



SUSTAINABLE AGRICULTURE THROUGH MINOR IRRIGATION TANKS IN MALKANGIRI DISTRICT OF ODISHA

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Introduction

Sustainable development implies the benefits of increasing per capita utility of well being for a long period of time (Mishra, 2002). Most of the economists interpret sustainable development as sustainable utility. Hartwick and Solow proposed non-declining consumption as sustainable development where the stock of capital do not decline over time. (Pearce et al, 1990, Turner et al 1991) The World Commission on Environment and Development (The Brundtland Commission) has offered the most widely popular definition about sustainable development. It refers to development that meets the need of the present without compromising the ability of the future generation to meet their own needs (WCED, 1987, P. 43).

Sustainable agriculture is a multi-dimensional concept where as from a biophysical perspective, agriculture effects to soil fertility, climate and pests, from economic perspective point, agriculture is an enterprise at the farm level and an important sector at the regional or national level. From a social perspective, agriculture is viewed at the macro-scale as a producer with a focus on its ability to satisfy requirements for food and fiber. Douglass (1984) identified three different views of agricultural sustainability on the basis of food sufficiency, sustainability of stewardship and sustainability of community. As stated by Pesek (1994) sustainable agriculture contains three broad important criteria like, environmental and ecological soundness, plant and animal productivity and socio-economic viability. For the growth, it is based on poverty alleviation, natural resource conservation and environmental protection. In many developing countries potential on agricultural output is lost due to wrong decision making process. To achieve sustainable development, government is projecting and establishing large dams. This type of input use for more output in agricultural sector never find the criteria of agricultural sustainability. It needs the consideration to identify all its positive and negative impact before the implementation. Research and promotion of sustainability as a set of strategies that become an important part of decision maker. Interpreting large dam to achieve sustainability in agriculture is not always useful. This type of investment is characterized as capital intensive and is based on modern mechanism.

Change is required in decision making before the construction of Large Dam Projects (Smith and McDonald, 1998). So Technique of Minor Irrigation Projects has a pragmatic value for sustainable development in agriculture, which has less ecologic, economic and social negativity. The theory has appropriately recommended to Rehabilitate East Bengali Settlements of Malkangiri district of Odisha. In this context, Minor Irrigation Tank located in the middle part of MV-79 and MV-80 Bengali Settlement are selected for zoon vision to deduce the inferences.

Objectives and Methodology

The Paper is intended to pursue the following objectives;

- To know the nature and extent of village tank in providing water for cultivation and to maintain percolation potential of rain and drain water.
- To point out the geographical barriers and obstacle for agricultural development in the district.
- To examine the types of agricultural practices by the Rehabilitated Bengali Farmers in the district.
- To find out the Role of Minor Irrigation Project (Tanks) in sustainable agricultural development and to appreciate income generating capacity of the Rehabilitated Bengali farmers in the district.

The methodology here is analytical and descriptive. Secondary data are collected from various printed office documents and books. Primary data are collected from the field survey for processing to deduce the inferences.

Profile of Malkangiri District

Malkangiri District is located between 17° 45' to 18° 22' North Latitude and 81° 26' to 82° 23' East Latitude. It is the Southernmost District of Odisha. The District covers an area of 6190 Sq. Kms. which is 3.92 percent of the State. The District is bounded by Koraput District of Odisha in North, Baster District of Chhatisgarh to West, Khammam and East Godavari District of Andhra Pradesh to South and Vishakhapatnam. As human settlement, Malkangiri is said to be existing since 25 thousand years ago. The tribal concentration is 57.54 percent in District. The average annual rainfall in the District is 1385mm (ITDA, Malkangiri). The district has a sub-tropical climate with hot and dry summer and pleasant winter. The South-West monsoon is the pleasant source but rainfall is uncertain and erratic. There are 932 villages and 213 MV and MPV



hamlets in the District. Since 1961 to 1991 the sub division (Declared as District on 2nd October 1992) adapted primitive method of cultivation. Only 31000 he. of land was cultivated with dry farming and with single crop. The economy of the region was backward and primitive with least development. About 91.8 % of the total population in the district live in rural areas and 8.2 % of population reside in urban centres.

Dandakaranya Project

When India achieved its liberation from British colonial occupation ‘Two Nations Theory’ was emerged. The Hindu people residing in the land of East Pakistan (Bangladesh) moved to India as refugees. The refugee People were rehabilitated and resettled in India in three phases. People were settled at West Bengal State and in second phase some of them were sent to take home at Assam and Tripura. In the third phase some of them were decided to send Madhya Pradesh (now in Chhatisgarh) and Odisha. The Dandakaranya Project (DNK) was envisaged on 12th September 1958. The Project was set up after the recommendation by a High Power Committee known as AMPO committee with its headquarters located at Koraput of Odisha (<https://www.revolv.com>). In 1962 the East Bengali People were brought to Malkangiri by the Central Government with the cooperation of State Government in a special rehabilitation and settlement package known as Dandakaranya Project (DNK).

Causes of High Population growth in the District

According to 1971 Census, the total population of Malkangiri was 2.69 lakhs where in 1961 the population was 1.42 lakhs. Thus, there was a net increase of 1.27 lakhs population in that decades with a growth rate of 89% due to the influx of East Bengal Refugees who settled in this area by Dandakaranya Development Authority. Other reasons of this growth of population can be attributed to the opening of Governments Developmental Programmes and Policies. The steep fall in the death rate are due to effective control of epidemic like, Malaria, T.B, Cholera, Dysentery, and other similar diseases. There has been a control of malnutrition through different measures by different sectors. The villages settled in the area are called as MV (Malkangiri Village) and MPV (Malkangiri Potteru Village).

The region is the border and remote area of Odisha having varieties of communities and attracted the Telugu, Tamil and Hindi speaking people to make them a permanent settler in the area. In addition to it, people from the other district of Odisha also found in a good number who are performing their duties in various sectors. Some of them are involved in service, contracting, trading and other commercial activities. The district is the home land of eight ethnic tribe like, Koya, Bonda, Paraja, Paranga, Gadaba Didayi. Kondha and Bhumia including two tribes namely Bonda and Didayi, the real primitive tribe in the region.

Major Geographical Barriers in the District

Malkangiri district has much diversity in the ground of geographical area, people and forest. The district distinct from dense forest terrains, far flung cut-off area of reservoir and the monotony of life. In the up-land and hills, shifting (Podu) cultivation is ongoing and people adopt the practice of mixed cropping. The district is a plateau of 500 feet from Mean Sea Level (MSL). It is a comparatively a flat and plain area but a number of rocky wooded hills and some of them rising to a considerable height which break the monotony of plain.

Table 1: Remote and Challenging Areas in the District

S. No	Name of the Block	Gram Panchayat	Geographical Barrier	Mode of Transportation	Distance from the district headquarters(Kms)
1	2	3	4	5	6
1	Kalimela	Poplur & Kurmanur	Hilltop Habitation	Metal hill slops	55
2.	Kairiput	Andrahal Mudulipada Baddural Mapond	Hilly pocket	Hilltop Bonda Habitat, Metal Road	52
3	Kudumuluguma	Badapada Jodaamba Panasput Papermetla Andrapally	Reservoir Cut-off Area	Lunch	80

Source : Dandakaranya Report, 1998



The District is peculiar for hilltop habitations, hilly populated pockets, reservoir cut-off areas with lunch communication and footways to different part of the Block like Kalimela, Khairiput and Kudumuluguma in the District (Table-1).

Land Topography in the District

The District is bounded by high mountain ranges and hill slopes in all the sides. The catchment area of two major rivers i.e. Sabari and Sileru (Tributary of Godavari). The topography of the District points out that the high land in the district is 69,500 ha. Incorporating of 23100 he. low land (Table-2). The District is having higher percentage of high-up land which is an obstacle of agricultural growth.

Table 2: Different land topography in the district

S. No	Types of Land	Land (in Hect.)
1	2	3
1	High-up land	69500
2	Medium land	35600
3	Low land	23100
Total		128200

Source: DAO, Malkangiri

Agricultural Practice in the District

Paddy is the principal crop in the district. Beside paddy, a good variety of crops are cultivated during Rabi and Khariff seasons. The other crops like till, ground nut and vegetable are produced. A list of various crops grown in the district is in Table- 3 shows that large part of the total cultivable area is in the form highland, which is suitable for Rabi crop.

Table 3: Crop grown in Malkangiri District

S. No	Species	Variety of Crops
1	2	3
1	Cereals	Paddy, Wheat, Maize, Ragi
2	Pulses	Greengram, Blackgram, Horsigram, Mung, Biri, Kulthi
3	Oil Seeds	Til, Ground nut, Musterd, Sun Flower
4	Vegetables	Sweet potato, Onions, Other Vegetables
5	Spices	Chilly, Garlic, Ginger
6	Fibre	Cotton, Jute
7	Others	Sugarcane

Source: DAO, Malkangiri

Irrigated and Non- Irrigated Cultivable Land in the District

Instead of a great obstacle and geographical hindrance people cultivate a higher percentage of different categorised land to produce different crops in the region.

Table 4: Irrigated and non-irrigated land used in agriculture

S. No	Types of Land	Land (in Hect.)
1	2	3
1	Total irrigated land	93390
2	Total non-irrigated land	48170
3	Total Cultivable Land	141560

Source: DAO, Malkangiri

A total area of 141560 he. of land has been cultivated incorporating of a total irrigated land 93390 hect and corporating 48170 he. of non-irrigated land (Table-4).

Different categories of Irrigated land used in Agriculture

The status of water availability varies over season and quantity depends on different type of irrigation sources in Malkangiri district . Water obtained from major medium, minor irrigation tanks through lift irrigation and from many perennial source. The area has been provided six categories of irrigation facilities for cultivation. Potteru Irrigation Project (Major irrigation) and medium have irrigated 34650 he. of land Rabi and 70300 Khariff. Minor irrigation Project provides 40860 he. of land in Khariff and 35.10 he. Rabi which is pertinent to the study. The supply of water to the cultivated land through other source is



2959 Karif and 2313 in Rabi. in Jalanidhi 107 he. Irrigation potential which is lowest potential in comparison to other source of irrigation. The irrigation potential created and status of water availability under different type of irrigation source in Malkangiri district is present in Table- 5.

Table 5: Irrigation potential from different sources in the district by 2015 (000 He.)

S. No	Sources	Irrigated Land Khariff	Irrigated Land Rabi
1	2	3	4
1	Major & Medium	70.030	34.650
2	Minor Irrigation	40.86	0.351
3	Lift Irrigation	6.748	3.775
4	Deep Borewell	7.350	1.974
5	Other Source	2.959	2.313
6	Jalanidhi	0.107	000
Total		91.28	43.063

Source: IISCWR, Korapat, Sunabeda, 2015

Irrigated land under Khariff outweighs irrigated land under Rabi.

Minor Irrigation Projects in the District

Minor Irrigation has a predominant role in agriculture as well as fishery development. All the tanks are used for both purposes in different block in the district. Most of the Bengali rehabilitees are efficient and skilled in fishing. They have been engaged in fishery for selling and domestic use (Table-6)

Table 6: Irrigation sources for agriculture and fishery development in the district

S. No	Types of Source	Nos.	Area (Ha.)
1	2	3	4
1	Minor Irrigation Project	26	286.465
2	Private tanks	5260	1572.89
3	Revenue Tank	150	180.00
4	Grampanchayat Tanks	887	779.84

Source: Various sectors in Malkangiri, 2007

The major source of irrigation in Malkangiri district constitutes private tanks and GP Tanks

The table-7 below shows the government facilities for minor irrigation through tanks and diversion weirs . It is seen that most of the tanks have a highest potentiality of supplying water to the cultivable land.

Table 7: Minor Irrigation Project and its potentiality for cultivation in the District

S. No	Name of MI village	MI Type	Block	Ayacut (Hec.)
1	2	3	4	5
1	Kalimela	Tank	Kalimela	46
2	Podia	Tank	Podia	229
3	Anantapali	Tank	Kalimela	160
4	Moranpalli	Tank	Kalimela	40
5	Ballisagar	Tank	Malkangiri	54
6	Sabram Nala	Diversion Weir	Kairiput	42
7	Mathili	Tank	Mathili	49
8	Bijaguria	Tank	Mathili	45
9	Hatimbu	Diversion Weir	Kudumuluguma	81

Source: Dandakaranya Project report, 1898

N.B:- Block of Kurukunda and some part of Mathili and Malkangiri block are not included in the above table.



Link between Potteru Irrigation Project and Minor Irrigation Projects in the District

The potteru Irrigation Project(PIP) which was taken up in 1972 holds the key factor for the speedy economic growth by providing water supply to 60000 he. each in Khariff and Rabi in the District. The Project was completed in 1998-99. Now the two main canals with its minors sub-minors and distributaries are providing water to 60 000 hectares of cultivable land in 4 blocks namely, Malkangiri, Korkunda, Kalimela and Podia. Forty thousand of Adivasi people and Resettled East Bengali People of 155 villages have been benefited, The increase net crop area from 750 he. in 1971 to 125 000 he.in 1999-2000 (both Khariff and Rabi) is the cause of development. Conservation of water through Minor Irrigation Project is possible due to the supply of Potteru Irrigation Project but water supply has been neglected by the Potteru Irrigation Project Authority for various reasons. It is found that water supply has not been undertaken at the time of non monsoon period. So, Minor irrigation has a predominant role in agricultural sector by conserving the canal water through big tanks located in different areas in the District. Malkangiri District is renowned for paddy, til and groundnut cultivation which has a greater share in the production of agriculture to the State. Human development Index shows that the upliftment of Koya people is possible due to the entry of Bengali people in this area. According to an official estimate Resettled Bengali People of Tamasa Grampanchayat earned a sum of Rs. 20 crores from groundnut with a part time supply of water to 1500 acres of land during 1999-2000 (Collector Office, Malkangiri).

Sustainable Development in Agriculture of Individual Farms through Minor Irrigation Tanks

Agriculture is the main occupation of the vast majority of the people. Paddy is the main crop shown during the khariff seasons. Apart from paddy other khariff crops are maize, millet and different type of pulses. In higher altitude above potato is cultivated in khariff. During rabi, oil seeds are the main crops. Pulses and wheat are also grown substantially.

Four individual farms located at the middle part of MV-79 and MV-80 adjacent to a Minor Irrigation Project Tank with a water reservoir capacity of ten acres are interviewed to know their farming practices, use of water from the tank to the cultivable land and their income generating capacity. Two farmers namely Sunabasi Baroi and Kalipad Biswas of MV-79 under revenue village Lachhipeta of Podia Block and two farmers namely Sunil Mondal and Bhupen Halder of MV-80 under revenue village Lugal of Kalimela Block were interviewed on April 2017.

Land under Cultivation and Agriculture Production

Malkangiri district showed wide variation in land use pattern. The land utilization pattern indicates that out of total geographical area, the forest area constitute 156493He. (27.02 %) and the net sown area is 142550 He. The average cropping intensity of the district is 122.4 %.

Table 8: Land and production of Individual farms

S. No	Name of the Farms	Area under cultivation	Types of Agriculture	Types of vegetable	Types of Horticulture
1	2	3	4	5	6
1	Sunabasi Farm	5.5	Pulses and cereals (paddy, mung etc.) Oil seeds(til, groundnut, sunflower)	Brinjal, ladies finger, tomato pea, bean, green leafs, cucumber etc	Mango, jackfruits, Cashewnut etc.
2	Kalipad Farm	5	Pulses and cereals(paddy, mung etc.) Oil seeds(Til, Groundnut, sunflower)	Brinjal, ladies finger, tomato pea, bean, green leafs, cucumber etc	Mango, jackfruits, Cashewnut etc.
3	Sunil Farm	10	Pulses and cereals (paddy, mung etc.) Oil seeds(Til, Groundnut, sunflower)	Brinjal, ladies finger, tomato pea, bean, green leafs, cucumber etc	Mango, jackfruits, Casewnut etc.
4	Bhupen Farm	5.5	Pulses and cereals(paddy, mung etc.) Oil seeds(til, groundnut, sunflower)	Brinjal, ladies finger, tomato pea, bean, green leafs, cucumber etc	Mango, jackfruits, Cashewnut etc.

Source: Compiled from Primary Data

It is evident that, Sunil farm cultivating 10 acres of land with higher number of agricultural products which is higher than other farms. All four farms are producing same varieties of products in their farms. Basically, all farms are practicing agricultural (both rabi and khariff), vegetable and horticulture production (Table-8).



Using of Irrigation from Different Source

The farms are using different source of irrigation facilities available to them. Rain water and Tank water undertake a predominant role in production which is 30 % and 60 % in Kalipada Farm and 40 % and 69 % in Bhupen farm respectively. (Table- 9).

Table 9: Sources of irrigation used by the farms (in percentage)

S. No	Name of the Farms	Lift irrigation	Dugwell	Rain Water	Tank water	Other Source	Total
1	2	3	4	5	6	7	8
1	Sunabasi Farm	18	-	30	50	2	100
2	Kalipad Farm	10	-	30	60	-	100
3	Sunil Farm	30	2	20	45	3	100
4	Bhupen Farm	-	-	40	60	-	100

Source: Compiled from Primary Data

Tank Water Constitutes 50 to 60% of Total Irrigation

Labour is the principal variable input in agricultural production. All the family members of the concern farms are working partly and fully in their farms. But sometimes they are engaging other labours at the time of sowing and harvesting with a labour charge of Rs.220 per day. Most of the time, they are taking the help of their relatives in the work. Sunil farm engaging 48 labours in a year which is highest in comparison to other farms. Kalipad and Bhupen farms both are employing 24 number of labours in a year. (Table-10)

Table 10: Average Labour Engagement

S. No	Name of the Farm	Labour Engaged	
		Monthly	Yearly
1	2	3	4
1	Sunabasi Farm	3	36
2	Kalipad Farm	2	24
3	Sunil Farm	4	48
4	Bhupen Farm	2	24

Source: Compiled from primary data

It is shows from the table-11 that most of the farm requires expenditure at the time of sowing, using of fertilisers, irrigation, harvesting, storing, marketing and for other purposes. The expenditure of Sunil farm is highest in comparison to other farms.

Table 11: Cost of agricultural production in a year (Rs.)

S. No	Name of the Farms	Sowing	Using fertiliser and medicine	Irrigation	Harvesting	Storing	Marketing	Others
1	2	3	4	5	6	7	8	9
1	Sunabasi Farm	1200	3500	3000	1500	-	2500	1200
2	Kalipad Farm	1000	3000	2500	1500	-	2500	1200
3	Sunil Farm	1500	4500	4000	3000	500	4000	3000
4	Bhupen Farm	1200	3500	2500	3000	-	2000	1200

Source: Compiled from Primary Data

N.B. Labour wage also included in all production head and family labour cost is excluded in the table

Earning of Farms from Market

All farms are selling their outputs in MV-79 weekly and daily markets located near to them. Sunil farm and Sunabasi farm also sending their surplus produce occasionally to sell in MV-72 weekly market located 12 Kms to them.



Table 12: Earning from markets in different season

S. No	Name of the Farms	Types of Products	Average income / season (Rs.)			Total (Rs.)
			Rainy	Winter	Summer	
1	2	3	4	5	6	7
1	Sunabasi Farm	Cereals, vegetable, Mango etc .	25000	36000	27000	93000
2	Kalipad Farm	Cereals, vegetable, oil seeds	20000	35000	25000	80000
3	Sunil Farm	Cereals, vegetable, oilseeds, cashewnuts, mango, jack fruits etc.	45000	50000	80000	175000
4	Bhupen Farm	Cereals, vegetable, oilseeds, cashewnuts, mango, jack fruits etc.	15000	30000	45000	90000

Source: Compiled from Primary Data

The table-12 depicts that sunil farm earns Rs.175000 in a year which is more than other farms in the area. Sunabasi farm also earns Rs. 93000 in a year. At the time of interview they have claimed that production of crops during summer is very expensive due to lack of water in the tank and using lift irrigation. The farms are producing cereals, vegetables and fruits. The earning of the individual farms in the table exclude the expenditure like labour wage, selling cost, pesticides and insecticides, fertilizer and expenditure towards irrigation.

Maintenance of Tanks by the MI Department

The minor irrigation tank was constructed by the Dandakaranya Project in 1972 for the betterment of the resettlers of MV-79 and MV-80. After the abolition of Dandakaranya Project, it was handed over to the state government under Minor Irrigation Department. From that day, the tank provides water to the periphery parts of the two villages. It is found from the empirical observation that the tank has been repaired in different heads by different contractors in a tender basis from 1997 onwards. The highest amount of Rs. 7 lakhs was being spent in 1997. The process of maintenance and repairing is continuing till date at the time of requirement. (Table-13)

Table 13: Maintenance expenditure of the tank by M.I. department

S. No	Year	Types of Work	Name of the Contractor	Tender Amount (Rs)
1	2	3	4	5
1	1997-1998	Excavation and tree cutting and Dam repairing	Syamal Haldar	7 lakhs
2	2003-2004	Canal and dam repairing	Panchuram Sarkar	3 lakhs
3	2008-2009	Outlet and Culvert repair	Panchuram Sarkar and Harekrushna Haldar	3 lakhs and 2.5 lakhs
4	2011-2012	Damrepair and Steps construction	Panchuram Sarkar and Yubak Sangha- MV-79	4.5 lakhs

Source: Compiled from Primary Data

Beneficiaries of the MI tank of MV-79 & MV-80.

Table 14: Beneficiary from the tank

S. No	Name of the village	No. of Beneficiary Families (Khariff)	No. of Beneficiary Families (Rabi)	Total land under cultivation(Ac.)
1	2	3	4	5
1	MV-79	27	18	45
2	MV-80	32	17	49
Total		59	35	94

Source: Compiled from Primary Data

59 families have been benefited by Mi Tank having khariff and 35 families being benefited by Rabi cultivation.



Limitations

Conservation of water in the minor irrigation tanks in the district is possible only by Potteru Irrigation Project (PIP) canals and is basically used in non monsoon period for summer crops.

- It is found that water scarcity occurs due to mass demand of water for cultivation in dried summer for groundnuts and vegetables.
- Water let outs of the tank in both the sides of the tank handles by the villagers of MV- 79 and MV-80 need excavation and repair in each year which has been neglected.
- The tender process of the tank for fishing pollutes the water quality and monopoly handle of tank by the auction holder also creates problems in water supply.
- Nearest highlands and cultivated lands which are not seen in radius within 1.5 Kms of the tanks is excluded from benefit of water supply.

Suggestions

- Water regulating committee in the two villages should be formed and organised like Panipanchayat.
- The tank should be excavated in consecutive years and sedimentation should be properly handled and managed.
- Regular water supply of PIP to fill up the tanks in non monsoon period should be taken as a priority basis by Potteru Irrigation Project Authority.
- Government should take initiative to regulate and distribute the water supply through the two outlets (left and right distributaries) equal and proportionally.

Conclusion

The plan for providing sufficient water supply to the cultivable land is the sole motto of DNK authorities which was implemented at the initial phase of the project by establishing big tanks by looking the topology of the land. But this needs regular soil conservation, sedimentation and siltation control, gully control, maintenance of tanks which must be helpful to achieve the Sustainable Agricultural Development of the rehabilitated people those are living to its periphery. The tank of MV-79 and MV-80 helps not only to sustainable agriculture but also to provide financial benefits through auction of the tank for fishing once up to three years for Rs. 7 lakhs which is equally distributed to both the hamlets for the infrastructural development of the villages. More than 59 and 35 families of two hamlets are benefited in Rabi and khariff cultivation. It is found by the application of Cost-Benefit Analysis that the ratio of cost to benefit is 1:5,

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