to be taken for the betterment of the beautiful mountainous state of Sikkim.

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Education, Life & Philosophy

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Abstract

Chief task of education is to make life worth living. Relationship between Philosophy and Education is very close. All subjects like Law, Economics, Political Science, Sociology, Literature, Education, depend for their flowering upon Philosophy. Philosophy of life, means outlook of life, how we regard things, events, relationships and values. Philosophy deals with the content of pure thought. Whoever has tried to philosophies about education have been called Educational Philosopher or Educational Thinker. Education is the harmonious development of all the powers of the human being - physical, social, intellectual, aesthetic, and spiritual. There can be no education without strong emphasis on the fundamental importance of its spiritual basis. The prime task of education therefore is to awaken the spiritual needs in the children in order to enable them to adapt and adjust themselves to the changing patterns of the society. Our land is a land of religions and spiritualism. Belief in God and Godliness is a great force behind dynamic and progressive society.

The *Gurukul* system in the past, had benefiting ingredients for healthy mind body development. Developing is not discarding the past, but growing with the aid of the richness of the past, for the brighter future. Now a day relationship through devices is common and correspondences through sms, emails, and face book are convenient, though their effect on mind and body is damaging. These are useful to an extent and should be utilized intelligently.

If India is to enhance its impact in the knowledge world, we have to encourage children to ask questions, arouse curiosity, and allow them to experiment, come closer to nature and think wildly. Education in India must create this spirit of democracy, scientific enquiry and philosophic toleration.

Keywords- Development, Education, Health, Life, Philosophy.

ayam bandhurayam neti ganana laghuchetasam

Udaracharitanam tu Vasudhaiva Kutumbakam¹

{Only small men discriminate saying: One is a relative; the other is a stranger. For those who live magnanimously the entire world constitutes but a family.}

We exist, we live and we learn. Our relationship with the existence is affecting our living. Changes without are giving birth to challenges within. We require an innovative educational methodology, which will aid in coping with the challenges, such that the learners lead a healthy life. Education exists in relationship and not in isolation. We are unable to relate learning with our day-to-day life. Throughout life, relationship is a great teacher, learning from the members of one's family, society, literature, nature and the environment. Awareness, attention and sensitivity play important roles in developing relationship with the surroundings and the learner learns from observations. Motivations beyond the syllabus based learning helps in an overall aesthetic development, the implication of which remains throughout life.

Is education aiding in better living, in the true sense? We have not considered that we have to change the system of learning, with changes in our social structure, encouraging learning in a way, such that the curriculum studies benefits the family and society. Learning minds have direct relationship with the surrounding environment. Living conditions have direct impact on learning minds. Most of the slum dwellers live in an unhealthy condition, which has a direct effect on their mind and body system. Their unhealthy living conditions affect their lives and their children developing in such environment suffer the most. Their learning minds are being spoilt in the unpleasant surroundings. Relations slowly become emotionless, and when such learners go to an educational institution, they look for an amicable condition and supportive human relationships, more than their academic learning. They want to spend few hours of their day in healthier conditions and in a joyful atmosphere, which they are deprived. Preparing lessons for those learners, in the form of skits and plays would develop creative skills.

Critical situation is there at all levels and this can be lessened, if one is aware of the requirement of the present, which will help us to form a vision for the future in terms of relevance. Cultural exchanges bind

learners in friendliness, developing an aesthetic atmosphere within the institutions. Our educational system had an amalgamation of thoughts and ideas due to several foreign invasions and our nation and its people faced challenges and have experienced changes. The Mughals and the English have made much contribution in life and learning, the impact of which is remaining. We have to make our learners more and more cognizant about the immense to learn and develop, from our past.

The versatility of human nature experiences freedom in learning, in a creative form, through which he is able to relate himself with the entire existence. This will leave the mind young and fresh. Learning through creative expressions of exposure, to different cultures and ways of living, develops the mind harmoniously. The various art and music of states like the 'Madhubani' painting of Bihar, Kathhak Dance of Uttar Pradesh, Odissi of Orissa can be introduced as part of school's extra curriculum activities. Developing an aesthetic relationship with art, should be an essential part of compulsory educational system, from the early years, as introduced by Rabindranath Tagore in Visva Bharati, Shantiniketan.

Human nature is undergoing changes with the changing circumstances, and human relationships are changing drastically. The rash behaviour of the youngsters, in the present society, is the result of negligence in mentoring. The changing relationship within families, e.g single parenting, is developing problems in the minds of the young learners. Their interactions in day-to-day life within the family, and in the outside world, affect their nature and their personality. Harmonious development within their immediate family will have an inspiring effect in their later lives. The educational institutions in the present are lacking an effective teacher student relationship, which flourishes best in an atmosphere of love and freedom. An ideal relationship, in a spirit of cooperation, is natural. In our traditional system, we have had very many examples of ideal teacher student relationships. The relationship of Krishna as a friend, who guided Arjuna in the battle field of Kurushetra, also reflects how friends, also can take on the role of a Guru in giving good advice in times of difficulty. Rabindranath Tagore said – 'We have to keep in mind that love and action are the only intermediaries through which perfect knowledge can be obtained, for the object of knowledge is not pedantry but wisdom. The primary

object of an institution should not be merely to educate one's limb and mind to be in efficient readiness or all emergencies, but to be in perfect tune in the symphony of response between life and world, to find the balance of their harmony, which is wisdom. We have to develop favourable conditions in educational institutions through enhanced teacher student relationships. Innovative methodologies to develop learners' interests in various fields, not only to keep them occupied, but informed in new inventions and discoveries; in order to build a better society and community.²

J.Krishnamurti said that most of us are acquiring knowledge, accumulating facts and data. Learning is constant. A relationship between theory and practice has to be maintained, keeping in mind that education is not only for the immediate present but for having a long vision in connection to life. According to the philosopher, relationship becomes mechanical when it is based on routine knowledge. Is there sensitivity in acquiring of knowledge? Intelligent learning is in awareness with sensitivity, where the senses play an active role with the surrounding circumstances. He mentions that cultivation of an 'awareness' and 'attention' are most desirable qualities in education. 'Attention is a state of mind that is totally committed to finding a way of living in which conflict of any kind has come to an end.'³ Awareness creates a sense of freedom, that enables learning and teaching with concern and responsibility. These are lost in today's carelessness, with which we approach education. He had said that education is educating the whole person, his every aspect and preparation for the entire life. He mentions, "The bringing up of a child requires intelligent observation and care. Experts and their knowledge can never replace the parents' love, but most parents corrupt that love by their own fears and ambitions, which condition and distort the outlook of the child. So few of us are concerned with love, but we are vastly taken up with the appearance of love."⁴ He adds, "The influence of the home and that of the school must not be in any way contradictory, so both parents and teachers must re-educate themselves. The contradiction which so often exists between the private life of the individual and his life as a member of the group creates an endless battle within himself and in his relationships."⁵

Our educational system cannot be successful in all its policy making, unless there exists a personal touch, human touch at all levels. A

system will be flourishing only when the students are satisfied in it, in their lives and in their career. Good education should cater to the purpose of the society and the individual student in a free and unrestrictive environment.

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Women's Role in Forest Protection and Management in the context of Gender-sensitive Joint Forest Management in West Bengal

A Case Study of Bankura District

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Abstract

West Bengal had been the first in the country to introduce gender-sensitive Joint Forest Management, seeking separate provision for women in forest protection and management. Thus, the first gender-sensitive JFM committee (popularly known as Female FPC) of the state came up in Bankura district in early 1990s. As cited by few (Banerjee 2004, Das 2012), Female FPCs are more organized than Joint FPCs and their contribution towards different activities under forest management program is substantially higher than the Joint FPCs. In this regard, the present study tries to find out the role of women members in forest protection and management within gender-sensitive Joint Forest Management unit (Female FPC) in West Bengal, in comparison to the members (mainly men) within general Joint Forest Management unit (Joint FPC). The study reveals the Female FPC village as apparently more organized than Joint FPC village in every activity (fixing of FPC meetings, distributing patrolling duty among the members, handling of offenders etc.) performed under JFM program. As regards to the participation level also, the Female FPC village members performance in every type of activity like attending FPC meetings, patrolling, reporting about the violators to administration is higher than the Joint FPC village members. However, land-holding status (indicating economic wellbeing of the members) also plays a crucial role in this regard. Generally, those who belong to landless households perform well in

all the activities than those belonging to landed households. It seems that, the landless members are more sincere in performing the above mentioned functions because of their higher dependency on head loading, compared to the landed. In the end, the study reveals that, if women are given the separate provision to protect and manage the forest resources within their own management system, then it can help to institutionalize their efficiency. In this regard, the study suggests for introducing more gender-sensitive planning under JFM for the sake of sustainable forests.

Keywords: *Gender-sensitive Joint Forest Management Programme, Forest Protection Committee, Head-loading, Participation.*

Introduction

In rural India, women constitute the most important user group in the forestry sector. Being primary gatherers of various forest products including fuel wood, fodder and other NTFPs, Indian women not only contribute a significant portion of forest-based livelihoods, but also acquire a greater knowledge and awareness about forests, compared to men. In this regard, active involvement of women in forest management and policies is an indispensable way of contributing towards sustainability of forests. The 1988 National Forest Policy, the basis for Joint Forest Management (JFM) in the country, has emphasized the involvement of both men and women in forest protection and management. It was followed by an order in 1991 specifying that, at least two women should be on every village management committee in the JFM program. However, evidences show that, in many cases, owing to several social and cultural constraints, women play a minimal role in such program and thus their participation remains on paper, only. (Godbole 2002, WWF-UK Report 2012) From this perspective, gender-sensitive Joint Forest Management (with the aim to institutionalize poor women's efficiency and equity in forest management and policies) has received considerable attention both in theoretical as well as in empirical research by distinguished scholars throughout the country.

West Bengal had been pioneering in the country to introduce gender-sensitive Joint Forest Management that widened the scope for women's participation in forest management and policies, by establishing Female Forest Protection Committees (FPCs), exclusively for women.

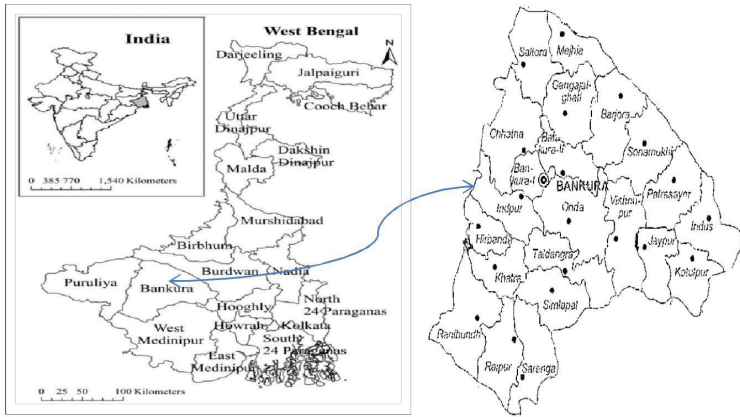
The first ever Female FPC (Brindaban FPC) of the state and of the county, as well, thus came up in Bankura district in 1991; the leader of the FPC, Mrs. Parul Lohar, was awarded the Government of India's honour for her noble work. By the end of 2001 the number of Female FPCs in the state swelled to 17, scattered among three forest divisions of the district-Bankura North, Bankura South and Bankura Panchet. Thus, although the number of Female FPCs was very small compared to the number of Joint FPCs (mainly dominated by men), forming of such FPCs in West Bengal was proved to be an innovative attempt by the Forest Department to motivate women for involvement in various activities under JFM program along with their own management system. (Banerjee 2004, Das & Sarkar' 2008, Das & Sarkar-2012)

In this background, the present study tries to find out what role the women members are playing in forest protection and management within gender-sensitive Joint Forest Management unit (Female FPC) in West Bengal, in comparison to the members(mainly men) within general Joint Forest Management unit (Joint FPC). The study comprises of total 5 sections. Following introduction the 2nd section of the study depicts about the sources of data and methodologies we have used throughout our study. The 3rd section highlights on the basic profile of specific FPC – villages/member households. The 4th section discusses about the forest dependence and forest outcomes of the FPC-villages/member households while the 5th section focuses on the role of the concerned women's role in forest protection and management. The last section follows the conclusion.

Data Set and Methodology

The study we have taken mainly involves primary data sources. For the purpose of collection of the data, we have carried out an intensive field survey in between December 2016 and February 2017, across four FPC-villages of Bankura district¹¹, West Bengal, covering 155 members/households from these.

- 1 Bankura is one of the districts of West Bengal which occupies a large area under Joint Forest Management program with a considerable number of Forest Protection Committees. Presently, the district has 1416 FPCs (which is about 36.25% of total FPCs of South West Bengal and about 32.23% of total FPCs of the state) that protect about a forest area of 126029.1 ha(which is about 32.40% of forest area protected in South West Bengal and 21.28% of forest area protected in the state). An estimated



A multi-stage stratified sampling technique has been applied for the selection of four specific FPCs under our study. We have purposively chosen Bankura South forest division² out of three forest divisions of Bankura district based on its majority in total number of FPCs. Then, from this particular division, two forest ranges, namely- Hirbandh and Khatra have been chosen (out of twelve forest ranges). This selection has also been done on the basis of majority in total number of FPCs. From each of two forest ranges, two FPC-villages have been chosen, one of them being Female FPC village and another being Joint FPC village. Finally, a total 155 households have been chosen from these villages on random basis. (see appendix, table no. 2.1.)

Two types of structured questionnaire have been used for the field survey: one at FPC-village level and another at household level. The village level questionnaire seeks information regarding formation year of FPC, membership, forest types, distance from forest, frequency of monthly FPC-meeting, major issues discussed in the meetings, return from last felling etc. The respondents are mainly from executive committee of FPC.

142353 members are involved in these FPCs; of them only 5.91% are female and 21.97% are tribal.

2 Among three forest divisions of Bankura district (Bankura North, Bankura South and Panchet), Bankura South division occupies the maximum number of FPCs. Around 46% of the district's FPCs are located in this division, of which, around 3% are fully organized by female members.

At household level, the questionnaire is comprised of two sections. While the first section deals with the forest dependency of households (in terms of type of products collected, days employed in collection) along with other demographic and socio-economic features, the second section raises questions regarding the participation (of committee members) in different activities under the JFM program.

As regards to the objective of our study, the villages (under our study area) have been categorized into two groups: Female FPC village and Joint FPC village. Again, within each group of village, the households, on the basis of their (agricultural) land-holding status, have been categorized into two groups: landless and landed³. To examine the role of the members (landless or landed) under each group of village, we have used four participation indicators: monthly meeting called out by FPC, decision-making, patrolling of the associated forest area and report to the administrator about offenders (involved in illegal felling of trees, over grazing etc. in the forest area) All the four indicators are given three options to respond- Always, Sometimes and Never.

Basic Profile of FPC Households/Members

Of the four FPC-villages under our study area, Amjhuri and Dedua fall under Female FPC category, while the other two viz. Meridhara and Salbani fall under Joint FPC (apparently male-dominated) category. All of the four FPCs in the respective villages have been registered in between 2000-2008.⁴ All of the villages are located within a short range of one to two kilometers from the assigned forests. The per capita forest area ranges from the lowest of 0.21 ha (in Dedua) to the highest of 0.73 ha (in Salbani). The forests are mainly plantation forests, covered with some quick growing tree species like Akashmani, Eucalyptus, Sissoo, Segun, Gamhar etc. (see appendix, table no.3.1.)

- 3 Throughout our study we have not found any households who belong to small, medium or big land-holders. That's why, we have been bound to take only two types of households: one, who do not own any land i.e. the landless and another, who belong to marginal land-holders (having land-holding size up to 2.5 acre) i.e. the landed.
- 4 The registration year and the formation year are same for all FPCs, except for Meridhara. The committee was actually formed/registered in the year 1995. However, in between 1995-2007, some official documents related to the committee were lost from the range office. That is why; the committee was re-registered in 2008.

Average household size for all the villages lies between 4 and 5. In terms of sex-distribution, the majority of the population are female in all the villages, except Amjhuri. Caste-wise distribution of population shows preponderance of tribal in Meridhara and Salbani villages, while in other two villages the majority are others (mostly other backward castes). The literacy is above 60% in all the villages, except Meridhara (with 55%). In terms of female literacy, the percentage lies between 55%-60% in all the villages, except Amjhuri (with below 50%). A significant portion (above 60%) of total population in all the four villages is aged between 18-65 years. With respect to this group of population, Meridhara and Dedua villages show higher work participation rate (more than 80%) compared to that of Amjhuri and Sabani (with 73%). The female work participation rate is also higher (70%-80%) in former two villages compared to that in latter two (53%-56%). (see appendix, table no. 3.2.)

A significant number of households are landless in all of the four villages. The number is highest in Amjhuri (38%) and least in Salbani (12%). Among the landed, however, there are only marginal land holders⁵. Daily wage labour is the main occupation for most of the land-less households, while among the landed, majority are involved in daily wage labour, along with cultivation. Thus, on average, about 95% of the total working population from all the four villages are daily wage labourers. Among the wage labourers, agriculture is the main occupation we have found in all the villages. Almost all of them (either land-less or landed) remain involved in agricultural sector for about 4-6 months in a year. However, due to scarcity of local agricultural jobs, seasonal migration is common among them; they migrate to Burwan or Hoogly town for certain months (around 3-5months, on average), every year. To the landed households, cultivation is another important source of subsistence, apart from wage labour. The major crops cultivated by them are paddy, mustard seed, potato, onion etc. along with some pulses, maize, seasonal vegetables etc. Apart from this, some households (mostly landed) domesticate live stocks (mainly, cow, goat and duck/hen etc.) for subsistence. A majority of the household's monthly per capita income lies below Rs. 2000/-. (Field survey, 2016-17)

5 By marginal land-holders, we mean those who hold land size up to 2.5 acre.

Forest Dependence and Forest Outcomes

With an attempt to forge partnership between forest departments and local communities, JFM has now been widely accepted as a promising approach to forest management in order to regenerate degraded forest lands. However, there is quite difference between the forest department and village communities, in seeing JFM. Most of the forest officials see JFM primarily as a means to ensure rehabilitation of degraded forests. Village communities, on the other hand, see JFM as a way to avail the supply of biomass, a means to secure daily requirements of forest products and/ or a way to augment supplementary income. Thus, the success of JFM has a direct relation to the increased flow of forest products– the very incentive for the communities to protect the forest. (Joshi' 1998-99, Sunadr' 2000, Khare *et al'* 2000, Ghosh' 2008) Now, so far our studied FPCs are concerned; the scope of availability of NTFPs (which are considered to be significant source of forest income in India as well as in West Bengal) is very little, since the forests under these FPCs are plantation forests. People mainly use the forest areas for getting bio mass fuel (dry wood, leaves, cow dung) and grazing the cattle. Among the NTFPS, cashew nuts are available in two of the four FPC-forests (Dedua and Salbani). However, due to restrictions from the forestry department, they are not able to collect those. Along with this, some local mushroom (*astamir chhatu*) and medicinal plants (*kalmegh*) are grown in the forests, but their availability and extraction, both are limited. In this background, we have defined mainly three sources of forest income for the member households: bio-mass fuel (along with some free accessible NTFPs, as mentioned earlier), usufructs share (25% of the net income from felling of timber and auction of cashew nuts, where available) and forestry works.

As responded by the villagers, after the implementation of the program, the households, especially those from Female FPC village and those of the landless have benefited a lot in accessing free bio-mass fuel from the concerned forest areas. It has been seen that, the households (on average) earn a sum of Rs. 6168/- annually or Rs. 514/- monthly, from head loading. The sum, however, varies across and within villages, depending on households volume of collection. Apart from head loading, the households earn a certain sum of money from usufructs share and forestry works. This sum is, however, comparatively low

(Rs. 2064/-annually or Rs. 172/- monthly) than that obtained from head loading. This sum is also variable across villages, depending on forest area, felling/auction period, forest products & quality, market price (in case of usufructs share) and scope of forestry works in the concerned FPCs.(Field survey, 2016-17)

Thus, on average, household's income from forest sources accounts for Rs. 9393/- annually (or Rs. 783/- monthly) constituting 8.78% of total annual household income. Again, this percentage varies across and within villages. It has been seen that, in Female FPC village, the percentage is higher with 9.64%, compared to 7.93% in Joint FPC village. Again, within villages, the percentage is higher (9.6%) for the households belonged to landless category compared to those belonged to landed category (7.95%). Thus, on average, a major portion (73.04%) of forest income for all the households (irrespective of village category or land holding status) comes from biomass fuel (along with few NTFPs). (see appendix, table no. 5.1 and figure 5.1)

It seems that, JFM's role in terms of tangible economic outcomes is not sufficient, as a major portion of the outcomes is limited in biomass fuel. It could hamper the very motive behind sustainable forest management in the coming years, since it is clearly evident that, forest protection is highly linked to people's willingness and participation, which in turn depends on forest outcomes. This might also make people prone to illegal felling of trees. Moreover, less outcome leading to over extraction of forest-grown dry twigs and leaves which are mainly collected by floor sweeping, might have a harmful effect on forest productivity (Guhathakurata & Roy' 2000).

Women's Role in Forest Protection and Management

From the management perspective, the JFM experiences in many Indian states, have cited the realization that, the success of the program, largely depends on the villagers' participation (Ghosh'2008) and the level of participation under such program greatly vary according to gender, caste, class and occupation. As regard the gender-sensitive JFM program is concerned, several studies (De'2011, Poffenberger'2011, Das'2011) in Indian as well as in West Bengal context, have shown that, women's participation in forest protection and management is substantially higher within their own forest management unit than the men's in the general forest management unit.

In the context of gender-sensitive JFM in West Bengal, Banerjee (2004) has pointed out that, Female FPCs are more organized and better achievers regarding various activities under the JFM program, compared to the male-dominated general FPCs.

In this study, we have found a major disparity between the Female FPC -villages and Joint FPC-villages, in terms of strategies adopted for different activities (for the purpose of managing and protecting the concerned forest areas), which largely affects the individual participation level within villages. As we have seen, in both of the female FPC-villages, the committee members follow a systematic order either for fixing FPC meetings or for patrolling activities. As reported by the members from these villages, they organize at least one FPC-meeting in a month, where major decisions for the sake of forest conservation are taken. For the patrolling activity of the concerned forest areas also, they maintain a proper way. As one of the female members from Amjhuri village stated:

“Every day, we, the female members, in a group of 5-7, go to the forest area for patrolling. The grouping process is generally decided in monthly meeting. On average, every member is engaged for 2-3 days in a month for the patrolling activities. We, also, maintain a register book for this.”

The case is, however, different for those of the Joint FPC villages. They generally organize a FPC meeting within a gap of 3 to 4 months. They also do not maintain regularity or order in patrolling activities. As one of the male members from Meridhara village said:

“We don't patrol the forest area on daily basis. When we feel the need, we go to the forest area in a group of 15-20 members for patrolling.”

We have also found a kind of affirm mentality in the members of Female FPC villages in terms of handling the offenders (mostly, outsiders) compared to those of Joint FPC villages. As one of the members from Dedua village said:

“During patrolling of the forest area if we find someone violating the rule of the committee (illegal felling of trees or over grazing of cattle), we immediately report it to our executive committee members. They are charged penalties, based on the gravity of their offence. In extreme cases, they are handed over to the concerned Range office.”

As regards the members from Joint FPC villages are concerned, a few of them always follow the rule of reporting to the administrator about

the offenders. It was apparent that, some members at times depending on the situation might overlook the offence made by any outsider. As one of the members from Meridhara village, who introduced himself as the executive committee member of the concerned FPC, expressed his dissatisfaction over non-reporting:

“Often people from other villages come and cut the trees from the forest area. But the members do not always report us about it.”

During our survey, we have noticed many such points, which make us to believe apparently that, Female FPC members are more organized and concerned compared to the Joint FPC members, in handling various activities for the conservation of their forests. This difference is also reflected in their participation level.

As we can see from table 6.1:

- ▶ In case of FPC-meetings, the percentage of members who always attend the meetings, is substantially higher (93.2%) in Female FPC -village, compared to the same (78.9%) in Joint FPC- village. However, in case of decision-makings, no such difference exists between the two. If we compare the simple presence in meeting with ultimate participation in decision making, then it is little bit surprising, for both of the village categories. As we can see, in the Female FPC village, though, 93.2% members always attend the meetings, they have less control over the decisions made in them, as only 49.9% of the members always take part in decision-making. Similar things can be found in case of Joint FPC village, also. As depicted in the table, though 78.9% members from the Joint FPC-village always attend the meetings, in case of decision-making, the percentage stands at only 49.7%. Generally, it is believed that, in a Joint FPC, female members' suggestions are underrepresented, i.e. few males decide everything. The study, however, reveals that, the same monopoly over decision making is also present in case of female FPCs. Control over decision making may be influenced by other factors such as members' political identity,

level of education, caste, hierarchy etc. but the limited scope of this study could not take into account all those factors.

- ▶ Now let us turn to the patrolling activity. In this case, also, as in the case of FPC-meetings, the percentage of members who always take part is relatively higher (88.6%) in Female FPC-village compared to the same in Joint FPC village (83.9%).
- ▶ A major difference is found in case of reporting about the offenders to administration between the two kinds of FPC-villages. As we can see from the table, the percentage of members who always take part in such activities is significantly higher (55.1%) in Female FPC village compared to the same in Joint FPC village (10%). I reiterate that the plausible reasons behind this marked difference are better integrity among the members.
- ▶ Disparity (regarding participation in forest protection and management) has been found within the villages, also. As we can see, in Female FPC- village, the percentage of members who always take part in all of the four activities (meetings, decision making, patrolling and reporting about the offenders), is higher among those who belong to landless category compare to those who belong to landed category. The case is more-or-less similar for the Joint FPC-village also. As we can see from the table, except the reporting activity, in other three activities, the percentage of members who always take part is higher among those belonging to landless category compared to those belonging to landed category.

Table 6.1. Participation of members in different activities under JEM program

	FPC meeting	Decision making	Pa-trolling	Responses (in percentage term)				Report to administration about					
				Always	Never	Always	Never	Al-ways	Some-times	offend-ers			
Village category													
Household category													
	Always	Never	Some-times	Always	Never	Some-times	Always	Never	Some-times	Al-ways	Some-times	Never	Never
	100.0	0.0	0.0	52.7	3.6	43.8	100.0	0.0	0.0	66.1	33.9	0.0	0.0
	86.4	0.0	13.6	47.0	1.9	51.1	77.3	0.0	22.7	44.1	56.0	0.0	0.0
Female FPC													
	Always	Never	Some-times	Always	Never	Some-times	Always	Never	Some-times	Al-ways	Some-times	Never	Never
	93.2	0.0	6.8	49.9	2.8	47.4	88.6	0.0	11.4	55.1	44.9	0.0	0.0
	85.7	0.0	14.3	50.0	0.0	50.0	85.7	0.0	14.3	0.0	100.0	0.0	0.0
	72.0	10.1	17.9	49.7	10.1	40.1	82.0	6.8	11.2	20.0	80.0	0.0	0.0
Joint FPC													
	Always	Never	Some-times	Always	Never	Some-times	Always	Never	Some-times	Al-ways	Some-times	Never	Never
	78.9	5.1	16.1	49.8	5.1	45.1	83.9	3.4	12.8	10.0	90.0	0.0	0.0
Grand total	86.0	2.5	11.5	49.9	3.9	46.2	86.2	1.7	12.1	32.5	67.5	0.0	0.0

Source: Field survey' 2016-17

Concluding Remarks

In summing up, we can say that, Female FPC-village members are apparently more organized and concerned regarding forest protection and management compared to Joint FPC-village members, which is also reflected in their participation level under different functions like FPC meetings, decision making, patrolling and reporting about the offenders to administration. Again within villages, the members belonging to landless category show more contribution towards forest protection and management than those belonging to landed category. It seems that, the landless households are more sincere in performing the above mentioned functions because of their higher dependency on head loading, compared to the landed.

The study, in the end, reveals that, if women are given the separate provision to protect and manage the forest resources within their own management system, then it can help to institutionalize their efficiency. In this regard, the study suggests for introducing more gender-sensitive planning under JFM for the sake of sustainable forests.

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Appendix

Table 2.1. Sampling Design of the Study

Forest range	Name of FPC-village	Village category	Population size	Sample size
Hirbandh	Amjhuri	Female FPC	100	50
	Meridhara	Joint FPC	75	35
Khatra	Dedua	Female FPC	96	45
	Salbani	Joint FPC	50	25
Total sample size				155

Source: Field survey’2016-17

Table 3.1. Basic profile of the specific FPCs

Name of FPC	Amjhuri Mahilla Ban-Sangrakshan Committee	Meidhara Ban Sangrakshan Committee	Dedua Mahilla Ban Sangrakshan-Committee	Salbani Ban Sangrakshan Com-mittee
Village, Beat	Amjhuri, Hir-bandh 2	Meidhara, Hirbandh 2	Dedua, Kha-tra 1	Sabani, Khatra 1
Range, Division	Hirbandh, Bankura South	Hirbandh, Bankura South	Khatra, Bankura South	Khatra, Bankura South
Registration year	21/03/2006	08/04/2008	06/08/2002	28/01/2000
No. of mem-bers/households	50	35	45	25
Total forest area, forest area permember/household	33.28 ha, 0.33 ha	40.00 ha, 0.53 ha	19.83 ha, 0.21 ha	36.52 ha, 0.73 ha
Distance be-tween forest and FPC	1.5 km	2 km	1 km	2 km
Forest type	Planting	Planting	Planting	Planting
Main tree species	Akashmani, Sissoo, Segun, Gamhar etc.	Akashmani, Eucalyptus, Manjadi etc.	Akashmani, Eucalyptus, Cashew etc.	Akashmani, Eucalyptus, Cashew etc.

Source: Field survey' 2016-17

Table 3.2. Demographic characteristics of FPC-households

Name of FPC	Amjhuri	Meridhara	Dedua	Salbani
No. of households	50	35	45	25
Total population	247	151	237	112
HH size	4.9	4.3	5.3	4.5
Male population	51.10%	49.50%	48.60%	46.43%
Female population	49.90%	50.50%	51.40%	53.57%
SC population	8%	-	-	-
ST population	30%	77.00%	26%	100%
Others population	62%	23.00%	74%	-
Literacy rate	60.50%	54.78%	65.92%	60.71%
Female literacy rate	49.3%	58.26%	58.70%	55.00%

Approaches to Sustainable Development

Population in age group 18-65	68.50%	68.51%	67.60%	63.39%
Work participation rate w.r.t population in age group 18-65	73.20%	82.35%	80.17%	73.24%
Female work participation rate	53.27%	78.07%	69.70%	55.56%
Source: Field survey'2016-17				

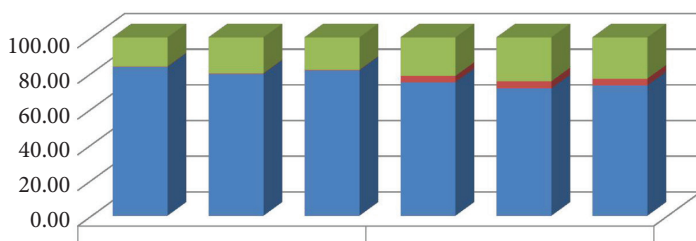
Table 5.1. Share of forest income to total (annual) household income(in percentage term)

Sources of income				
Village category	Household category	Farm*	Non-farm**	Forestry
	Landless	8.1	81.22	10.68
	Landed	7.1	84.29	8.6
Female FPC	Total	7.6	82.755	9.64
	Landless	0.09	91.37	8.53
	Landed	19.7	72.98	7.32
Joint FPC	Total	9.90	82.18	7.93
Grand total		8.75	82.47	8.78

Source: Field survey' 2016-17

- * Here, farm income includes the income from cultivation and live stocks.
- ** Here non-farm income includes income from wage labour, service, business and others.

Fig. 5.1 Contribution of various forest income sources in total forest income (in percentage term)



Landless	Landed	Total	Landless	Landed	Total
	Female FPC			Joint FPC	
● Bio-mass fuel & NTFPs			● Usufructs share		● Forestry work

Indigenous Technological Knowledge for Soil Management

Wisdom Alive in Tripura and West Bengal

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Introduction

The concept of indigenous knowledge in the context of agriculture is the traditional wisdom used for the conservation of soil and water resources for their sustainable use. These practices are the outcome of trial and error method and passed down from generation to generation, usually verbally or by practice. But in the pace of agricultural intensification these values are mostly lost. However, in the current context of declining soil health it is the high time to think again of indigenous nutrient management which is being lost to modern agriculture and use it properly either as such or after suitable refining it scientifically as per the need of the farmers.

Soil is the most basic and vital natural resource on which agricultural production depends. Maintenance of soil fertility and productivity is, therefore, a real key to achieve sustainability in agriculture. No doubt, well frontier science based technologies appropriate for efficient management of soil fertility optimizing nutrient supplies from different sources have been developed, but many of these technologies could not find favour with farming community, in general and

resource poor small and marginal farmers, in particular. Against this, there is growing realization that the present technologies need to be modified in the light of indigenous technological knowledge (ITK) available with farmers so as to make them cost effective and acceptable to local farming communities.

Farmers possess a store-house of knowledge about their soil and various practices to restore and maintain soil fertility. Since the earliest stage of agriculture, farmers have been active in developing techniques for crop production and maintaining soil fertility. The indigenous technological knowledge available with farmers provides much needed insight into the management of soil fertility and nutrient management for sustained agricultural production, because such knowledge has been time tested and inherited from one generation to another. Moreover, indigenous technologies developed on the basis of experience gained and lessons learnt by the farmers are generally eco-friendly and do not require off-farm inputs. These technologies are at the finger tips of the farmers and thus give result invariably. In order to make use of these technologies they should be collected and fine tuned with scientific touch.

Indigenous technological knowledge (ITK) available in Tripura and West Bengal

The state of Tripura and West Bengal are endowed with diverse pedo-meteorological condition. Consequently a spectrum of socio-economically and culturally distinct people is engaged in agriculture. The people of Tripura and West Bengal have evolved a large numbers of practices related to soil management systems suitable for different agro-climatic conditions of the state. They are time tested and effective for nutrient management. The systematic documentation of indigenous nutrient management practices is necessary to conserve the agricultural heritage of Tripura and West Bengal from being lost. Here are few ITKs related soil nutrient management.

1. Use of Ash

Ash, particularly from rice husk and cowdung cake is an important material for agricultural use in the plains and valleys of Tripura and West Bengal. In *jhum* cultivation, ash from burning of grasses weeds etc are used by the tribal people in hilly areas of the state. Ash primarily meets the deficiency of potash and supplies huge amount

of silicon and it imparts friability to the seedbed soil which facilitates germination of seeds and also the easy uprooting of the seedlings. A thin film made by spreading of ash protects the seeds for the damage caused by birds. Spreading of ash mixing with kerosene oil on vegetable leaves in the morning hours is a common practice to protect the plants from the attack of insect-pests, particularly jassids and red beetles. Mixing of ash with household waste helps in surface soil crust breaking, and rain water conservation. This ITK practice is widely used in both Tripura and West Bengal. This practice is technically feasible, inputs easily available, compatible with internal resources of the household, eco-friendly, enhance soil fertility and crop production.

2. Spade insertion into the soil as indicator of irrigation requirement

Insertion of spade or digging the soil is used to test moisture content of the soil. It is a local practice to ascertain the optimum utilization of water and its penetration up to the root zone of the soil profile. Moisture content in the soil particles are necessary for increasing soil fertility. Both under rain fed and irrigated condition farmer test soil with the help of spade digging. Farmers regulate irrigation to desired soil depth by inserting spade to the soil. If it is completely inserted from front portion, it is considered to be properly irrigated. Similarly in other cases soil is thrown upside with spade and its splits into small pieces. This practice is a good indicator for farmers of Tripura and West Bengal to estimate proper irrigation of agricultural land. It is simple, easy to adopt and saves time as well as labour.

3. Moisture conservation through mulching

In Tripura and West Bengal many farmers use paddy straw as mulch material. Mulching conserves soil moisture in the field and also helps in maintaining soil temperature, controlling weed population. Moreover, it resists soil erosion to some extent. Mulching with farm yard manure is also used by the farmers. This ITK practice is cheap and simple to adopt which conserves soil moisture, boon to the rural people for increased crop production and higher soil fertility as well as maximum use of raw material.

4. Indigenous compost pit

Application of compost helped to restore the fertility and soil moisture. So farmers of Tripura and West Bengal indigenously developed some compost pit structure in which natural earthen pit is prepared wherein cow dung, grasses, wasted vegetables were dumped, and opening of pit is closed for three months. The application of compost improves soil fertility and improves the water holding capacity of soil.

5. Use of pond silt

Use of pond silt (dried bottom mud of pond) in crop and plantation crops is an age-old popular practice in the state of Tripura and West Bengal. During summer months the village ponds are dried up naturally or are dried by pumping out water in a rotation once in an interval of 5-10 years for the purpose of deepening of the pond. When bottom mass are clearly dried it is dug out and directly applied to the plantation as well as field crops. It is believed that the longer the period of interval between two successive drying of the pond, the better in the quality of pond silt in term of nutrient. Besides, the darker the colour and lighter the weight per unit volume the richer is the pond silt in nutrients. The darker colour and the lighter weight signify the presence of large amount of humified organic matter. Many farmers reapply the silt gathered in pond or lakes to the crop field in order to improve soil fertility and physical condition like texture and structure owing to the presence of a good amount of organic matter and clay. Silt collected from ponds and lakes are spread evenly on the field alone or in combination with FYM before sowing. Advantages of silt application include increased soil fertility and therefore improve crop yield, increased moisture content of soil, improvement in water table due to increased filtration.

6. Crop residue application in the field

The farmers of Tripura and West Bengal apply crop residues in crop field which on decomposition increase the organic matter content of soil and also improve the soil physical, chemical and biological properties of soil resulting in higher crop yield. But quantification of yield advantage after the incorporation of crop residue is a researchable issue which needs to be addressed.

7. Use of sand bags as erosion control measure

A sandbag is a bag or sack made of polypropylene or other sturdy material that is filled with sand or soil and is used in Tripura and West Bengal for gully erosion control which is very common in hilly areas of Tripura and West Bengal. The advantages are that the bags and the sand are inexpensive. When empty the bags are compact and lightweight and easy to storage and transport. They can be brought to a site empty and filled with local sand and soil.

8. Application of mixture of salt, ash and soil in the coconut pit before transplanting

Coconut trees need high potassium. Use of common salt (NaCl) at the time of planting coconut saplings and also almost in every year is a common age-old practice in the state of Tripura and West Bengal. On an average, one *ser* (900 g approx.) is applied per plant. The Na in NaCl may replace non-exchangeable form of K from soil sites and make it available to the plants. This is how use of salt is beneficial to the trees. The objective of application of ash to provides potassium and sand makes root penetration easier so that productivity increases.

9. Use of Coconut husk inside the planting pit of plantation crops

Coconut husk increases the water holding capacity of the soil and also supplies potassium. It also helps in easy root penetration. This is a common age-old practice in the state of Tripura and West Bengal.

10. Penning of animal in the field

Tribal families those practice *Jhum* cultivation are nomadic in nature. They migrate from one place to another along with their cows and sheep also. The practice of penning animal in the slash and burn filed is common to *jhumian* tribal families. Wooden logs are usually used to tie the animals in the fields. Frequent shifting of animal is done so as to cover the whole field for uniform distribution of the animal dung and urine.

Relevance of Indigenous Technological Knowledge

- ▶ The excavation and removal of sediments from the pond base helps in i) enhancing the infiltration rate of water during the monsoon and the storage capacity of water, and ii) minimizing the chances of nitrate addition to ground water through pond

base. The high infiltration rate of water in the pond helps in increasing the recharge of ground water. In such a process surface removal of nutrient coming from the runoff water is recycled by putting back all these nutrients, humified organic matter and clay in the form of pond silt. Such approach also reduces the chance of ground water pollution.

- ▶ The practice of animal penning has practical value. The fresh dung left in the field rapidly dries up. The drying checks the ammonification and methane emission. The dung is usually worked into the soil and therefore, does not lose much of its fertilizer value. The urine is absorbed directly in to the soil and reduce the chances of volatilization of nitrogenous compound for being lost. Due to current short *jhum* cycle of 2-3 years, the fertility gets deteriorated quickly. Penning animal in field may rejuvenate the field to some extent.
- ▶ Ash primarily meets the deficiency of potash and supplies huge amount of silicon and it imparts friability to the seedbed soil which facilitates germination of seeds and also the easy uprooting of the seedlings. A thin film made by spreading of ash protects the seeds for the damage caused by birds. Spreading of ash mixing with kerosene oil on vegetable leaves in the morning hours is a common practice to protect the plants from the attack of insect-pests, particularly jassids and red beetles. Mixing of ash with household waste helps in surface soil crust breaking, and rain water conservation. This practice is technically feasible, inputs easily available, compatible with internal resources of the household, eco-friendly, enhance soil fertility and crop production.
- ▶ Application of table salt in coconut plant has scientific relevance. Coconut plants are potassium loving crop. The Na in common salt (NaCl) may replace non-exchangeable form of K from soil sites and make it available to the plants. Thus, plant gets benefitted. However, currently the relevance of salt

application in coconut plants is lost due to the use of KCl as potassic fertilizer.

- ▶ In general it is observed that organic manure based farming systems encourage the build up of soil organic matter, which reduces the erosion and runoff of inorganic matter to streams and rivers besides improving the physical, chemical, biological and biochemical properties of soils. In addition to the highest degree of yield stability, organic manure and crop residues can also reduce the pest and disease incidence by increasing species diversity, absorb and inactivate residual pesticides. Organic matter by virtue of its high CEC protects the nutrients being lost and thus, improves the use efficiency of applied chemical fertilizers.
- ▶ Material used for mulching like straw, saw dust etc are bad insulator. Small wave length rays having high energy coming from sun while fall on mulching material pass through mulching material and converted into long wave length rays of less energy. Energy is then converted to heat energy and cannot dissipate through mulching material due to their bad insulator property, thus, maintains soil temperature. Water, thus, vaporised cannot escape from soil due to mulch coverage.

Blending of Indigenous Technology with Latest Scientific Techniques

The soils of Tripura are acidic in reaction and susceptible to various kinds of degradation due to high rainfall and hill agriculture. The soils of northern hilly areas as well as lateritic belt of West Bengal are also acidic in reaction and the soils of almost all areas of West Bengal are susceptible to various kinds of degradation. The average consumption of chemical fertilizers is low and yield of most of the crops are well below the national average possibly because of the low level of adoption of package of practices and other soil related constraints. The cost of chemical fertilizers has increased tremendously after their decontrol. In future, further increase in fertilizer price is expected due to phase wise withdrawal of concession given by Government. Under these circumstances it is deemed necessary to use locally available, time tested indigenous technologies in conjunction with modern technologies. For example, most of ITKs adopted by the local farmers

are meant for organic matter enrichment in soil. So, combined use of chemical fertilizers in conjunction with crop residues/compost/pond silt/coir dust/rice husk etc will be beneficial for maintenance of soil organic matter in one hand, increase in plant nutrient availability and fertilizer use efficiency, on the other hand. This integrated approach will be the cheapest mean of providing nutrients for crop production and protecting nutrient loss from the field of poor and marginal farmers. Large numbers of experiments conducted all over the country proved that integrated use of chemical and organic can sustain the crop productivity and soil health.

The blending of the indigenous technology with latest scientific techniques holds a great promise not only for sustaining and maintaining soil fertility and crop productivity but also acts against emergence of multiple nutrient deficiencies and also protects soil health from deterioration.

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Rural tourism as a tool for Sustainable Rural Development

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Abstract

Tourism is a popular economic development strategy and the concept of sustainability of tourism emerged due to the effect of mass tourism activities and its adverse environmental impact. Rural tourism came into existence with the principles of sustainable tourism practices where sustainability includes economic development, socio-cultural integrity and ecological and environmental supportable activities. Rural tourism is a discrete activity with distinct characteristics which may vary according to area and intensity. This paper deals with the theoretical and conceptual framework of rural tourism and its contribution in sustainable tourism development in rural area. Qualitative status of rural tourism leads towards sustainable rural development and the proper implication of the concept at ground level and marketing strategies brings the result came into reality and the goal of sustainable tourism and rural development is achieved.

Keywords: *Rurality, Rural tourism, Sustainable tourism, Rural Development*

Introduction

The concept of rural tourism first originating in mid-19th century in Europe and later on spread over different parts of the world (Zhang, X. 2012). The concept gained popularity in India at recent past two decade. Based on the attraction of natural landscape, natural environment, culture of local people, heritage and aesthetic beauty, handicrafts, socio-cultural environment etc. people from urban origin came to spend in rural areas or villages to meet their recreational needs. The tourist are basically urban origin and came to visit village for releasing stress from their daily life and lifestyle. The development of rural tourism not only helps to the tourist but also creates local employment or economic opportunities among the villagers and this boost micro economy of the village. There are several form of tourism practices all over the world and with other

form of tourism rural tourism emerged as a form of alternative as well as sustainable tourism practices where tourism practices economically viable, socio-culturally approved and environment and ecologically supportable. The maximum portion of rural people in India basically dependent on primary economic activities or agricultural activities. Based on agro-tourism practices the emergence of rural tourism practices creates economic opportunities of the local people and leads towards sustainable tourism development based on the products for tourism such as culture of local people, natural environment, and customs and believes and also other tourism related resources (Hall et al., 2003).

Rurality

The concept of rurality embodies all those quality that are missing from urban area and modern urban societies (Williams, 1975). Bramwell (1994) identifies four main characteristics and qualities of rurality i.e. relatively low physical density of people; buildings and activities; less social and cultural heterogeneity; less economic diversity and a comprehensive physical isolation from general economic, social and political networks. In other sense rurality involves the lands under agricultural activities, lands under forest and woodlands, uncultivated lands, different social and cultural environment, natural environment with different life style of people where 'tourism' acknowledged as an economic activities involved by tourist based on a set of tourism facilities or products (Best & Rogers, 1973). Rural environment is differ from urban in terms of some characteristics and societies explained by Frankenburg (1966) are as follow.

Table 1: *Characteristics of rural and urban societies*

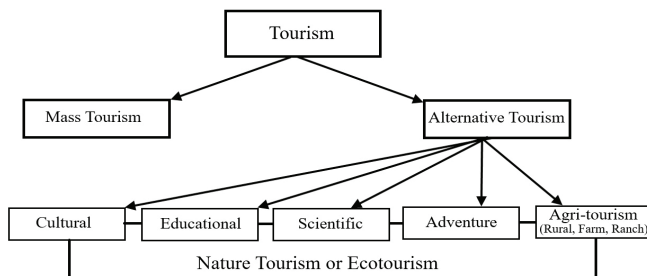
Sl. No.	Rural	Urban
1.	Community	Association
2.	Social field involving few but multiple role relationship	Social fields involving many overlapping role relationship
3.	Different social role played by same person	Different social roles played by different people
4.	Simple Economies	Diverse economies
5.	Little division of labour	Great specialization in labour force
6.	Ascribed status	Achieved status
7.	Education according to status	Status derived from education
8.	Role embracement	Role commitment

Rural tourism as a tool for Sustainable Rural Development

9.	Close-knit networks	Loose-knit networks
10.	Locals	Cosmopolitans
11.	Economic class is one of several divisions	Economic class is the major division
12.	Conjunction	Segregation
13.	Integrating with work	Separation of work environment

Rural tourism

Different scholars defined rural tourism in different manner and the perspectives of definition and content changes over the period of time. Rural tourism is the tourism that located in rural areas (Lane, 1994) and European Commission states rural tourism describe and explain tourist activities in rural areas and villages (European Commission, 2000). Oppermann (1997) defines rural tourism as a tourism practices in a non-urban territory where human activity is going on and primarily agricultural. So rural tourism and local economy in as independent factor and it determines the regional economic development in destination region. Whereas Ganon (1994) describe rural tourism as ‘a range of activities, services and amenities provided by farmers and rural people to attract tourist to their area in order to generate extra income for their business. So from the above definition it could be said that rural tourism is based upon three axes i.e. *Space, People and Product* because the area without human existence can not support the coexistence; people without space or product have only a limited capacity to receive and the products that are not based space and people have only a short existence and can not deliver sustainable development locally (Bran et al, 1997).



Source: Mieczkowski, 1995, p.459

Figure 1: Different forms of tourism.

There are two forms of tourism practices all over the world at present day i.e. mass tourism and alternative tourism where mass tourism involves the conventional and standardized form of tourism which results in large scale environmental degradation and alternative tourism on the other hand can be viewed as being synonymous with the concept of sustainable tourism development (Holden, 2000). Rural tourism as a form of alternative tourism where alternative tourism means ‘ a form of tourism that is made to be friendly to the environment and to respect social and cultural values of the communities, and which allow both host and guests to enjoy positive and worthwhile interaction and shared experiences’ (Wearing & Neil, 2000). Mieczkowski (1995) identifies different forms of alternative tourism i.e. cultural, educational, scientific, adventure and agro or farm tourism (rural tourism) (Figure: 1). Bernard Lane (1994) identifies rural tourism as the societies towards traditionalism where it has some characteristics i.e.

1. Located in rural areas
2. Functionally rural and it built upon the world’s special features of small scale enterprise, open space, contact with nature and the natural world, heritage, traditional societies and traditional practices.
3. Rural in scale – both in terms of building and settlements and therefore usually small scale.
4. Traditional in character, growing slowly and organically and connected with local families. It will often be very largely controlled locally and developed for the long term good of the area.
5. Of many different kinds, representing the complex pattern of rural environment, economy, history and location

Rural tourism differ from other forms of tourism based on its characteristics and principles. The tourist from urban origin is the primary element in rural tourism and the products or the activities involves such as walking, cycling, hunting, bird watching, agricultural practices, landscape appreciation, rural heritage sites, village touring, skiing, rafting, canoeing, wilderness holidays, climbing, horse riding, relaxing, spa activities, rural festivals, river and canal angling, craft holidays etc. for rural tourism in a destination region. But the

products differ according to the physical and sociocultural environment where the village is located.

Rural tourism and sustainability

Rural tourism emerged as a form of sustainable tourism and a variety of terms has been used in the tourism industry which are related to rural areas i.e. farm tourism, agro tourism, soft tourism, village tourism and sometimes ecotourism. The concept of rural tourism is based upon the principles of sustainability and a form of alternative tourism. In other words it can be said that the fundamentals for a sustainable tourism industry is accepting the key principles of rural tourism (Pavel, 2013). So the concept of sustainability in rural tourism based on conservation ethics is a multipurpose one if it has to succeed and the aim of sustainable rural tourism is explained by Lane (1994) is-

1. Sustain the culture and character of host communities
2. Sustain landscape and habitats
3. Sustain the rural economy
4. Sustain a tourism industry which will be viable in the long term and this in term means the promotion of successful and satisfying holiday experiences.
5. Develop sufficient understandings, leadership and vision amongst the decision makers in an area that they realise and danger of too much reliance on tourism, and continue to work towards a balanced and diversified rural economy.

Sustainable tourism aims to minimize environmental and cultural damage, optimize visitor satisfaction and minimize long term economic growth for the region (Lane, 1994). Rural tourism focuses on travel on undisturbed natural areas or ecosystems and ethno-cultural complexes, which has direct impact on rural development and also subject for control in the purpose of sustainable rural development (Ivolga & Erokhin, 2013). Promotion and responsible marketing approach helps to the villagers or local communities and also local entrepreneurs to recognize the intrinsic value of rural tourism. The environmental concern of both hosts and tourists helps to form a sustainable tourism or environmentally responsible tourism in the destination region and this environmentally responsible tourism practice ensures different positive aspects for rural development such

as socio-economic development, alternative way of earning, local level employment opportunities, micro scale economic development, alternative business opportunities, job retention, poverty alleviation, empowerment of localities, production and sell of local art and crafts, environmental quality improvement and the preservation of heritage of the village etc. The insufficient financial support, improper communication skill, legislation problem, lack of trained human resource for tourism, lack of training facilities etc. factors can not able to the fruitful result of rural tourism in a sustainable manner or sustainable tourism development. Large scale development of rural tourism provides several positive aspects for the development and on the other hand cultural heritage may be at risk from outsider and perhaps powerful outside culture (Lane, 1994). Rural tourism is an environmentally oriented tourist product to the tourist and a tool for sustainable rural development (Ivolga, 2014).

Conclusion

Rural tourism is a way towards sustainable tourism practices and also a tool for sustainable rural development. The participation of local people in the process and practice of rural tourism is most important aspect for the development of rural tourism in a rural area. The term development involves the economic, sociocultural, ecological and environmental aspects of local community. The participation of local community with the involvement of local government, non-governmental organizations (NGOs) and local stakeholder may bring the fruitful result of rural tourism. But the rural people due to their lack of knowledge and lack of skill development programme and awareness programme does not ready to accept a new model of development based on cooperation and networking. This indicated backdrops for the development of rural tourism as well as rural development through tourism. So the provision of economic support to the villagers by the government, skill development programme, involvement of local people in tourism practices, involvement through cultural practices etc. helps towards economic wellbeing and cultural integrity of rural community and it helps sustainable tourism development as well as sustainable rural development

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Income Generation in the Agricultural Sector

The Instrument for Repayment of Bank Loan

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Abstract

Income generation is the basic and primary objective of intake of bank loans. We would like to investigate in this paper whether income were generated in the agricultural sector due to taking of bank loans in the districts of Hooghly and Bankura in West Bengal. For this purpose we have collected the primary data from 672 sample borrowers who have taken loans from Commercial, Regional Rural and Co-operative bank. Given the sample observations of 672 households, we intend to estimate the linear model with the help by ordinary least squares method. The study shows that the income generation due to intake of bank loans is influenced by the worker population ratio, productive use of loans, shortfall of desired investment, interest rate differential and education. It is shown that the growth rate of income or income generation varies directly with the level of income.

Key Words: Generation, Repayment, Wilful, Defaulter, Investment

Introduction

In a country like India, agriculture has a dominant share in the economic growth and provides the base for the growth of other sectors. But the small and marginal farmers who dominate agriculture in West Bengal are not in a position to generate sufficient savings to take care of fixed capital formation. So they entirely depend on loan. If the loans are properly used in production, this will result in increased output and income. Consequently the borrowers will be able to repay the loans to banks. If the process goes on in this manner the wheel of development will smoothly run. But the problem starts,

if the borrowers fail to repay the loans. There is a common idea that Indian peasants are born in debt, live in debt and die in debt. Debt is evil when it is incurred for consumption. But, it becomes harmless and even desirable when it is used for productive purpose. Debt, used for productive purpose in agriculture or industry, serves as an instrument of development.

Review of Economic Literature

C. Muthiah (1970) merely analyzed the main reasons for the increasing overdues in the case of agricultural loans and this is a fact that was due to successive crop failures resulting from adverse seasonal conditions. Besides this Muthiah points out that most of the borrowers did not use their loans in productive purposes. Again D.G. Agarwal (1971) has considered some factors that help the borrowers to repay their loans in time. According to him, one-third of repaying capacity is based on the realized value of produce and total income. In other words, the repayment of loans by the borrowers depends mainly on the produced goods and total income. H.K. Das Gupta and A. R. Dutta (1971) assumed that consumption expenditure is not likely to change with the increase in total disposable income at least in the short run. If this assumption is true the repaying capacity of the small farmers estimated from the potential income will considerably increase. For this reason Das Gupta and Dutta think that the income of the borrowers will increase due to the adoption of new technology, greater diversification in production and inclusion of commercial crops and animal husbandry programme in the production plans. Further, R.N. Pandey, A.G. Gangwar and Kusum Aggarwal (1986) reported that the financing from the institution sources is biased in favour of relatively larger farmers. The amount of loans given for dairy, poultry, piggery, etc. the trades, which are generally undertaken by the downtrodden section of population is found to be almost negligible as a share of total loans disbursed. While the total amount of loans due to repayment exceeds that repaying capacity of the small and medium farmers, it was reverse for the large farmers. Rajendra Singh (1986) correctly examined the temporal pattern of income generation, level of incremental income as related to the assumptions made and the phenomenon of overdues and reasons thereof by supporting credit for pump sets under minor irrigation scheme through the Land

Development Banks. B. Samal (2002) also considered that the income generation depends on the seasonal pattern and intensity of cropping. Though, his analytical results only empirically.

Objective of the Study

It attempts to investigate that whether income were generated due to taking of bank loans in the agricultural sector and its proper use in production in the district of Hooghly and Bankura in West Bengal of India. This paper helps to increase the income of the borrowers by properly utilised their loans in productive purposes in agricultural sector. Besides, it attempts to improve the performance in the banking sector.

Specification of the Model

Income generation of the borrower is affected by a number of factors. We have considered the income generation for all farms, small and marginal farms, medium farms and large farms in the agricultural sector. The analytical models of income generation have been considered as follows.

$$\begin{aligned} \text{Grateincome} &= \beta_0 + \beta_1 \text{ Age} + \beta_2 \text{ Education} + \beta_3 \text{ Pinloan} + \beta_4 \text{ Wpr} \\ &+ \beta_5 \text{ Irrland} + \beta_6 \text{ Nirrland} + \beta_7 \text{ Dintrate} + \beta_8 + \text{Technology} + \beta_9 \text{ Cropfailure} \\ &+ \beta_{10} \text{ Caste} + \beta_{11} \text{ Naloanuse} + \text{Error} \end{aligned} \quad (1)$$

Data and Methodology

The study has been conducted in the district of Hooghly and Bankura in the state of West Bengal. There are 19 districts in the state of West Bengal. We have chosen these two districts, namely, Hooghly and Bankura, simply purposively. The rational behind the choice of these districts lies in the consideration of economic condition. Contrasted with Bankura, the district of Hooghly is economically more advanced and prosperous in respect of agriculture.

We have collected the primary data for the year 2002 – 2003 from 672 sample borrowers. We have selected the districts purposively. From each district, one subdivision was randomly selected. These two sub-divisions are Arambagh from Hooghly and Vishnupur from Bankura. Again from each sub-division two blocks were randomly

selected. We have chosen Khanakul – 1 and Pursursa as two blocks from Arambagh sub-division of Hooghly and Indus and Joypur as the other two blocks from Vishnupur sub-division of Bankura. From each of these two blocks of Arambagh 182 borrowers were randomly selected. Again from each of these two blocks of Vishnupur 154 borrowers were randomly selected. Thus a sample of 672 borrowers was selected for the purpose of the study.

Primary data were collected for the agricultural year 2002-2003 from 672 sample borrowers who have taken loans from commercial, Regional Rural and Co-operative bank branches operating in the four blocks through personal interview on the basis of a pre-structured questionnaire.

Given the above factors and the sample observations of 364 households, we have used the standard general linear model for the purpose of estimation of income generation. The model of income generation in matrix form is

$$Y = X\beta + U \quad (2)$$

where X is the design matrix of observations on the explanatory variables, Y is the column vector of observations on the explained variable and U is the column vector of disturbances and β is the column vector of the parameters to be estimated. We assume that

$$E(U) = 0$$

$$E(UU') = \sigma^2 I$$

The design matrix X is non-stochastic.

The design matrix X has full column rank.

Given these assumptions, we can apply OLS method to estimate the parameters of the income generation model (3). The vector of estimates of the coefficients is

$$\hat{\beta} = (X'X)^{-1} X'Y \quad (3)$$

And the estimated variance-covariance matrix is

$$\text{var}(\hat{\beta}) = \sigma^2 (X'X)^{-1} \quad (4)$$

Where

$$\hat{\sigma}^2 = \frac{e'e}{n-k} \quad \text{and} \quad e = Y - X\beta \quad (5)$$

Empirical Estimates

In this section, we would consider the income generation in the agricultural sector for the district of Hooghly and Bankura.

A. Income Generation in the Agricultural Sector in the District of Hooghly

Here we would consider the income generation for the agricultural sector in the district of Hooghly. We have classified the farms according to three land sizes, namely small and marginal farms with land size below 4 acres of land, medium farms with land size between 4 to 10 acres of lands and large farms with land size of 10 acres and above. Such classification of farms has been made on the basis of minimum coefficient of variation of land within a size class. The coefficient of variation is somewhat larger for some other farm sizes.

Refer to table – 1 and 2 where the income generation of all farms, small and marginal farms, medium farms and large farms in the district of Hooghly is presented. Consider first the model of all farms. Age has got positive impact on income generation, but it is statistically significant. Education is found to affect income generation favourably. It increases income generation by almost 4.3% and it is statistically significant at 1% level of significance. The income generation has been increased by 84% by the proportion of investment financed by loans. And the proportion of investment financed by loans is statistically significant at 1% level of significance. The worker population ratio is also very statistically significant at 1% level of significance in increasing the income generation to the extent of almost 60%. The Irrigated land has affected the income generation favourably. It has increased the income generation by 14.4% and is statistically significant at 1% level of significance.

The non-irrigated land and the difference in the interest rate have got positive but statistically insignificant impact on income generation. So is true with respect to caste. Though it is found that the farmers who belong to upper caste get a reduction in the income generation compared to the farmers who belong to the lower caste, caste appears

to be a statistically insignificant factor in affecting the income generation.

Table 1: *Income Generation in the Agricultural Sector in the District of Hooghly*

Ordinary Least Squares Estimation Dependent variable is Grateincome (Growth Rate of Income)						
Regressor	All farms			Small and Marginal Farms		
	Coefficient	Standard Error	t-Statistic	Coefficient	Standard Error	t-Statistic
Constant	-1.583***	0.834	-1.898	-1.830	1.136	-1.610
Age	0.006	0.010	0.563	0.007	0.012	0.548
Education	0.043*	0.016	2.646	0.022**	0.010	2.262
Pinfloan	0.840*	0.193	4.346	0.338**	0.132	2.562
Wpr	0.594*	0.186	3.200	0.410**	0.171	2.389
Irrland	0.144*	0.047	3.030	0.214*	0.080	2.678
Nirrland	0.015	0.054	0.273	0.011	0.187	0.061
Dintrate	0.015	0.014	1.082	0.001	0.018	0.060
Technology	0.185*	0.052	3.539	0.131*	0.045	2.903
Cropfailure	-0.073*	0.028	-2.648	-0.120*	0.043	-2.782
Caste	-0.224	0.326	-0.689	0.324	0.354	0.915
Naloanuse	0.157*	0.061	2.585	0.222*	0.083	2.666
Number of Observations	364			220		
R-Squared	0.78			0.75		
R-Bar-Squared	0.77			0.74		
F-Statistic	F(11, 352) = 114.503			F(11, 208) = 56.659		
DW-statistic	2.059			1.997		

Source: Author's own calculation. * stands for significant at 1% level; ** stands for significant at 5% level; *** stands for significant at 10% level.

Technology serves as an important determinant of income generation. It has got a positive impact on income generation. Income generation is increased to the extent of almost 19% due to adoption of HYV technology and it appears to statistically significant at 1% level of significance. It is very much obvious that while a good crop production affects favourably the income generation, a crop failure due to agro-climatic conditions, whims and whips of nature will

definitely reduce the income generation of the farms. This has been found true for model of all farms. All the farms suffer from a reduction in income generation due to crop failure to the extent of 7.3%. Crop failure is found to be statistically significant at 1% level of significance in affecting income generation. Finally, the productive use of loans by the farms leads an increase in income generation by 15.7% and it is statistically significant at 1% level of significance.

Consider the model of small and marginal farms in table – 1. Age has got insignificant effect on income generation. Education is statistically significant at 5% level of significance and it raises income generation by 2.2%. The proportion of investment financed by loans affects income generation positively and there is a rise in income generation by 33.8%. It is statistically significant at 5% level of significance. The worker population ratio contributes favourably to income generation by 41% and this determinant is statistically significant at 5% level of significance. Similarly, the irrigated land is found to affect the income generation favourably and it increases income generation by 21.4%. For model of small and marginal farms, the irrigated land is statistically significant 1% level of significance. The non-irrigated land, difference in the interest rate and caste – all are the statistically insignificant determinants of income generation.

Technology and crop failure are of having opposite impacts on the income generation. While the technology exercises positive effect on the income generation to the extent of 13.1%, the crop failure exercises a negative impact on the income generation to the extent of 13%. Both the technology and crop failure are statistically significant at 1% level of significance. The productive use of loan shows that income generation is affected favourably and it has raised the income generation by 22.2%. This determinant is statistically significant at 1% level of significance.

Consider the model of medium farms in table – 2. Age exercises a negative but insignificant effect on income generation. Education raises income generation by 4.5% and it is statistically significant at 5% level of significance. The proportion of investment financed by loans affects the income generation directly. It increases the growth rate of income by 31.1% and is statistically significant 1% level of significance. The worker population ratio affects favourably the income generation, since the growth rate of income is increased by

the worker population ratio by 47.1%. The worker population ratio is statistically significant at 1% level of significance.

Table 2: Income Generation in the Agricultural Sector in the District of Hooghly

Ordinary Least Squares Estimation						
Dependent variable is GRATEINCOME (Growth Rate of Income)						
Regressor	Medium Farms			Large Farms		
	Coefficient	Standard Error	t-Statistic	Coefficient	Standard Error	t-Statistic
Constant	-0.336	1.710	-0.197	1.605	5.330	0.301
Age	-0.003	0.017	-0.179	0.057	0.056	1.010
Education	0.045**	0.019	2.456	0.137**	0.069	1.986
Pinloan	0.311*	0.090	3.441	0.981*	0.349	2.812
Wpr	0.471*	0.027	2.671	0.538**	0.245	2.194
Irrland	0.114**	0.056	2.026	0.164*	0.044	3.741
Nirrland	0.057	0.126	0.454	0.137	0.302	0.454
Dintrate	0.003	0.023	0.152	0.049	0.075	0.651
Technology	0.159*	0.057	2.779	0.296*	0.111	2.665
Cropfailure	-0.071**	0.034	-2.080	-0.012	0.012	-1.047
Caste	-0.172	0.485	-0.355	-1.645	1.258	-1.308
Naloanuse	0.291*	0.111	2.630	0.973**	0.430	2.262
Number of Observations	103			41		
R-Squared	0.91			0.95		
R-Bar-Squared	0.90			0.93		
F-Statistic	F(11, 92) = 80.399			F(11, 29) = 51.266		
DW-statistic	1.915			1.849		

Source: Author's own calculation. * stands for significant at 1% level; ** stands for significant at 5% level; *** stands for significant at 10% level.

The irrigated land and the adoption of HYV technology increase the growth rate of income by 11.4% and 15.9% respectively. Thus the income generation is favourably affected by these two factors and they statistically significant at 5% and 1% level of significance respectively. Both the non-irrigated land and the difference in the interest rate leave the growth rate of income unaffected significantly.

Thus the non-irrigated land and the difference in the interest rate do not affect the income generation significantly.

For the medium farms, the crop failure and caste both have negative impact on income generation. But, the crop failure is statistically significant at 1% level of significance, whereas caste is not statistically significant. Income generation is favourably affected by the productive use of loans. We see that the productive use of loans has raised the growth rate of income by 29.1% and it is statistically significant at 1% level of significance.

Consider the model of large farms in table – 2. Age has raised the growth rate of income but it is not statistically significant. Education has led to an increase of 13.7% of the growth rate of income. Thus the income generation is favourably affected by the education and it is statistically significant at 5% level of significance. There is 98.1% increase in the growth rate of income due to the proportion of investment financed by loans. Hence income generation is affected favourably and the proportion of investment financed by loans is statistically significant at 1% level.

The worker population ratio has raised the growth rate of income by 53.8%. Thus, the worker population ratio affects the income generation favourably and it is statistically significant at 5% level of significance. The irrigated land affects the income generation directly. The irrigated land has increased the growth rate of income by 16.4% and this determinant is found to be statistically significant at 1% level of significance. Both the non-irrigated land and the difference in the interest rate do not affect the growth rate of income. Thus, income generation is not affected significantly by the non-irrigated land and the difference in the interest rate.

Technology, as in all the previous models of farms, affects income generation favourably. It has raised the growth rate of income by 29.6% and is statistically significant. But, it is worthy to note that although the crop failure has led to a fall in the growth rate of income and hence a reduction in income generation, the crop failure is found to be statistically insignificant for the large farms in reducing the growth rate of income. This is because of the fact that the large farms are financially solvent enough so that they can absorb/tolerate the shock of crop failure. Hence, though the crop failure reduces the growth rate

of income leading to a negative impact on the income generation, it is not statistically significant for the large farms. But, the crop failure is statistically significant for all other farms.

Caste has got negative but insignificant effect on growth rate of income and hence on income generation. As before, the large farmers in the upper caste suffer from a fall in the growth rate of income compared to the large farms in the lower caste. Finally, the productive use of loans for the large farms also leads to a rise in the growth rate of income to the extent of 97.3% and it statistically significant at 5% level of significance.

We would conclude this section by stating some facts. First, Age, the non-irrigated land, the difference in the interest rate and caste are of little significance in affecting the growth rate of income and hence the income generation in the agricultural sector in the district of Hooghly. Second, the education, the proportion of investment financed by loans, the worker population ratio, irrigated land, technology, crop failure and the nature of loan use are of immense significance in affecting the growth rate of income and hence the income generation in the agricultural sector in the district of Hooghly.

B. Income Generation in the Agricultural Sector in the District of Bankura

Here we are going to consider the income generation in the agricultural sector in the district of Bankura. Consider the table – 3 and 4.

Consider the model of all farms in table – 3. We find that age reduces the growth rate of income and hence affects the income generation adversely. The age is not statistically significant. The education affects the income generation favourably, since it has raised the growth rate of income by 2.4% and it is statistically significant at 5% level of significance. The proportion of investment financed by loans increases the growth rate of income by 60.3% and thus income generation favourably affected. The proportion of investment financed by loans is statistically significant at 5% level of significance. The worker population ratio affects the income generation positively, since it has raised the growth rate of income by 36%. The worker population ratio is statistically significant at 5% level of significance.

The irrigated land has raised the growth rate of income by 7.3% and income generation is favourably affected. The irrigated land is statistically significant at 1% level of significance. The non-irrigated land has no significant impact on the income generation, as the growth rate of income is not significantly affected. The caste and difference in the interest rate affect income generation adversely, though their effects on the growth rate of income are not statistically significant.

The technology affects the income generation favourably. The growth rate of income due to the adoption of HYV technology has been increased by 14.2%. Thus, the hypothesis that the technology creates favourable effects on income generation is accepted at 5% level of significance. The crop failure reduces the growth rate of income by 9.3% and thus income generation is adversely affected. The crop failure is statistically significant at 1% level of significance. The productive use of loans for all farms raises the growth rate of income by 23% and thus income generation is favourably affected. The nature of loan use is thus statistically significant at 1% level of significance.

Table 3: *Income Generation in the Agricultural Sector in the District of Bankura*

Ordinary Least Squares Estimation						
Dependent variable is Grateincome (Growth Rate of Income)						
Regressor	All farms			Small and Marginal Farms		
	Coefficient	Standard Error	t-Statistic	Coefficient	Standard Error	t-Statistic
Constant	0.835	0.692	1.207	-2.509	1.660	-1.511
Age	-0.011	0.008	-1.382	-0.017	0.019	-0.897
Education	0.024**	0.010	2.492	0.275**	0.131	2.106
Pinloan	0.603**	0.235	2.561	0.813**	0.392	2.071
WPR	0.360**	0.984	2.533	0.728**	0.344	2.118
Irrland	0.073*	0.019	3.763	0.796**	0.331	2.403
Nirrland	0.027	0.028	0.952	0.516	0.583	0.885
Dintrate	-0.001	0.011	-0.108	0.025	0.026	0.943
Technology	0.142**	0.066	2.157	0.018	0.016	1.157
Cropfailure	-0.093*	0.035	-2.648	-0.229*	0.061	-3.773
Caste	-0.125	0.230	-0.543	0.147	0.581	0.253
Naloanuse	0.230*	0.078	2.946	0.687**	0.291	2.364

Number of Observations	308	85
R-Squared	0.79	0.77
R-Bar-Squared	0.78	0.73
F-Statistic	F(11, 296) = 99.474	F(11, 73) = 22.162
DW-statistic	1.848	1.774

Source: Author's own calculation. * stands for significant at 1% level; ** stands for significant at 5% level; *** stands for significant at 10% level.

Consider the model of small and marginal farms. Age influences negative and insignificantly the income generation. The education affects the income generation favourably. It is statistically significant at 5% level in increasing the growth rate of income by 27.5%. The growth rate of income is increased by 81.3% due the proportion of investment financed by loans. Thus, the proportion of investment financed by loans affects the income generation positively and it is statistically significant at 5% level of significance. There is a rise of 72.8% in the growth rate of income due to worker population ratio and thus the worker population ratio is statistically significant at 5% level of significance in favourably affecting the income generation.

The irrigated land raises the growth rate of income by almost 80%. Thus the irrigated land is statistically significant at 5% level in affecting favourably the income generation. But, the non-irrigated land although increases the growth rate of income, is not statistically significant. The difference in the interest rate also does not appear to be statistically significant in affecting favourably the income generation. We note that for small and marginal farms the technology increases the growth rate of income but still the favourable effect of technology on income generation is not statistically significant. The result is not difficult to understand. The financial strength or economic capacity of the small and marginal farms is so poor that they cannot fruitfully reap the benefits of the technology. Although the small and marginal farms use the technology, they use it partially only and thus get themselves deprived of full effects of the technical progress.

We note that the crop failure for the small and marginal farms has significantly and adversely affected the income generation, since it has reduced the growth rate of income significantly to the extent of almost 23%. Thus, the hypothesis that crop failure leads to a reduction

in the growth rate of income and hence in income generation, appears to be accepted at 1% level of significance. Though the small and marginal farmers in the upper caste get favourable effects on income generation compared to that of the small and marginal farms in the lower caste, still caste is not statistically significant in affecting income generation. Finally the productive use of loans significantly increases the growth rate of income to the extent of 68.7%. Thus, the nature of loan use is statistically significant in affecting the income generation.

Table 4: *Income Generation in the Agricultural Sector in the District of Bankura*

Ordinary Least Squares Estimation						
Dependent variable is GRATEINCOME (Growth Rate of Income)						
Regressor	Medium Farms			Large Farms		
	Coefficient	Standard Error	t-Statistic	Coefficient	Standard Error	t-Statistic
Constant	0.752	1.141	0.659	-0.051	0.778	-0.065
Age	0.002	0.013	0.172	-0.004	0.009	-0.420
Education	0.144**	0.072	1.995	0.059**	0.027	2.188
Pinloan	0.636*	0.199	3.190	0.715*	0.240	2.979
Wpr	0.507**	0.098	2.561	0.404**	0.161	2.512
Irrland	0.083*	0.032	2.601	0.316**	0.129	2.449
Nirrland	-0.027	0.153	-0.178	0.002	0.017	0.125
Dintrate	-0.026	0.019	-1.378	0.004	0.011	0.340
Technology	0.059**	0.028	2.123	0.396*	0.103	3.854
Cropfailure	-0.128*	0.046	-2.773	-0.011	0.009	-1.173
Caste	-0.092	0.378	-0.243	0.091	0.223	0.408
Naloanuse	0.721*	0.082	8.798	0.745*	0.120	6.193
Number of Observations	125			98		
R-Squared	0.85			0.73		
R-Bar-Squared	0.83			0.70		
F-Statistic	F(11, 113) = 57.178			F(11, 86) = 21.138		
DW-statistic	2.235			1.969		

Source: Author's own calculation. * stands for significant at 1% level; ** stands for significant at 5% level; *** stands for significant at 10% level.

Consider the model of medium farms in table – 4. We note that due to age there is only 2% rise in the growth rate of income and it is not statistically significant. Education has raised the growth rate of income by 14.4% and it is statistically significant at 5% level of significance with a favourable impact on the income generation of the medium farms. The proportion of investment financed by loans has increased the growth rate of income by 63.6% and this is statistically significant at 1% level of significance. The worker population ratio has increased the growth rate of income by about 51% and thus affects the income generation favourably. The hypothesis that the worker population ratio will affect the income generation favourably is accepted at 5% level of significance.

The irrigated land has got some favourable effect on the income generation of the medium farms, since it has increased the growth rate of income by 8.3%. Thus, the hypothesis that the irrigated land affects the income generation favourably is accepted at 1% level of significance. On the other hand, the hypothesis that the non-irrigated land raises the growth rate of income and hence favourably affects the income generation is rejected. We also reject the hypothesis that the difference in the interest rate affects the growth rate of income and hence the income generation. In the case, case of medium farms what we not is that both the non-irrigated land and the difference in the interest rate affect adversely the growth rate of income and hence the income generation.

It is being seen that the technology is statistically significant at 5% level in increasing the growth rate of income and in affecting the income generation favourably. We see that there is an increase in growth rate of income of 5.9% due to technology. As expected, the crop failure has reduced the growth rate of income and hence adversely affected the income generation. We note that the crop failure has reduced the growth rate of income by 12.8% and it is statistically significant at 1% level of significance. Caste has got no statistically significant effect on growth rate of income and income generation. The productive use of loans has resulted in 72.1% increase in the growth rate of income and hence has affected favourably the income generation. The productive use of loans is statistically significant at 1% level of significance.

Consider the model of large farms. We find that age does not contribute significantly to the growth rate of income and income

generation. Education raises the growth rate of income by 5.9% and thus favourably affects the income generation and it is statistically significant at 5% level of significance. The proportion of investment financed by loans has increased the growth rate of income by 71.5%. So the income generation income generation has got favourable effect from the proportion of investment financed by loans and it is statistically significant at 1% level of significance. The worker population ratio is also statistically significant at 5% level of significance. It increases the growth rate of income by almost 40% leading to some favourable effect on income generation. The irrigated land for the large farms is seen to increase the growth rate of income and income generation by 31.6% and it is statistically significant at 5% level of significance.

The non-irrigated land does not affect the income generation significantly. It has increased the growth rate of income only by 0.20%. Thus the hypothesis of positive impact of the non-irrigated land on the income generation is rejected. Similarly, the hypothesis of adverse impact of crop failure on growth rate of income and hence on income generation is also rejected. Actually, the large farms have strong shock absorbing power, which helps them tolerate the negative impact of crop failure on income generation. But, this is not true for the small and marginal farms and medium farms.

The caste and the difference in the interest rate are also statistically insignificant in affecting the growth rate of income and the income generation for the large farms. We note that the nature of loan use is very much important in affecting the growth rate of income and income generation. It contributes towards the growth rate of income an increase of 74.5% and is statistically significant at 1% level of significance.

In the end, we like to point out that in the district of Bankura age, the non-irrigated land, the difference in the interest rate and caste are not statistically significant in increasing the growth rate of income and affecting favourably the income generation. But, on the other hand, the education, the proportion of investment financed by loans, the worker population ratio, the nature of loan use, crop failure and the technology are all important and statistically significant determinant of growth rate of income and income generation.

There are some points, which are worthy to note in the agricultural sector of both the districts. First, there is a positive relation between farm size and the effect of education on income generation, and it has been everywhere found that education has resulted in the positive effect on income generation and growth rate of income. Second, the effect of proportion of investment financed by loans on income generation is lowest for the medium farms as compared to that of the small and marginal farms and large farms. In between small and marginal farms and large farms, the farm size and the effect of proportion of investment financed by loans are inversely related in the district of Bankura and directly related in the district of Hooghly. The effect of proportion of investment financed by loans on income generation is greater in the district of Bankura than that in the district of Hooghly. Third, farm size and the effect of worker population ratio on income generation are directly related in the district of Hooghly and inversely related in the district of Bankura. Fourth, farm size and the effect of irrigated land on income generation are inversely connected in the district of Hooghly and Bankura. The effect of irrigated land in the district of Bankura is greater than that in the district of Hooghly. Fifth, farm size and the effect of technology on income generation are inversely connected. This is very much natural, since the small and marginal farms and the medium farms cannot reap the full benefits of the technology as the large farms can do. The large farms due to their relative strong position in the economy can use the technology better than the small and marginal farms and medium farms. The effect of technology on income generation is greater in the district of Hooghly than in the district of Bankura. Sixth, farm size and the impact of crop failure on income generation are inversely related. This is what we expect, since the shock absorbing capacity of the large farms is much greater than that of small and marginal farms and medium farms. This is a fact, which has a true reflection on the growth rate of income of the several farm size. Seventh, we note that the effect of productive use of loans varies directly with the farm size.

We would like to state in the context of above analysis that the models are properly specified as indicated and supported by the value of Durbin-Watson d-statistic. The value of DW-statistics in all cases is approximately close to two or the coefficient of autocorrelation is very close to zero. This justifies that there is no mis-specification of model.

The value of R-squared and adjusted R-squared and the F-statistics are significant. This implies that our models are good-fitted.

Policy Recommendations

We are now in a position to prescribe some economic policy that would help the income generation of households of borrowers. In formulating the economic policy we shall be guided by the empirical estimates of our model. Now these policies are mentioned below.

- (1) Education brings the outer world in the arena of the farmers. The farmers get much information through education and acquaint them with the possible knowledge that results in fruitful effect from production. If proper training is arranged, the farmers will come to know the proper input-mix of the production from which the optimum return can be found. Therefore, imparting educational training for the farmers in the agricultural will stimulate the income generation.
- (2) Not merely the investment but the investment at the desired level is the necessary condition for stimulating income generation. Therefore, we would suggest that the banks should provide to the farmers with the loans sufficient to finance the project the farmers have planned for. Otherwise, the under-investment or investment at the sub-optimal level cannot generate income to the desired level and there will be insufficient income generation.
- (3) Creation of the jobs or employments will increase the worker population ratio and it will reduce the dependency ratio of the family. This, as our empirical estimates show will have a favourable effect on income generation.
- (4) We have noticed that the irrigated land has a positive effect on the income generation. Therefore, if the government improves the irrigation facilities among the farmers, their income generation will also improve.
- (5) The government should take measures so that the borrowers cannot be converted into local moneylenders and re-lend the some of money borrowed by them at a high rate of interest in the local money market. This will resist the diversification

- of loans from the productive investment to non-productive activities. So income generation will naturally be stimulated.
- (6) The productive use of loans has always a positive and favorable effect on the income generation. The government or the appropriate loan sanctioning authority should be watchful enough so that the borrowers do not get the scope to diversify the loans from the productive activities to non-productive activities.
 - (7) Adoption of the technology is another important factor of income generation. It has a positive impact on the income generation. But, the use of technology is costly. Therefore, the small and marginal farms cannot afford to use technology and the medium farms and large farms can do. Thus, the use of fertilizers, machineries for agriculture and seeds of HYV are only by the large farms. Therefore, the government should look after this matter and arrange by paying subsidies if required so that the small and marginal farms and medium farms can reap the benefit of the technology.

Conclusion

Although this study relates only to the districts of Hooghly and Bankura in the agricultural sector, the findings are fairly general in the rural areas. From the empirical findings it has been noted that the low income generation (measured by growth rate of income) of the farmers is responsible for their low ability to repay loans to the banks. So reduce the number of defaulters, all attempts should be employed to increase the growth rate of income. This implies that the income generation must be the necessary condition for the repayment of bank loans. And this income generation takes place at a sufficient level only through the productive use of loans.

At the same time, the institution must keep close watch on the farmers. So, the education of the farmers, responsibility of the financial institutions, and above all sweet relationship between the institutions and the farmers are the keys to repay their debts. As results, the banking performance will go forward towards development and setting path for the development.

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