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Sustainability Assessment of Non-Public Sector Initiatives in Housing for Marginalized Groups: Cases of Dhurmus Suntali Foundation

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Abstract
Sustainable housing can be defined as the housing that can address the social, economic, and cultural needs of the residents. Sustainable housing should be energy efficient and affordable for the low income groups. Nepal Government has listed 22 ethnic groups as a marginalized groups among which 17 ethnic groups reside in Terai region. Among those 17 groups, the highly marginalized group is Musahar group who are socially deprived. Many private sectors have been involved in the making of affordable housing who are mainly focused in quantity rather than quality. So, the main purpose of this research is to assess the sustainability of the integrated model settlement established by Dhurmus Suntali Foundation both in Terai as well as in Hilly region of Nepal.
This research also attempted to study the socio-cultural aspects, economic aspects and environmental aspects of the settlement with an exploratory and descriptive approach of research, following case study as a research design strategy and observations, interviews, ethnography, questionnaire survey as a research methods. For this, first of all, list of indicators were developed based on the literature review which were précised more and then the performance indicators were derived which was followed by methodology. Deductive approach of research has been applied to compare the list of performance indicators with the data obtained from site visit. The study showed that Tamang people in Giranchaur are not ethnically marginalized but from the perspective of social participation and economic dimension they seem to be marginalized. In terms of marking of individual indicator parameters, all the settlements have scored very small marks in indicator parameters like passive solar design, energy efficient appliances, use of materials, orientation, economic opportunities etc. Based on these findings, different design strategies has been recommended on those low scoring indicators.

Keywords
Sustainability, Sustainable Housing, Thermal Comfort, Resiliency, Livelihood

1. Introduction

The lack of secure housing for the marginalized groups has become one of the major planning issue in both urban and rural area. According to Shelter Policy 2012, Nepal's housing deficiency would reach to 900, 000 by 2023, which implies annually we require around 90000 numbers of housing units to meet the target [1]. To address the issue of sustainability the integrated settlement can be a good initiation but at the same time it would be more exemplary if it could be able to incorporate the triple bottom line approach of sustainability. Sustainable housing can be defined as the housing that can address the social, economic, and cultural needs of the residents. Newman describes sustainable housing as, more than just a roof over the head. Sustainable housing should be energy efficient and affordable for the low income groups. Size, location, orientation, layout, materials etc. are some of the ideas that can be incorporated in the design of sustainable housing.

The national census of Nepal 2011 has categorized 125 different castes of people living in three geographic regions of Nepal among which 22 groups are categorized under underprivileged groups. Out of them 17 groups are in Terai region and 5 are in Hilly region [2].

National Census 2011 reveals that 12% (3.1 million) of the total population is homeless. The government of Nepal has less involvement in the sector of private housing of people. Developed countries have carried out institutional reforms by clarifying the role of governmental, non-governmental, private sector and

communities to make the housing sector successful. Nepal is spending only 0.05% of Gross Domestic Product in housing. According to Department of Urban Development and Building Construction; 4,700 families have already settled in the government constructed such houses. Around 1,200 units are constructed every year [3]. In the similar manner other private initiatives are also under active participation in doing such construction works. Different organizations like OXFAM, Lumanti, and Habitat for Humanity, Dhurmus Suntali foundation and many other more private sectors are involved in making low income houses for marginal groups in different regions of Nepal. The immediate problems of housing has been addressed by such initiatives but there is always a question in my mind what will be the next? These organizations are more focused in quantity rather than quality. Advocacy on sustainability has already been geared by the concerned agencies. So this research intends to explore the level of sustainability of those housing or settlements set up by the private sectors.

2. Research objectives

The main objective of this research is to assess the sustainability of private sector initiatives in housing for the marginalized groups using established indicators of sustainable development goals and provide suitable design strategies for sustainable housing.To support this main objective other specific objectives are created which are as follows:

- To assess the so called integrated settlement of Dhurmus Suntali foundation from sustainability perspective.
- To develop the suitable design strategies for similar type of housing for upcoming housing projects and recommend the alternative building materials for maintaining the thermal comfort.
- To analyze the possibilities for improved livelihood.

3. Methodology

The research is based mainly on case study strategy and the study area is limited to the settlements built by Dhurmus Suntali Foundation.

3.1 Selection of Case Study Area

Three settlements were taken that were built by Dhurmus Suntali foundation because this is the first attempt from private sector to build the dwelling for marginal groups in Nepal and the campaign began right after the earthquake 2015. In a very short period of time the foundation was able to build four such settlements and gain popularity in the nation. So this research was an attempt to explore the sustainability of these settlements and eventually come up with few findings which could be helpful for other such projects.

3.2 Selection of the indicators

Table 1 shows the list of indicators which were derived from a detail literature study. Initially more than 50 indicators were derived from different standards of different countries. Most of the indicators were based on UN indicators of sustainable development guidelines and methods. Among the number of indicators 25 indicators parameters were taken as per the site and context that suited in my case area.The selected indicators parameters were reviewed and validated by the experts under which the whole research is based upon [4].

3.3 Data collection and analysis

The primary data were collected through different methods like observations, questionnaire survey, phenomenology, focus group, photographs, audio, video, tape measurement and interview which were later analyzed through different perspectives of sustainability. Individual dwelling and the whole settlement were analyzed in terms of different indicators using charts and graphs. Comparative charts and graphs helped to draw the conclusion which were logical in terms of sustainability. Each indicator parameters were given certain scale ranging from 1-3 after which total marks was calculated and compare with the range from 0-25, 25-50 or 50-75. Those who fall in the range of 0-25 was called to be low sustainable,25-50 is medium sustainable and more than getting 50 points was called to be high sustainable which is more clear in table 2.

Table 1: Development of indicators and their performance indicators

Dimensions	Indicator Parameters	Performance Indicators
Environmental	Density	No. of dwelling per hectare
	Passive solar design	Dwelling orientation and layout
	Renewable energy technology	percentage of HH using solar PV
	Energy efficient appliances	percentage of people using CFL, LED
	Building materials	U-Value of walling and roofing materials
	Indoor thermal comfort	Insulation,Area of openings per floor area
	Access to water supply	Per day per HH water consumption(in)liters
	Ground water recharge	Use of pervious pavement
	Solid waste management	Recycle or taken my municipality
	Liquid waste management	Treatment of grey water
	Fuels used	LPG, firewood, electricity
Socio-cultural	Proximity to services and facilities	Distance to market, bus stop, school, health post
	Housing diversity	Variation in dwellings type
	Size of dwellings	Per capita floor area in sq.ft.
	Safety and security	Probability of floods, landslides
	Community participation	Involvement in community groups like club,co-operative,women group
	Cultural practices	Celebration of festivals and rituals
	Socio-cultural norms	Way of communication, daily lifestyle, greetings
	Social exclusion	Poverty, Participation in decision making
Economic	Social assistance to the less advantaged	Household receiving any allowance
	Affordability	Unit labor cost, income range
	Livelihood opportunities	Employment rate
	Livelihood structure	Sectors (agriculture, industry, animal husbandry)
	Land ownership	Provision of lalpurja
	Citizenship card	People having citizenship
	Vocational skill	No of people doing such activities

source: UN 2007

Table 2: Grading of Sustainability

Scale	Settlement	Grading
0-30	None	Low
30-60	Bardibas, Santapur	Medium
60-90	Giranchaur	High

4. Analysis and Discussion

All the indicators were thoroughly analyzed both in terms of individual dwelling and whole settlement and major indicators who did not perform well are discussed below.

4.1 Density

Table 3: Dwelling and population density

Dwelling density per hectare		
103.88	114.63	37.07
Bardibas	Santapur	Giranchaur
721	692	215
Population density per hectare		

Table 2 shows the population and dwelling density in each settlement. As compared to KVDA standard of 300-400 pph, Bardibas and Santapur exceeds that standard whereas Giranchaur has not reached in that standard. Bardibas and Santapur is densely populated with 721 and 692 respectively and Giranchaur has 215pph. In reference to Gurgaon India, for a low cost housing, the dwelling density should lie in the range of 125-150 dwelling per hectare, and Bardibas and Santapur are very close to this range with density 103 and 114 but Giranchaur has very less density of 37 dwelling per hectare.

4.2 Building Material

Bardiabs and Santapur has used 9" thick brick wall in cement mortar in wall and CGI sheet in roof whereas 8" thick HCB block has been used in Giranchaur.The U value of the building materials are responsible for maintaining thermal comfort inside the building. The U- value for 9 "thick brick wall is 1.96 W/m2- K, 8" thick HCB block is 1.89 W/m2- K, and that of CGI sheet is 61 W/m2- K which is very high due to which thermal comfort cannot be maintained inside the dwellings. Because of use of CGI sheet in roof and absence of insulation, people are feeling too much hot inside the room in all three cases. Since the U-value of HCB is lesser than brick it would be better to use HCB or other alternative building materials like CSEB, adobe.RHPP can also be used which are more sustainable and can be prepared locally. The roofing materials can be replaced by slate, tile and straw which can make the dwellings more vernacular and local.

Table 4: U-value and embodied energy of brick and HCB

Components	Bardibas	Santapur	Giranchaur
Wall materials	9"thk brick wall	9"thk brick wall	8"thk HCB
Roof materials	CGI sheet	CGI sheet	CGI sheet
U-value of wall material	1.96 W/m2-K	1.96 W/m2-K	1.89 W/m2-K
Embodied energy for wall materials per 100m2 in GJ)	580.19	580.19	508.82
U-value of roof materials	61 W/m2-K	61 W/m2-K	61 W/m2-K

Source: Shrestha,2018

4.3 Indoor Thermal Comfort

As per national building code, the area of opening should be minimum 10% of floor area. Here in all three settlement, the opening area is about 10% which is within the range of national standard.The problem of insulation was a major issue during the cold season. The use of thick ply board in first floor helps to reduce the heat gain from the roof that helps in making comfortable in ground floor whereas it is very difficult for them to stay in attic floor due to no provision of insulation. The insulation can be done by using plastic sheet or sack, in the attic level. The bamboo mat can also be used to reduce the heat gain. In case of Bardibas and Santapur very few number of household have used their bed sheet under the roof in order to prevent the dew coming inside the room and also to reduce excess heat gain. In Giranchaur, they also have the heating and dew problem in the attic floor because of no provision of insulation. So they also feel very cold in winter and very warm in summer.

Table 5: Opening to floor area ratio

Settlements	**Opening** to floor area ratio
Bardibas	0.13
Santapur	0.12
Giranchaur	0.25

4.4 Livelihood opportunities and structure

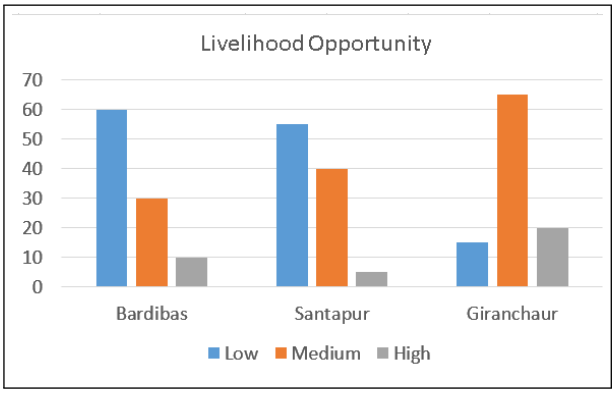

Figure 1: Livelihood opportunity around the vicinity

Graph above shows that there is very low chance of getting job in Bardibas and Santapur but in Giranchaur there is medium chance of getting job. Since Giranchaur lies very near to Indrawoti River and other smaller river most of the people are engaged in the extraction of sand and aggregate. Almost all of the people have their agriculture land, they are almost busy in their own work. Few of them are involved in government job and some of them drives heavy vehicles to transport these building materials to Kathmandu and nearby districts. These days' people have lots of opportunities in the construction of houses after earthquake. The nearest market in Melamchi. So there is few chance of getting some formal jobs within the town.

Graph below indicates that majority of the people are engaged in agricultural and others (labor works) works. In Bardibas and Santapur, the nature of the job varies daily. People wander daily in search of jobs. Some days they do construction jobs, some days they go to agriculture field.

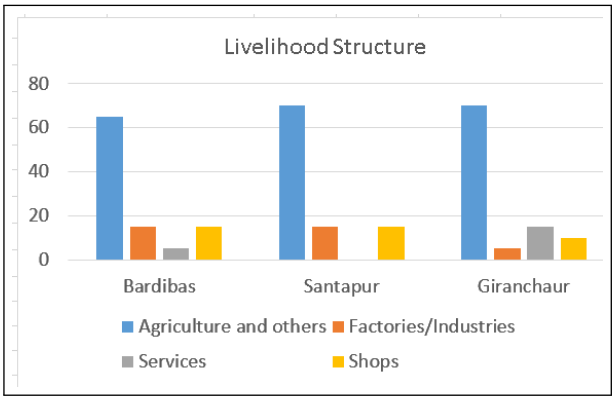

Figure 2: Percentage of people in different livelihood structure

Though people in Bardibas and Santapur do not have any land for cultivation, they go to others field for work.

5. Sustainable Design Strategy

Some of the strategies were derived in Table 6 after analyzing all different indicator parameters. These are general strategies that can be applied while designing sustainable settlement.(Refer Table 6)

6. Conclusion

Incorporating the aspects of sustainability in affordable housing for people has been less practiced in our context which was also clearly indicated after the study of these three settlements. So the main aim of this research was to find the level of sustainability under the various indicators which was achieved after analyzing the settlements from three aspects of sustainability. In terms of sustainability scale, Bardibas and Santapur was found to be medium sustainable and Giranchaur was found to be high sustainable. However, looking into each aspects individually, the major problem in Bardibas and Santapur was related with economic sustainability but in Giranchaur few things are to be improvised in environmental aspects like drinking water problem, solid and liquid waste management. None of the people are getting citizenship card in Bardibas which was another big issue related with livelihood opportunities. Social and economic marginalization is common to both Bardibas and Santapur. In terms of density of population and dwelling, Bardibas and Santapur was found to be more densified whereas Giranchaur has very less population and dwelling density.

In a conclusion, there are different factors that needs to be considered while planning sustainable and affordable housing for different ethnic groups. The culture and cultural activities can have a great role in creating a spaces in and outside the dwellings. The immediate demand has been fulfilled for the victims of earthquake and flooding by the provision of housing but people are in search of something else for their livelihood. The major problem for all settlement is concerned with economic status due to which their life has become hard. Initiation of the capacity development program among these people can provide them livelihood opportunities.

Table 6: Sustainable Design Strategy

Indicators	Design Strategy
Population Density	As per KVDA density can go up to 300-400 people per hectare. For the group housing it can go as high as 600
Passive Solar Design	The longer axis should be aligned towards N-S direction for less penetration of south sun to the dwellings. But in hilly area it is better to orient dwellings towards south-west direction to gain more sunlight. Provision of cross ventilation and open spaces within the settlement are to be provided. Proper planning with response of sun and wind should be done.
Renewable energy technology	Better to have the access of solar PV for lighting. Rain water harvesting can be a good sustainable technique where there is the scarcity of water. Biogas plant can be done in case of hilly area where people are rearing domestic animals. Provision of subsidy should be done by local government in promoting renewable energy
Energy efficient appliances	Better to use less energy consumption equipment like induction cooker, led bulbs etc. Availability and affordability of such appliances should be made easily accessible by these groups.
Building materials	Better to use locally available materials which can be brick, CSEB, adobe, hollow concrete block, slate roof or thatched roof etc. use of cement concrete in rural area can be minimized by giving the proper guidance and awareness program on the advantages of mud mortar and timber technology. In case of Terai region elephant grass, wattle and daub, bamboo can be used in building dwelling.
Indoor thermal comfort	Insulation can be provided. Choice of suitable building materials as per climatic zone and provision of cross ventilation for area with tropical climate is a must. Opening to floor area ratio can be maximized to get enough air during summer in Terai region.
Access to water supply	Rain water harvesting is an option for the area with less access of drinking water. For the efficient supply of water line integrated settlement with row housing is a good approach. Identifying the suitable location for the continuous supply of water from the source. In case of Terai region boring water must be well treated for the drinking purposes. Water treatment plant can be done by the local community group with the help of local government.
Ground water recharge	The area should be less paved with concrete or stone on the ground. Recharge pits can be dug.
Solid waste management	Solid degradable waste can be used as a compost in the agriculture whereas the liquid waste except excreta can be used in kitchen garden.
Fuels used	Firewood and biogas can be used for cooking purposes instead of LPG. Other alternative fuels like bio-briquette, wooden dust etc can be used.
Proximity to services and facilities	Distance to nearby markets, school, health post, bus stop etc should be within the walking distance. People preferred the maximum distance to be in the walking distance of 15-20 minutes. Before planning such settlement all these parameters should be clearly analyzed so that basic facilities can be located within the walking distance.
Safety and security	Dwellings should be protective against flood, landslide, wild animals and theft. For the safety from landslide and flood, choice of location should be wisely done.
Size of dwellings	Our national standard says the minimum floor area should be 7 sqm. Size of the dwellings can be maximized depending on the plot size and the percentage of ground covering as per the building code. For the sufficient spaces for the dwellers, storey of the dwelling can be increased.
Community participation	The hierarchy of caste system is a barrier for the marginal people to take part in community activities. Bonding in people for all caste groups is essential for the development of locality. All people should be treated equally. For such projects, community participation approach is vital. Social integration among different community can be made possible.
Cultural practices	Cultural practices, ritual works, feasts and festivals if celebrate by the respective cultural groups then the society can be culturally sustainable as culture is a driver for the sustainable society.
Socio-cultural norms	The way of behaving and treating with people, behavioral changes etc should be changed as per the time and situation as these people in Musahar settlement are still seems to be less civilized in term of their attire and way of eating
Social exclusion	There should be inclusive environment among different ethnic groups. No people is excluded from the similar opportunities. The social hierarchy if possible could be somewhat be changed
Health services	At least there must be the access of one general hospital in town level or better health post in an individual wards.
Social assistance to less advantaged people	Some sorts of economic help like social security allowance can be given to very old and needy people
Local identity	Promotion and advertising can be done for any place after identifying the peculiar characters of that place. People would come to visit if they know about the place and its strength.
Affordability	Monthly repayment of the dwelling units may not exceed 30Of household income.
Livelihood opportunities	Zoning for market area and residential area should be properly done so that there is more chance of offering livelihood opportunities within the nearby areas.
Livelihood structure	Livelihood structure depends upon the capability and affected by education.
Citizenship card	There is a provision of getting citizenship in the constitution of Nepal as per different conditions. Government should have clear policy for providing citizenship card.

7. Recommendation

7.1 Materials and Technology

For the affordable housing, the building materials are the primary concern. In case of Bardibas and Santapur, the local technology of using thatched roof, wattle and daub, bamboo, straw, clay tiles etc could have been very affordable and sustainable in terms of both economy and climate. For already constructed dwellings, insulation can be done both in roof and wall. In roof bamboo mat or sacks can be used to prevent summer heat or even CGI roof can be replaced with thatched roof. Plastering can be done from both sides in the wall for more thermal comfort. Since U-value for HCB is less than the brick it can also be used both in Hilly and Terai region as well which is locally made and economic too in comparison to brick. In Bardibas and Santapur the glass window shutter can also be replaced by timber shutter and the provision of cross ventilation can be made by creating openings. Similarly, the shading devices in the windows can be added to make thermal comfort inside room.

7.2 General Recommendation

Social integration and connectivity of these settlements with other community and groups is the one of the main strategy to make these settlement socially sustainable. For this there should be some policy and strategy from the local government. Common open spaces for performing some social activities and programs should be initiated so that they can know each other and social integrity can be increased. Equal opportunity should be given to socially marginalized groups in any sectors of development.

The major consideration in capacity development should be given in order to create some livelihood opportunities within the periphery. For this engagement of the people in the whole life cycle of the project could have been done. Due to poor economic status of the people, it will be difficult for them to continue their cultural and religious activities due to which there will be big threat in socio-cultural sustainability. Socio-cultural norms and social behaviour in Bardibas and Santpaur is quite different from the common society which can be improved by the education and the awareness program. To improve the economic condition, local government should initiate to engage people in different sectors like animals farming, poultry farming, fish farming or in the vegetable farming. These sorts of activities can be initiated within the settlement as well. Some sorts of subsidy can be given to them to start such economic activities which make them economically sustainable in long run. Though there is no direct impact in environmental aspects, the solid wastes generated within the settlement should be treated or recycled by municipality or from the individual side it can be burnt or compost.

7.3 Recommendation to Foundation and policy maker

Initiation of the research on using the best sustainable materials and technology should be done by foundation otherwise it will not address the real problem of the people. Proper planning and analysis of the situation has to be done before doing such housing projects for the marginal groups. Many such private and non-public sectors are doing the housing projects for poor people which were not successful as expected and that may be due to lack of sufficient exercises on planning and designing. The foundation is run by the artist groups who do not have any idea regarding the sustainable housing and its technical parts.So it would be better to consult with the expertise who can provide a suitable solution. If we assume that they have consulted with the expertise then the project was seemed to be done in rush. If they were really concerned about the affordability and sustainability, then they would come up with some better housing units which units and capacity development of the local people that can make them more sustainable.

Local government or central level government has to make clear vision about giving permission to such private sectors otherwise there will be competition on private companies to build large quantities of housing units, that ultimately results in less sustainable settlements. For the future projects on such housing, it will be better if they consider minimum parameters of sustainability which can be livelihood improvement through capacity development. The other strategy could be feeling of equality among different groups around the vicinity which can help in making social integration and community resiliency. Good symbiosis among private sector, local stakeholders, expertise and local government can create more sustainable community where there will be common opportunity for all groups of people.

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