

Sustainable Livelihood Assessment of Taro and Paddy Growers in Nayagarh District of Odisha

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ABSTRACT

Livelihood assessment was conducted among 50 taro and 50 paddy growing farmers in Nayagarh district of Odisha, India. Data were collected using PRA tools, interview schedule and focus group discussions. Livelihood sustainable index was estimated using the DFID methodology. The analysis revealed that the average age of taro and paddy growers was almost similar (55 years). The average yield of taro (43.34 quintal/acre) was higher than the yield of paddy (20.94 quintal/acre). There was significant difference in the yield, cost of cultivation and net profit between taro and paddy. On an average, the taro growers realized 128% higher net returns than the paddy growers. The rural sustainable livelihood index was marginally more for paddy (60) than taro growers (59). The mean values of different capitals of taro and paddy growers were in the decreasing order with respect to physical, natural, social, human and financial capitals. Lack of market facilities was ranked first with a mean score of 2.51 out of maximum score of 3. The other constraints reported by the taro farmers were, price fluctuation (2.21), lack of irrigation facilities (2.04), wild animals attack (1.98) and non availability of skilled labour (1.74). Lack of irrigation facilities (2.35), weather aberrations (2.15), incidence of pests and diseases (2.0) and non availability of skilled labour (1.98) were perceived as major constraints in paddy cultivation.

Keywords: Livelihood index, Odisha, Paddy, Sustainability, Taro

INTRODUCTION

Taro also known as Colocasia, is an important tuber crop of tropical and sub tropical regions. In India, it is mainly cultivated in Eastern, North Eastern and Southern states. The tubers are mostly used as vegetable or as subsidiary food after roasting, baking or boiling and the leaves and petioles are also consumed as vegetable. The tubers of taro are rich source of starch (upto 21% total carbohydrate), protein and minerals (>3%). Tubers form a rich source of calcium, iron, phosphorous and vitamin A and C. Taro starch has very low granule size compared to other tuber crops starches which forms an excellent ingredient of weaning baby foods and preparation of extruded products.

Taro plays an important role in food and nutrition security for the global population especially the small and marginal famers and the tribal community. Taro is one of the major tuber crops grown in Odisha for livelihood and food security of the poor and marginal

farmers. Farmers have their own livelihood strategies to cope up with the environment and to sustain their living. Livelihood assessment of the taro growers and comparing them with another important crop growers i.e. paddy growers in the study area will help to identify the different assets possessed by the growers and their contribution to their livelihood. To improve the livelihood status of the growers, the concept of sustainable livelihoods is gaining importance in research and development initiatives for poverty alleviation and rural agriculture development (Chambers, 1987; Ashley, 2000). Broad sustainable livelihood principles underpin application of the sustainable livelihood approach, which assess how development activities fit with the livelihoods of the poor (Carney *et al.*, 1999; DFID, 2000).

Livelihoods are 'means of making a living', the various activities and resources that allow people to live (FAO, 2007). Livelihood can be defined as a measure of the set of actions taken by people within their capacity and capitals to make a living by maintaining highly diverse

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portfolio of activities, while livelihood capitals cover natural, physical, human, social and financial resources that are critical to the survival of people in response to stresses and shocks while not compromising the natural resource base (Ansoms and McKay, 2010; Mutenje *et al.*, 2010; Ellis, 1998; Ellis, 2000; Scoones, 1998). Livelihood strategies comprise the range and combination of activities and choices that people undertake to achieve their livelihood goals (Adam and Kneeshaw, 2008). The relationship between farm household livelihood strategies and livelihood capitals has received much attention in recent years in view of sustainability (Waleign *et al.*, 2016; Peng *et al.*, 2017). Livelihood capitals viz., human, financial, social, natural and physical capitals and household structure, labour quality and ecological policies are the major drivers of farmers' choice of livelihood strategy (Iiyama *et al.*, 2008; Mutenje *et al.*, 2010; Angelson *et al.*, 2014; Peng *et al.*, 2017). The Sustainable Livelihood Approach (SLA)/ Sustainable Livelihood Framework (SLF) assumes that people's livelihood is a set of five livelihood capitals or assets (Sayer and Campbell, 2003). Taro and paddy are the two important food crops which provide livelihood support to the farmers of Nayagarh district of Odisha. Thus, it is important to understand the livelihood capitals of both the farmers to formulate suitable strategies to enhance the livelihood status of the farmers. With this background, the study was conducted with the objectives, to investigate the profile characteristics of taro and paddy growers, to analyze the key components of sustainable livelihood capitals of taro and paddy growers and to formulate strategies to enhance taro and paddy growers' capabilities for sustainable livelihood security.

MATERIALS AND METHODS

The DFID's livelihood framework was adopted to assess the different capitals possessed by the taro and paddy growers. The conceptual framework of Department for International Development (DFID) provides attention to measured changes in the different factors, which contribute to livelihoods especially human, social, financial, physical and natural assets (DFID, 2000; Sreedevi, 2005). The sustainable livelihoods framework presents the main factors that affect the sources of people's livelihoods and also make typical relationship among them. Each capital consists of key indicators which contributes to that livelihood capital.

The study was conducted in the Nayagarh district of Odisha, which is one of the major producers of taro and paddy in Odisha. Two taluks namely, Ranpur and Khandapada were selected based on large area under taro and paddy. From these two taluks, five villages were selected randomly and from each village ten taro and ten paddy growers were selected using snowball sampling and thus the total sample was 100. The farmers deriving more than 50% of their income from each crop viz., taro and paddy were selected as respondents. Data were collected using PRA tools, structured interview schedule and focus group discussion during October to December 2019. Livelihood capital index was worked out for each capital using the formula

$$\text{Capital Index} = \frac{\text{Actual score}}{\text{Maximum obtainable score}} \times 100$$

Actual score is the score obtained by the respondent under each capital.

$$\text{Rural sustainable livelihood index} = \frac{\text{HCI} + \text{PCI} + \text{SCI} + \text{FCI} + \text{NCI}}{5}$$

where, HCI : Human Capital Index, PCI : Physical Capital Index, SCI : Social Capital Index,

FCI : Financial Capital Index and NCI : Natural Capital Index

RESULTS AND DISCUSSION

District profile: Nayagarh district comes under the tropical climate with the latitude and longitude of 19° 54' to 20° 32' N; 84° 29' to 85° 27' E. The total area of the district is 3890 sq.km with a population of 9.63 lakhs. The district has 1702 villages and is dominated by agricultural and allied activities. The net sown area and gross cropped area is 1.27 lakhs ha and 2.23 lakhs ha respectively (GoO, 2019). The cropping intensity is 176 per cent which is above the national average indicating the importance of agriculture in the district. Only about one third (0.39 lakh ha) of the net sown area is under irrigated conditions and majority of the crops are grown under rainfed conditions which depends on the annual rainfall of about 1355 mm. The temperature ranges from 40°C during summer to 10°C during winter. Major soil types are red, alluvial, black and laterite which are suitable for cultivation of major crops like paddy, green gram, sugarcane, coconut, mango, vegetables, tuber crops, maize etc.

Profile characteristics of taro and paddy growers:

Table 1 reveals that the average age of both the farmers were around 55 years and there is no significant difference. The level of education was more or less similar to both the farmers. The number of family members in a household was around seven members which shows that they have big family size. In India, the average household size for all areas stands at 4.3, while it is 4.5 for rural and 4.1 for the urban areas (GOI, 2011). In the study area, the family size was more than the national average. The total farm size was 1.84 acres for taro farmers and 2.12 acres for paddy farmers. The area for cultivation of paddy was more (1.22 acres) which is significant at 1 percent level in comparison to taro area. Farming experience was more for paddy farmers (30.26 years) which shows that paddy is a traditional crop which is being cultivated since many years for their food and livelihood security. Similar findings were reported by Jaganathan *et al.* (2019).

Table 1: Profile characteristics of taro and paddy growers

Characteristics	Taro (n=50)	Paddy (n=50)	Difference
Age of respondent (years)	55.06	54.96	0.100
Level of education (years)	6.64	6.76	-0.12
Family size (number)	7.42	7.80	-0.38
Total farm area (acre)	1.84	2.12	-0.27
Area under cultivation (acre)	0.70	1.22	-0.518***
Farming experience (years)	26.54	30.26	-3.72

*** significant at 1 % level

Costs and returns in taro and paddy cultivation:

The costs and returns in taro and paddy cultivation is given in Table 2. The average yield of taro (43.34 quintal/acre) was higher than the yield of paddy (20.94 quintal/acre). There is not much difference in the cost of production between taro and paddy. But there are significant differences with respect to yield, cost of

Table 2. Cost and returns in Taro and Paddy cultivation

Particulars	Taro (n=50)	Paddy (n=50)	Difference	% increase
Yield (q acre ⁻¹)	43.34	20.94	22.400***	107
Cost of cultivation (Rs. acre ⁻¹)	33910	16159	17751***	110
Cost of production (Rs. quintal ⁻¹)	817.86	916.37	- 40	-11
Net profit (Rs. acre ⁻¹)	49024	21533	27491***	128

*** Significant at 1 per cent level

cultivation and net profit between taro and paddy. However, the higher yield realization makes taro cultivation more profitable. On an average, the taro growers realized 128 per cent higher net returns than the paddy growers. Thus, taro crop may be popularized in suitable areas for doubling farmers income as it was revealed from the results.

Livelihood capitals Index: Livelihood capitals *viz.*, human, physical, social, financial and natural indices of taro and paddy growers are discussed below.

Human Capital Index: Human capital includes education level of the growers, training undergone, labour availability, health facilities and experience of the growers. It helps people to pursue livelihood strategies to achieve their goals. At a household level, human capital is the factor of the number and quality of labour available; this varies according to household size, skill levels, leadership potential, health status, etc. It is a key factor within the livelihood framework for the reason that all other capitals are partly depend on it for the sustainability (Sayer and Campbell, 2003).

It is observed from the Table 3 that the education index of both the farmers were more or less similar. It was 44 for taro growers and 45 for paddy farmers whereas, the training index was higher for paddy growers

Table 3: Human capital index of taro and paddy growers

Parameters	Taro growers (n=50)	Paddy growers (n=50)
Education	44	45
Training	22	44
Labour	53	79
Health	49	59
Experience in farming	85	91
Knowledge	48	77
Human Capital Index	50	66

(44). The reason could be that more number of trainings were organised by the department for paddy cultivation than taro cultivation. As Lynton and Pareek (1990) stated that training consists largely of well organized opportunities for participants to acquire necessary understanding and skill. Hence efforts need to be put to improve the capacity building of the taro growers. Labour availability was more for paddy farming (79) as paddy is a labour intensive crop and it needs more labour when compared to taro. Knowledge was also more for paddy growers which may be due to the training programmes they had attended. The farming experience was more for both the farmers as they were involved in traditional farming over the years. Health facilities were more for paddy growers. The overall human capital index was more for paddy growers (66) than taro growers (50). Sheela Immanuel *et al.* (2019) and Jaganathan *et al.* (2019) reported similar findings.

Physical Capital Index: Physical capital is the basic infrastructure and an indicator for the development status of the villages. It includes transport facilities, housing type, drinking water facilities, electricity and cooking fuel available to the growers. Infrastructure is commonly a public good that is used without direct payment, consisting of changes to the physical environment that help people to meet their basic needs and to be more productive (Jonathan, 2000). Physical capital includes productive assets that can be used as tools and communal assets such as access to roads or local infrastructure (De Sherbinin *et al.*, 2008).

It is inferred from the Table 4 that all the villages were electrified which indicates the progress witnessed by the villages. Housing, drinking water and fuel facilities were more for taro growers than paddy growers. Transport facilities was more for paddy growers than taro growers. The overall physical capital index was more for taro growers (73.6) than paddy growers (69.5).

Table 4: Physical capital index of taro and paddy growers

Parameters	Taro growers (n=50)	Paddy growers (n=50)
Transport facilities	41.3	51.0
Housing type	57.3	52.0
Drinking water facilities	74.0	70.0
Type of fuel	95.3	74.7
Electricity	100.0	100.0
Physical Capital Index	73.6	69.5

Social capital Index: Social capital implicates social resources including informal networks, membership and relationships of formalised groups and trust that facilitate cooperation (Clark and Carney, 2008; Sayer and Campbell, 2003). Social capital has direct link with the development of the society and the livelihood of the people. If a society is progressing it means that the people are progressing because society is a fabric of people. The components under social capital were relationship within the communities, membership in organisations, access to society, access to agricultural information and communication facilities available in the village. Social capital is the most important resource available in the rural communities as they have a strong societal tie up.

Table 5: Social Capital Index of Taro and Paddy growers

Parameters	Taro growers (n=50)	Paddy growers (n=50)
Social relationship	58.7	65.3
Membership in organisation	80.0	54.0
Access to organization	61.3	68.0
Access to agricultural information	56.7	74.0
Communication facilities	52.7	48.7
Social Capital Index	62.0	62.0

From Table 5, it is observed that social capital index was similar to both the growers. Similar results were reported by Jaganathan *et al.* (2019). Membership in organisations was more for taro growers (80) when compared to paddy growers (54). However, access to organisations was slightly more for paddy growers. This could be due to more number of meetings/ trainings organized by department/paddy farmers society. Though communication facilities were more for taro growers (52.7), access to agricultural information was more for paddy farmers (74) which was due to the fact that paddy was a major crop and farmers were given more information through various TOT programmes including social media. Shinogi *et al.* (2019) reported that sustainable livelihood of farmers who practiced organic-by-default system and traditional homestead organic system were severely affected with lack of technological backup because of inaccessibility to information sources.

Financial capital index: Financial capital includes annual income, access to credit, savings, and the borrowed capital. Financial capital is very crucial for growth and

development in a society. Farming community is largely supported by financial institutions for enhancing their farm activities. The Government is also improving the financial capacity of the farmers by providing them subsidies, loans and grants. Various farmers oriented schemes are operated for the welfare of the farmers. Financial capital enables people to opt for other livelihood strategies.

Table 6: Financial Capital Index of Taro and Paddy growers

Parameters	Taro growers (n=50)	Paddy growers (n=50)
Household income	44.0	36.9
Credit availability	59.3	70.7
Savings	38.0	15.0
Borrowed capital	22.0	26.0
Financial Capital Index	40.8	37.1

The analysis clearly indicated (Table 6) that the credit availability for paddy growers was more (70.7) when compared to taro growers (59.30) whereas, the savings of the paddy growers was very low (15). Paddy is a capital intensive crop and moreover the land holdings of the farmers was also very less. Most of them had large family size and this could also be one of the factors for low savings. The household income was more for taro growers (44) when compared to paddy growers. The overall financial capital index was more for taro growers (40.8) than paddy growers (37.1).

Poor farmers as well as the medium farmers usually avail loan of 40% towards meeting natural calamities faced in their agricultural and livestock sectors (Swathi Lekshmi, 2008). Access to agricultural credit is an important element in empowerment process (Kirsten *et al.*, 1998; Hedden-Dunkhorst *et al.*, 2001).

Natural Capital Index: Natural capital includes the land area owned by the growers, ownership status of cultivable land, type of land and also the number of crops grown by the farmer. Most of the agricultural activities depend on the natural capital. If the natural resources are conducive and favourable, it will contribute to the agriculture development in the rural areas.

It is revealed from Table 7 that the index for area of land for paddy growers was more (50.50) when compared to taro (47.0) as paddy was a commercial crop. More farmers in both the category were having

Table 7. Natural Capital Index of Taro and Paddy growers

Parameters	Taro growers (n=50)	Paddy growers (n=50)
Area of land	47.0	50.5
Ownership of land	94.0	98.0
Type of land	93.0	82.0
Crops grown	62.8	42.4
Coping with natural calamities	48.0	43.7
Natural Capital Index	69.0	63.3

their own land. Taro growers were following cropping systems involving two to three crops which resulted in more index for crops grown (62.8) than paddy growers (42.4). Sharma *et al.* (2019) reported that the incorporation of oilseed and pulses ensured livelihood security of the farmers by producing necessary household items on his own farm and generating more employment during lean period. The index for type of land and coping with natural calamities were more for taro growers. The overall natural capital index was more for taro growers (69) than paddy growers (63.3). Access to natural capital may facilitate improvements to other livelihood assets such as financial capital for income generation through productive means (Pereira and Shackleton, 2006).

Rural Sustainable Livelihood Index: The sustainable livelihood index of taro and paddy growers was analyzed and the results are presented in Table 8. It is revealed that the rural sustainable livelihood index was marginally more for paddy (60) than taro growers (59). The human capital index was more for paddy growers (66) when compared to taro growers (50). Physical capital was high for taro growers (73.6). Physical capital was more when compared to all other capitals which is an indicator for the development of the agricultural villages in Odisha. Similar findings were reported by Sheela Immanuel *et al.* (2017) and Jaganathan *et al.* (2019). Social capital is same for both the growers (62). Financial capital was more for taro growers (40.8). Natural capital was also higher for taro growers (69) than paddy growers (63.3). The association or similarities of mean values of different capitals between taro and paddy growers is given in Figure 1. Similarities between capitals of taro and paddy growers are in the decreasing order with respect to physical, natural, social, human and financial capitals.

Sheela Immanuel *et al.* (2019) and Jaganathan *et al.* (2019) reported that physical and natural capitals were

Table 8: Comparison of the different capitals between Taro and Paddy growers

Capitals	Taro growers (n=50)	Paddy growers (n=50)	Ranking
Human Capital	50.0	66.0	IV
Physical Capital	73.6	69.5	I
Social Capital	62.0	62.0	III
Financial Capital	40.8	37.1	V
Natural Capital	69.0	63.3	II
Rural Sustainable Livelihood Index	59.0	60.0	

Physical > Natural > Social > Human > Financial

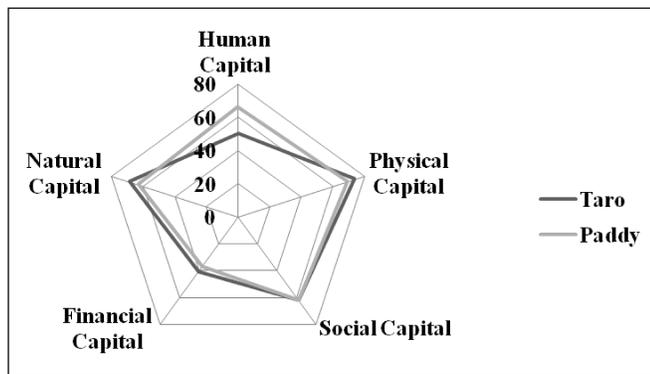


Figure 1: Livelihood capital asset pentagon for taro and paddy growers

higher while those for social, human and financial capitals were lower among cassava growers in Tamil Nadu and sweet potato growers in Karnataka respectively. Major sources of livelihood as reported by both the farmers were agriculture, employment in private sector and petty business. The vulnerability factors were price fluctuation, climatic variations and increased labour cost. The trends observed were high input cost, climate change and labour shortage. The constraints reported by the taro and paddy cultivation farmers were ranked based on mean score. Lack of market facilities was ranked first with a mean score of 2.51 out of maximum score of 3. The other constraints reported by the taro farmers were price fluctuation (2.21), lack of irrigation facilities (2.04), wild animals attack (1.98) non availability of skilled labour (1.74) and incidence of pests and diseases (1.72). Lack of irrigation facilities (2.35), weather aberrations (2.15), incidence of pests and diseases (2.0), non availability of skilled labour (1.98) and non availability of quality seeds (1.93) were perceived as major constraints in paddy cultivation.

Strategies for livelihood improvement: Livelihood analysis revealed that taro being a tropical tuber crop with high yielding potential and nutritional qualities contributes significantly towards livelihood security of

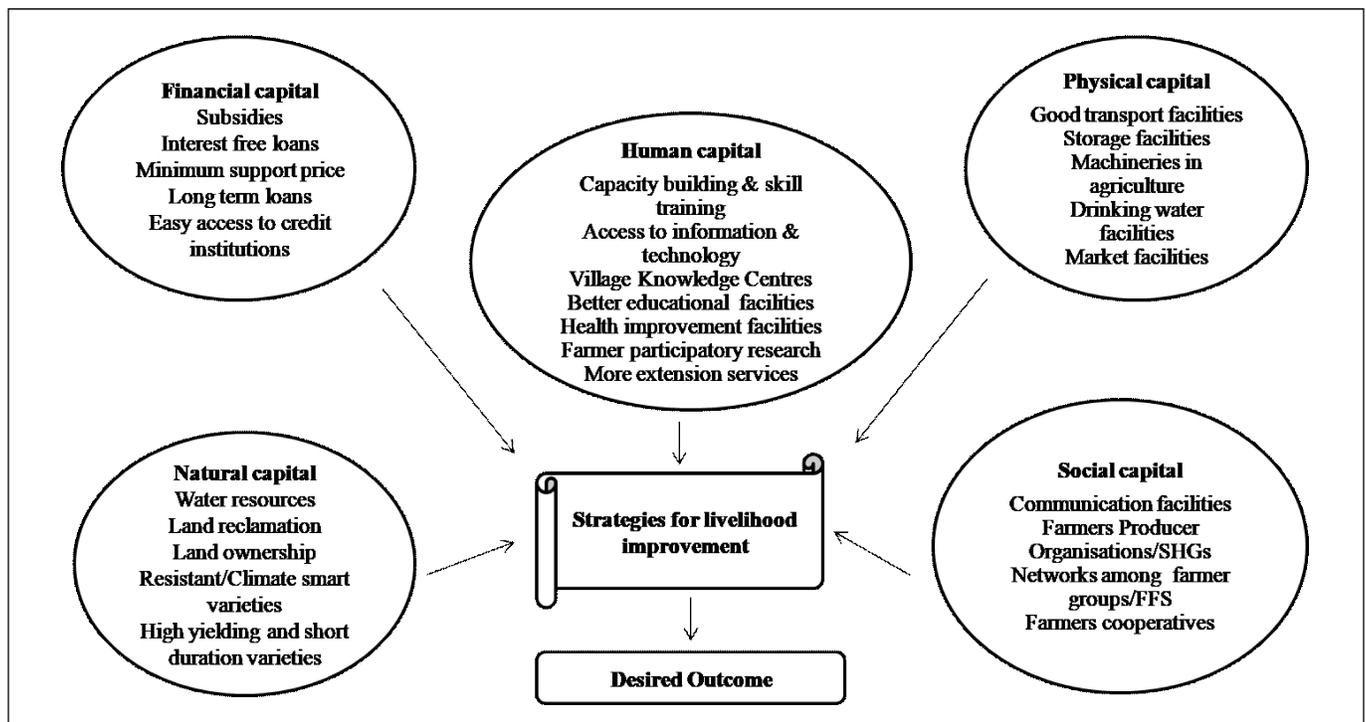


Figure 2: Strategy for sustainable livelihood improvement of taro and paddy growers

the growers. Tuber crops based cropping/farming system may be adopted in large scale to double the farmers' income keeping in view of the demand for the produce in domestic and international market. Sequential cropping of taro followed by cereals and pulses may be adopted to maintain the soil fertility which in turn will help in food and nutritional security. The rural sustainable livelihood indicated the relative importance and the role of each capital for the development of farming and their livelihood. Reduction in human and financial capital would inhibit the development of taro and paddy growers. So, more opportunities need to be given to the farmers to improve their skill and knowledge through training programmes. To improve their credit, more support to be given to them through strengthening of rural banks/cooperative organizations. This would enable improvement of other capitals, thereby contributing to the improvement of the livelihood of taro and paddy growers. The overall strategy for sustainable livelihood improvement of taro and paddy growers has been formulated and depicted in Figure 2. Strategies under each capital is important to address the issues pertaining to each capital. Moreover, all five capitals are interlinked with each other for sustaining the livelihood security of the farmers. All these strategies are to be followed to improve the livelihood security of taro and paddy growers in Odisha in general and Nayagarh district in particular.

CONCLUSION

The study has analyzed the livelihood status of taro and paddy growers using sustainable livelihood framework. Among all the capitals, financial capital is the main string in the chain of growth and development for which interventions in the form of financial packages need to be given to the farmers for enhancing their financial status. In addition, area expansion of both the crops is also possible if they are provided with financial support in the form of subsidies and credit. Human capital needs few interventions viz., capacity building and enriching their knowledge in using scientific methods of cultivation for better production, productivity and farm income. The livelihood status of taro growers is more or less similar to paddy growers hence taro cultivation could be popularized in similar areas without compromising their livelihood status.

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