Community-based Multi-Storied Rural Housing (PalliJanapad)
-A Green Innovation for Sustainable Rural Development

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Abstract

Most of the rural people in Bangladesh face quality of life and livelihood challenges associated with healthy housing and sub-optimal sanitation because of existing improper waste management system. In Bangladesh about one percent of land is loosing for construction of unplanned housing and industries. The average Organic Matter (OM) in the soil of Bangladesh is less than one percentage, whereas the standard is one. Bangladesh is also passing through power crises, which have been continuing for several years. Day by day this situation is worsening.

Overcome the difficulties and in addition to incorporate the success of using solar energy for lighting against load shedding period and using renewable energy (Bio-gas and Solar Power) for lifting and supply of water this cooperative based model house (PalliJanapad) would be a milestone for rural development. Total 272 HHs could be lived in a common tower with modern urban facilities of rearing 500 cows and 16126 poultry birds. The building is designed with low-cost locally available materials (Ferocement slab; Sandwich panel roof; 3D wall) to reduce the self load of the building and make affordable price (Tk. 1600 per sft) for the rural people. With in this cost every HH will get the accommodation facilities of rearing one cow and 27 poultry birds. Southern roof is dedicated for setting up solar panel to lighten the HH in the time of load shedding. In Spain every village become a housing tower. Academy (RDA), Bogra like to experiment the concept in Bangladesh as "PalliJanapad" it was also the dream of our Father of Nation mentioned by our current Prime Minister.The recommended green housing model will save the agricultural land of 9.27 ha.; erase the construction cost of 6.15 km overhead electric line; connect the all families to water supply with one pipe connection.

All degradable waste (Excreta, Cow dung, Kitchen waste and poultry drops) of 3.8512 million tons/yrcouldbe managed by collecting them in a single point by gravity flow. Waste management becomes easier and produced bio-gas supplied to the individual flat with solar lighting facilities (50 kW) in load shedding period. Both the renewable energy (Bio-gas and Solar power) should be used for lifting water and supply. Yearly produced 145152 m^3 of bio-gas and two tons of organic fertilizer daily which gross market value stand $0.06million per year. 50kW of electric power will be produced using solar energy and the flat owner will be enjoyed three light and one fan facilities The piece of study is the success experience of using renewable energy in multi-dimensional sectors of rural development in efficient way.

Total 3.75 acre of land is used to construct the building. In the village community those who are sacrificed their land for constructing PalliJanapad will get priority for any type of flat, then the local community, Union, Upazilla, District well as the Division level people will get preference sequentially. The nominated HH owner have to pay the 30% of the flat cost as down payment and have the key to live. The rest 70% will have to pay back with in 15 years with 5% interest and become the owner of the flat with percentage of land.

If the research result indicates sustainable or significant Government can take initiative to develop all villages as PalliJanapad for over all development of the rural Bangladesh.

Key words:rural housing, pallijanapad, renewable energy, bio-gas, solar power, means of livelihood, rda

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1.0 Introduction

Bangladesh is a densely populated country. It is the eighth most populous country in the world. It was estimated that the population is about 152.25 million with a growth rate of 1.34%. The population density of Bangladesh is 1069 per km^2 (Bangladesh Economic Review, 2011), which is one of the highest in the world. In 1947, the density was only 306 per km^2 and the demand for forest products as well as land for settlement was very little. In 1971, the density increased to 510 per km^2 and the demand increased by 67%. At present, the density is 1069 per km^2 and compared to the 1947 baseline, the demand for forestland for settlement increased by 189%. There is a forecast of an estimation that the population will reach to 177.30 million by 2025 and 210.80 million by 2050 (Davidson, 2000). Around 75% of the people live in rural areas of which 60% depends on agriculture for their livelihood. In Bangladesh 21.77% of Gross Domestic Product (GDP) coming from the agriculture, forestry and fisheries sectors (Bangladesh Bureau of Statistics, 2004).

The country's population is almost evenly distributed throughout its 64 districts except for the three Hill Tracts districts which are rather sparsely inhabited. Regionally, the eastern districts have a slightly higher density than the western ones. On average, a district has a population of about 1.80 million, a thana 230,000, a union 25,000 and a village 2,000. There are 596 thanas, 4,498 unions and 89,000 villages. The number of households is about 28.57 million. On average, a household consists of 5.6 persons. The tribal people, who lead a simple life, are generally self-reliant, producing their own food and drinks and weaving their own clothes.

There are 4 metropolitan cities and 308 municipalities in the country. The level of urbanization is low at 20%. 80% of the country's total population of about 120 million to live in the rural areas which primarily depend on a poorly developed agriculture for livelihood. The annual growth rate of the population has come down to 1.75% with the acceptance of family planning practices rising to 48.70%. The crude birth rate per 1000 is 25.60 and the death rate is 8.10. Life expectancy at birth is 59.5 years. The rate of child mortality per 1000 has come down to 76.80 and that of maternal mortality to 4.50. The density of population per square kilometer is 950.

Agriculture in Bangladesh is still dominating our economy in terms of employment, though not in terms of GDP. Agriculture traditionally had been dependent on rain-fed irrigation. But with the advent of science and technology and under the pressure of a very fast growing population, modernization of agriculture became inevitable. All options of modernizing agriculture had to be exercised. To supplement the volatile and irregular precipitation causing fluctuation in agricultural yield was identified as one of the major hindrances to the sustainable growth of agricultural output.

Moreover, injudicious application of chemical fertilizer makes agricultural land degradation. Various harmful changes are being taken place over agricultural land due to various land-use patterns. The people have turned single harvested agricultural land into two, two harvested agricultural land into three. The farmers do not stop cultivation in mid period between two crops. This time is necessary to grow up natural elements of soil. Random use of cultivable agricultural land by increasing urban infrastructure leads to degradation of cultivable agricultural land continuously. The different chemical waste from different mills and factories are being mixed with soil and subsequently degrade the fertility and pollutes the environment. Population needs many roads, houses, markets, offices, industries, mosques, schools, colleges, universities, factories and parks. So the people are using cultivable agricultural land to

fulfill their needs. Every year about 1% of our agricultural land is being decreased for housing and other urbanization activities. This concept is proposed to secure against the wastage of agricultural land in association with following select objectives bellow:

2.0 Objectives of the study

The broader objective of this research is to elicit a practical concept of community-based rural housing (PalliJanapad) with all modern urban facilities, affordable for the rural poor to reduce the agricultural land losses. The specific objectives are as follow:

- Design a multi-storied low-cost community-based housing (PajjiJanapad) with engineering point of view using proven technologies locally available;
- Facilities make available to brand the housing as eco-friendly as well as attract the inhabitants;
- Savings of agricultural land and public resources to make the housing a unique building; and
- Strategy of flat distribution and more attractive payment policy with client satisfaction thus make the concept sustainable one.

3.0 Methodology

Various research found the common rural scenario that some people fabricate their cottages on the agricultural land in a wasteful scattered manner. In this context RDA is always thinking about vertical expansion of building. The Director General of RDA developed the concept. He is a rural development practitioner over his service life. A long experience of oversees visit especially in Spain and interest of reading research books and journals insist him to develop the concept of community based rural housing. As an engineer experience and updated knowledge on low-cost alternatives available materials using for low-cost building in native and oversees countries inspired him to mold up this housing concept. Wide experience of rural livelihood practitioner he approaches to make the HH owner more cooperatives and way of become the owner of the flat under their level of affordability.

This is a synthesized innovation of all fruitful concepts practiced and going to be implemented in Bangladesh and oversees countries for the rehabilitation of rural people with integrated approach for sustainable development of the rural areas.

The project plans to construct sustainable low-cost multistoried building in the rural area. Aim of this initiative is to accumulate the scattered people in a common shelter with all modern urban utility facilities including modern hygiene and waste management. Besides these there will be the opportunities for various attractive income generating interventions to develop the economic level of the inhabitants to payback the construction cost of the flat.

The study was carried out in a relatively short period of time. Systematic way of data collection is required for in-depth information.

4.0 Results/Findings

In Bangladesh context it was found that the per capita share of agricultural land has been half in 2001 where it was double in 1974. Per capita share of agricultural land has been decreased in all areas. It is 4 increasing over pressure on agricultural land. As an agriculture-based country about 80% of total agricultural land is used in agricultural purpose and most of the people live in rural areas (Census, 1991). But urbanization rate is very high. The present urbanization ratio of Bangladesh is about 20.14% (Seikh, 1992). But the rate is not equal in all times. As an example the urbanizing ratio was 15% in 1981 and 20% in 1991 (Census, 1981; 1991). It was found on an average about 1% of our agricultural land is decreasing every year due to shelter (housing), industrialization and urbanization. It's a great threat against our development and food security as well. So intellectual community and policy planners should come forward to under take some research in this regard.

Considering the above-mentioned thrust, the proper management and planned use of agricultural land are very much essential for our increasing population. The agricultural land will not be increased with population. The reality is, it is decreasing day by day. Land use consequence is very important in the present context of Bangladesh. The urban population growth and population pressures are increasing on agricultural land.

To reduce the extra pressure and secured the agricultural land, the proposed planned and management may be a good option. If we can assemble or accumulate the scattered rural people, pull together in a common tower for rehabilitation with all modern utility-facility and proper management the losing of agricultural land may be protected. The secured land will come in agricultural production with an integrated farming for household food security and the country as well.

4.1 Low-cost building materials used in PalliJanapadBhaban

To make the building low-cost in engineering point of view reviewinguniversal low-cost materials widely used all over the world and finally selected the following materials:

4.1.1 Cellular Light Weight Concrete (CLC)

CLC is called as Cellular Light Weight Concrete and it is also called as Foam Concrete. It is a version of light weight concrete that is produced like normal concrete under ambient conditions.CLC Blocks are a cement-bonded material made by blending slurry of cement.Stable, pre-formed foam manufactured on site is injected into this slurry to form foam concrete. Fresh foam concrete looks like milk- shake and the volume of slurry in the foam dictates the cast density of the foam concrete.

Advantages

- CLC Bricks have excellent compressive strength in excess of regular clay bricks/solid blocks, guarantees min. Compressive strength of 3N/mm2
- Bending strength is 15 to 20% of compressive strength
- CLC Bricks density is 800kg/m2 which reduce dead load on structures
- Huge saving in foundation and structure savings up to 30% on beam costs
- Good earth quake resistance properties

4.1.2 Ferro Cement Technology

Ferro cement is a type of thin wall reinforced concrete, commonly constructed of hydraulic cement mortar, reinforced with closely spaced layers of continuous and relatively small size wire mesh. The mesh may be made of metallic or other suitable materials.

Advantages of Ferro cement

- High ductility
- Ferro cement construction saves time 20% and cost by about 30%
- High resistance to cracking width
- Ability to undergo large deflection
- Improved impact resistance and toughness
- Good fire resistance
- Good impermeability
- Low strength to weight ratio
- Low maintenance costs

4.1.3 Sandwich panel Technology

A sandwich panel is a structure made of three layers: low density core inserted in between two relatively thin skin layers. This sandwich setup allows achieving excellent mechanical performance at minimal weight. The very high rigidity of a sandwich panel is achieved thanks to interaction of its components under flexural load applied to the panel: core takes the shear loads and creates a distance between the skins which take the in-plane stresses, one skin in tension, the other in compression.

Advantages

- High heat insulation
- Easy and fast installation
- Lower investment cost in comparison with traditional building
- Panel thickness can vary between 50mm to 300mm in steps of 25mm
- Low bulk density 100 kg/m^3 over brick and concrete
- Fabrication cost is Tk. 125/sft.

4.2 Multistoried Rural Housing (PajjiJnapad)

Various research revels that every year about 1% of our agricultural land is being decreased for housing and other urbanization activities and the percentage of organic materials of our farming land is decreasing day by day that stands less than 1% but the standard is 5%.

Inconsideration to restrict the agricultural land loss the experience of oversees visit noticed in Spain is modified to cope up the economic and social culture of Bangladesh. In Spain the household of each village are shifted in a tower. The building was designed for six storied with the accommodation of 272 families. To make the building low-cost one the slab is designed by ferocement, is a proven material of 1.5-inch thickness thus reduce the self load of the building. It's a universal

low-cost building material and Housing and Building Research Institute (HBRI), Bangladesh has wide experience on it. Sandwich panel is used in the Top roof to minimize the temperature and the southern roof is covered by solar panel as a source of power. Walls of the building is designed by PLC bricks, it's a very light block-bricks made by cement, sand and foam. The weight of this brick is one third of the conventional brick. A two storied cattle shed is designed with the same materials to make the building low-cost as well. Where there is an accommodation of 500 cows in ground floor and rearing facilities of 16126 poultry birds in first floor and storage facilities, guesthouse and an open drying yard at top level. Incorporating the thought of our present Prime Minister (PM) i.e. four storied building with lakes for fire fighting, playground for the children, interconnected veranda (passage of walking path), bathroom and toilets are separate location, every flats unit are face to face etc. the building is become a green and named as PalliJanapad.

Four types of units are there Type-A, Type-B, Type-C and Type-D of actual floor area of 915 sft, 710 sft, 460 sft, and 365 sftrespectively. The gross area of the units aresequentially 1383 sft, 1073 sft, 695 sft and 552sqft.Total 64 numbers of A-type flat, 96 numbers of B-type, 32 numbers of C-type and 80 numbers of D-type flats are available in each PalliJanapad housing. In addition to these there is the accommodation of two grocery shops, two Community Centers, two plus two technician's room for poultry and dairy, two rooms for Paravet, two plus two guest rooms for poultry and dairy, six numbers of grain storage rooms of 55 sft gross area (actual 41 sft), one stall of Books and Stationary, tailoring, saloon, medicine corner, Health Centre, Internet and Computer facility, Library facilities are prevailing in the PalliJanapad housing. The unit cost of the PalliJanapad building is estimated as Tk. 1603.75 per sft.

4.3PajjiJnapad an Eco-friendly Building

The main difficulties of the community bio-gas sub-project sites are to accumulate, transport, handle and manage the total amount of waste produced in a village community. Community Based Multi-storied Rural Housing is the option to accumulate total of 288 farm families in a common tower with all modern urban amenities (piped water supply, biogas connection, biogas and solar based electricity, best solid waste management). The flat owners have the scope of rearing 500 cows and 16126 poultry birds. The total generated wastes (human excreta, cow dung, poultry drop and kitchen waste) of 3.8512 million tons/year are used to generate bio-gas, supplied to the individual household for cooking and a portion is used to produce electricity for ensuring water supply. The decomposed waste will be converted to organic manure (PalliJoiboSar) and yearly produced 145152 m^3 of bio-gas. A good amount (Two ton) of organic manure will be produced daily of market price $59312.5 per year. In the rooftop of PalliJanapad 50kW of electric power will be produced using solar energy. South part of the roof will be covered by solar panel. In the time of load shedding every flat owner have to enjoy three lights and one-fan facilities. The solar power will also be used for lifting water and domestic supply to reduce the extra thrust on national grid.

A water body to storage of sufficient water for fire fighting occupies a side of the Palli-Janapad. There is a provision of rainwater harvesting, a sufficient capacity of water reservoir to be constructed for storage of rainwater. The excess water runs to lake. There is also the provision of recycling of washroom water (showered water).

Both the sources of water will be used for toilet flashing. Using of renewable energy in multi-sectors and recycling of water and rainwater harvesting make the building eco-friendly.

4.4 Savings of Agricultural Land and Public Resources

In study it was found that in village areas most of the households requires an average land size of 5 decimal. Approach road needs land area of 3 decimal and the cattle shed requires 2 decimal of land. So the total land holdings of a village house is about 10 decimal each. The accommodation of 288 HH into a multi-storied building of 3.75 ha saves 22.9 acres i.e. 9.27 ha of land. Installation of the community bio- gas plant will save annual fuel cost of Tk. 81.60 lakh and minimize the carbon emission as well. Metal road construction cost of Tk. 1088.06 lakh at LGED rate on 16.18 acres of land will be saved by constructing a single metal road of Tk. 4.01 lakh on 0.59 acres of land. Installation of biogas-operated generator would save 6.15 km of electric cable and help save annual electricity bill of Tk. 16.32 lakh. Developed modern facilities of rearing 500 cows and 16126 poultry birds with drying yard and storage facilities for grains are ensured in PalliJanapad.

4.5 Strategy of flat distribution and mode of payment policy make the project sustainable

The individual household owner as down payment must give minimum 30% of the total capital cost by installment basis (maximum three installments before receiving the key). Flat will be handed over to the flat owner after the down payment and rest 70% capital investment will be paid back by the beneficiary within 15 years with 5% flat interest rate.

Before selecting the sub-project sites, a focus group discussion (FGD) has been arranged among the beneficiary families in each selected sub-project sites and search out their thought, capability, affordability and mode of interest to avail/enjoy that sort of project support facilities. The FGD findings prevailed that the beneficiaries of the sub-project area will be capable enough and interested to deposit the down payment as well as willing to pay the total project investment with in the anticipated span of time. We found them more attentive, mind blowing and motivated enough to spend the shelter cost according to our project rules. As they are already used to (habituate) with group activities through credit program, all of them committed to live together under a common shed. After examining the above attitude the sub-project sites are chosen.

First of all, a large gathering will be arranged locally with common people (All stakeholders) to aware people about the facilities, building materials, concept of community building (PalliJanapad), who are suppose to get the flats, why and how they will get the flat, policy of payment more details etc.

Application will be received from the all stakeholders from different corner of the distinguish division and make a long list. Priority will be given those who are sacrificed (sale) their land for establishing the PalliJanapad. Second priority will get the local people i.e. native union, Upazila, District and Division respectively. Besides this the main focus will be given to the groups those who are earning foreign remittance and planning to construct a new building by using their agricultural

holdings. Reservation also be restricted for the Freedom Fighter and their children's. If the demand of specific flat goes beyond the total units of flat lottery will be arranged among the applicant. A new list client is developed from the long list by considering the above-mentioned criteria. This group will be registered under the Department of Cooperatives.

This group is divided into many sub-groups on their interested trade and arranges some training, awareness program and continues nourishment to develop them same mentality, skilled on specific trade, provide lone with 11% interest as SME and make them capable to secure additional income.

Every flat owner has to pay minimum 30% of the total construction cost of the asking flat as down payment by single payment or maximum three installments before receiving the key of the flat. An MOU will be signed in this regard. If any one become fail to maintain the commitment the terms and condition of the MOU then without giving any chance, a new member will be enrolled in lew of him from the rest of the long list.

A MOU will be signed between RDA and the beneficiary family under the terms and condition that he/she will be capable to recover the rest 70% capital cost of flat as annual basis with equal installment to RDA with in 15 years with 5% interest. The beneficiary groups to be trained up again on various trades (interested IGAs). During inception period two numbers of Farmers' Field School (FFS) will be arranged in each sub-project area to select the IGAs. The modern irrigation system with on-farm water management practice; Nursery development; Poultry and cow-rearing; beef fattening; Modern fish culture; Food processing and preservation; organic manure production, processing and marketing etc. such type of IGAs will be taken under the project program. After completion of intensive training on specific interested trade the training matched RDA-credit will be given (interest rate of 11%) to support the skilled manpower for undertaking the IGAs as business firm. Close monitoring will be ensured from CIWM, RDA part to develop the beneficiary farm families' sound enough to repay the capital by earning additional income through IGAs. Program Organizer (PO), Deputy Director (DD) & Assistant Director (AD) of CIWM will be assigned for over all management, monitoring and continuous supervision for smooth credit operation to attain the project sustainability.

4.6 Overall Criterion for Selection of Project Area and Target Groups

For the sustainability of any project, selection of project area as well as target groups/beneficiaries is one of the important tasks. RDA has a wide range of experiences in the field of sustainable project implementation. Centre for Irrigation and Water Management (CIWM) has been set-up under the administrative control of RDA for popularization, extension, continuation and also for smooth operation and maintenance of the completed projects for its sustainability.

The proposed project will be implemented by CIWM of RDA, Bogra. Usually after completion of the project CIWM continues the project activities in the project villages and takes-up the monitoring, operation & maintenance as well as over all responsibilitiesof the project for its sustainability by involving the beneficiary people in various IGAs activities.

The FGD findings prevailed that the beneficiaries of the sub-project area will be capable enough and interested to deposit the down payment as well as willing to pay the total project investment with in the desired span of time. We select the

beneficiaries who are more attentive, mind blowing and motivated enough to spend the shelter cost according to our project rules. As the target groups are already habituate with group activities through credit program and all of them committed to live together under a common shed so we selected them as target group.

4.6.1 Site Selection Criteria

i. The project village will be selected near to the growth centre of Upazilla, where, there is a scope of getting 3.75 acre of land and the people have the interest to invest money and like to enjoy accommodation in a common building with improved and modern utility facilities.

ii. The areas where a group of farm families live together those who have received foreign remittance and have tendency to use agricultural land for constructing a new house are the target groups of this proposed project.

iii. RDA, Bogra has different action research project sites over the country. Among the executed project sites the best sub-project sites may be selected (comparatively best and have the above criterion). Preference will be given to sort out the villages are innovative, progressive with capable farm families as well as remittance earning village. The farm families of those villages are already financially solved as they are skilled enough on their interested trade and benefited from credit support. Still the beneficiaries are under close supervision of CIWM, RDA. Such villages from the mentioned divisions may be selected.

iv. Considering the above factors, before selecting the sub-project sites a baseline survey and a focus group discussion (FGD) have been arranged among the intended beneficiary families in each selected sub-project sites and search out their thought, capability, affordability and mode of interest to avail/enjoy that sort of project support/facilities.

v. The findings/outcomes of baseline and FGD will be discussed to the Project Implementation Committee (PIC). The sub-project site will be finalized based on the guidelines and recommendations as well as the decision of the Project Steering Committee (PSC).

vi. After final selection the expected beneficiary were highly insisted and counseled by the project people not to waste the cultivable land.

4.6.2 Process of Flat distribution and Mode of Payment

i. A cooperative housing society will be formed and be signed a MOU with RDA. Initially land will be registered in the name of housing society. Each and every interested beneficiary should be the member of the society and she/he should have the membership criteria. Maximum 272 members will be enrolled under the cooperative society by first come first serve.

ii. Minimum 30% of the total capital cost will be given by the individual household owner as down payment by installment basis (maximum three installments before receiving the key).

iii. Flat will be handed over to the flat owner after the down payment and rest 70% capital investment will be paid back by the beneficiary within 15 years with 5% flat interest rate.

iv. Every household will enjoy the accommodation facility of 27 poultry birds and a cow rearing space as they should have the commitment of giving cow dung and poultry drops in to the biogas digester at free of cost. If any one seeks more, he/she has to pay the actual cost of required facility.

v. A MoU will be signed between RDA and the beneficiary family under the terms and conditions that he/she will be capable to recover the rest 70% capital cost of flat/unit as month/annual basis with equal installment (flat rate) to RDA within 15 years with 5% interest.

vi. After full payment, flat and percentage of land will be registered in the name of individual flat owner.

vii. The beneficiary groups to be trained up again on various trades (interested IGAs). During inception period two numbers of Farmers' Field School (FFS) will be arranged in each sub-project area to select the IGAs. After completion of intensive training on specific interested trade the training matched RDA-credit will be given (interest rate of 11%) to support the skilled manpower for undertaking the IGAs as business firm.

viii. Training and credit facility will be provided/disbursed among the beneficiary for their skill development and improvement of socio-economic capability through the cooperative housing society.

ix. Close monitoring will be ensured from CIWM, RDA to develop the beneficiary farm families' sound enough to repay the rest amount of capital.

4.6.3 Criteria of Beneficiaries

i. The people have the interest to invest money for improved and modern utility facilities.

ii. Like to enjoy accommodation in a common building.

iii. The farm families those who have received foreign remittance and have tendency to use agricultural land for constructing a new house will be get preference.

iv. Should be the member of the society and like to do savings.

v. Like to trained on interested IGAs and be developed as entrepreneur.

vi. He/She like to interest in engaging training match credit if they need.

vii. Last of all he/she must obey the rules and regulation of the housing society.

After the project completion, total asset and liability of the project will be under CIWM for attaining the status of a self-sustained centre of excellence. Thus, CIWM, RDA, Bogra will take over all responsibilities for total monitoring, operation & maintenance of the project from its own income.

4.7 Outcome Results of the Feasibility Study

A feasibility study on the proposed rural housing has been conducted by RDA to know the peoples' response about their affordability, perception, acceptability, expectation and the suggestions of the community are appended herewith.

The findings of the study show that total land area engaged by 205 households for domestic use including homestead, cattle house, vegetable garden and others was 32.12 acres.

By portraying community benefits of the study found:

- Rehabilitating 272 households into a multi-storied building of 1.5 acres saves 42.02 acres of land
- The study revealed that 57.56% of the respondents of the area have a plan for building new house. On an average 0.048 acre agricultural land per household is going to be turned into homestead area. This proposed project will restore 13.056 acres of land from being converted to homestead area very soon
- Installation of the community bio- gas plant will save annual fuel cost of 81.60 lakh tk and minimize the carbon emission as well
- Metal road construction cost of 1088.06 lakhtk at LGED rate on 16.18 acres of land will be saved by constructing a single metal road of 4.01 lakh tk on 0.59 acres of land.
- Installation of bio-gas operated generator would save 6.15 km of electric cable and help save annual electricity bill of 16.32 lakh tk
- Comparison of construction cost building using Ferro-cement technology with PWD rate schedule revealed that it was about 30% less than traditional one
- Garidaho village is located at 16 km away from Bogra town by the Asian highway towards Dhaka. It is adjacent to RDA. Compare to other villages of Bangladesh this village enjoys modern facilities easily at cheaper cost. Therefore, the portrayed cost structure will be much bigger in the traditional villages.
- The study found all groups of people specially who migrated at Garidaho and landless local people showed their highest degree of interest because:

- They perceived this projects as a revolutionary initiative to restore the agricultural land
- They expressed their opinions that this project need to be initiated as early as possible at Garidaho
- They were in hurry to enlist their name as a client of the co-operative based modern multi storied housing project at cheap rate

They were interested because of flexible loan, disadvantages of current living condition, security, and for co-operative based income generating activities.

5.0 Conclusion and Recommendations

The piece of study is the success experience of using renewable energy in multi-dimensional sectors of rural development in efficient way.

The community-based multi-storied rural housing (PalliJanapad) is a new concept to develop the rural areas and livelihoods with urbanization flavor. It is much more difficult to accommodatethe large numbers of families in a common shelter with different culture, income and level as well, but some one should come forward and start the initiatives to restrict the wastage of agricultural land. RDA innovate the idea and have started the piloting of that innovation for the betterment of our rural people and country as well. RDA likes to welcome constructive suggestions, ideas, thoughts and opinions to make the concept more fruitful from different corner and institutes for the betterment of our country.

Further more social study will be needed after implementation of the project. Study on peoples' response against the cooperative-based building also be needed among the beneficiaries and the neighbor people. These research findings will help to remold the concept to make it more sustainable. Thus the project may be a guide line for the rural development practitioner, planner and researcher to sketch the rural development in near future.

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