ARTH GANGA
SAHEBGANJ DISTRICT

Submitted By

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TABLE OF CONTENT

Executive Summary

Sahebganj (also known as Sahibganj) is a scenic town and a port city with the serene Ganga and sturdy hills in the Sahibganj subdivision of the Jharkhand state, India. It is located on the north-east of Jharkhand and situated on the banks of Ganges.

Sahebganj is primarily an agricultural district. Majority of the population is dependent on agriculture. The major crops grown in the district are paddy, wheat, gram, maize. The agro climatic condition of Sahebganj has the characteristics of low water retention capacity of soil, particularly on upland, late arrival and early cessation of monsoon and uneven distribution of rainfall. The horticulture cultivation is almost zero in the district. Vegetable farming needs to develop on a commercial scale through the distribution of improved seeds, planting material and infrastructural facilities such as market, transport etc. In this district, storage capacity is limited. The crops are transported in very little time of harvest so farmers did not get good prices for their crops. Therefore, a storage facility should be developed in this district.

The wetlands in this region are of more significance, with the large number of tanks and ponds. Wetlands are a habitat to aquatic flora and fauna and numerous species of birds, including migratory species. The extensive bed of the Ganges at Sahibganj offers one of the best fields in the state for collection of fish spawn and fishing, it also mitigates floods and recharges the groundwater. The wetlands need to be intact, but at the same time, they need to be planned wisely to support the district economically, socially, and environmentally, which will lead to indirectly relieving of stress from the Ganga river to a large extent. It will also lower the local people's dependence on the Ganga river for their small-scale industry or basic daily needs. It is recommended to promote eco-tourism in the region. The wetlands must be allowed for a limited number of visitors. The economy generated by eco-tourism must be utilized in the maintenance of the hotspot. The awareness campaign like say no to plastics, let us make hills plastic-free must be organized. Strict action for littering, no plastic zone like action must be taken to conserve. Although no formal ecotourism operation has been developed so far, there is a huge potential of ecotourism options available. Different ecosystems like ghats, nature and wildlife along with historical monuments must be preserved, maintained. Since there is a demand for religious, historical and ecotourism, necessary policy decisions must be made to develop the said types of tourism along with their ecosystems.

Jharkhand being rich in forest and minerals, the district has a wide variety of forest covers. Boswellia, Acacia, Butea, Tectona etc are some of the common trees in this category of the forest. However, there is a need for the implementation of a national afforestation programme to restore degraded forest area and increase forest area. The district is also home to various tribes which earn their daily cash through small scale agriculture and selling NTFPs. The major drawback is lack of infiltration of schemes to the tribes. Van Dhan Vikas Karyakram will be the great intervention for economic development of people. Establishment of information & training centres, collection centres should be the priority for the district. Cluster based enterprises can be initiated by the local governments to promote local produce.

In Sahibganj district, thermal energy is the primary source for electricity generation. However, it does not have any running projects for biomass energy production in spite of having large quantities of biomass in forms of municipal wastes, crop residues, food processing wastes etc. Implementation of various biogas generation schemes such as National biogas fertilizer management program, biogas-based power generation program, bagasse-based cogeneration projects in sugar mills power projects based on other biomass, biomass-based gasifier power projects, Industrial waste-based power projects, biomass-based cogeneration power projects for increase generation of biogas and solid waste management, would help in the biomass energy production. In addition to that, increasing awareness would promote the farmers and local citizens about the biogas potential, necessity of solid waste management and efficient use of agriculture and animal waste to produce biogas and fertilizer. Strict policy measures are required to increase biogas production from municipal and industrial wastes.

This research project is focused upon the shortcoming in overall development of the district. It also recommends relevant changes and actions that can support the initiatives to work well. The recommendations of the research are mainly concentrated in the field of biodiversity, biogas, hydropower, wetlands and forestry.

1. District Overview

Situated on the banks of river Ganga, Sahebganj (also known as Sahibganj) is a striking town and a port city with sturdy hills in the Sahebganj subdivision of the Sahebganj district of Jharkhand state, India.

Table 1: Demographics of the District 2011

Area (Sq. Km)	1599.00
Population	1,150,567
Blocks	9
Villages	1819

Sahibganj ranks thirteenth in terms of total population in the state and thirteenth in regard to decadal population growth rate (2001-11) among the twenty-four districts. The district comprises nine blocks, namely, Sahibganj, Mandro, Borio, Barhait, Taljhari, Rajmahal, Udhwa, Pathna and Barharwa.

Figure 1 – Map of District Sahebganj

Location and Geography

The district is bounded on north by the river Ganges and district of Katihar, on the south by the district Godda, on the east by Maldah and Murshidabad districts of the state of West Bengal, and on the west by Bhagalpur and Godda districts.

The district of Sahibganj lies approximately between 24042′ north and 25021′ north latitude and between 87025′ and 87054 east longitude. Sahibganj is the administrative headquarter of the district and situated on the bank of the river Ganges at 25015′ north latitude and 87038′ east longitude.

1.1. Physical Aspects

The district may be divided into two natural divisions on the basis of its geographical location and cultivable land.

First region consists of Borio, Mandro, Barhait, Pathna and Taljhari blocks and lies under the Damin-I-koh area. The hills and slopes are covered with forests, once dense but scanty now. The valleys have cultivable lands, yielding mostly paddy.

The inhabitants of this region are generally Paharias, Mal Paharias and Santhals.

The second region consists of Sahibganj, Rajmahal, Udhwa and Barharwa blocks. This plain region consists of the uplands, undulation along ridges and depressions. The Ganges, Gumani and Bansloi rivers flow through this region. This area has plenty of fertile lands and is richly cultivated. The inhabitants of this region are mainly middle-class people of different castes, Paharias and Santhals.

1.2 Climate

The nearness to West Bengal and varied elevations influences the climatic condition. The district receives an annual rainfall of 1500 mm. and most of the rainfall occurs during the rainy season. During winter it becomes cool and record average temperature of 150 C. but during summer temperature ranges from 30 to 400 C.

1.3 Communication

Roads: - The district has a good network of roadways. No important place in the district is left unconnected by a metalled road.

Railways: - The district is deprived of adequate railway communication as it lies on the Howrah-Bhagalpur loop line. Both the sub-divisional headquarters have railway stations. Presently there is rail connection for Howrah, New Delhi and Patna.

Waterways: -The only navigable waterways are the river Ganges. There are ferry services across the river Ganges between Sahibganj ghat to Manihari Ghat in Katihar district of Bihar, which is directly linked to the Guwahati highway and between Rajmahal ghat to Manikchak ghat in Maldah district of West Bengal.

Table 2: Trends in Gross District Domestic product in Sahebganj at Constant Prices (base 2004-05), Millions in Rs

Year	Sector- wise GDDP				Annual Growth Rates			
	PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR	TOTAL GDDP	PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR	TOTAL GDP

2007	5041	3309	4733	13082				
	(38.53)	(25.29)	(36.18)	(100.00)				
2008	6442	2843	5098	14382	27.79	-14.08	7.71	9.94
	(44.79)	(19.77)	(35.45)	(100.00)				
2009	6049	3046	5865	14960	-6.10	7.14	15.05	4.02
	(40.43)	(20.36)	(39.20)	(100.00)				
2010	6556	3800	6805	17161	8.38	24.75	16.03	14.71
	(38.20)	(22.14)	(39.65)	(100.00)				
2011	7875	4578	7103	19557	20.12	20.47	4.38	13.96
	(40.27)	(23.41)	(36.32)	(100.00)				
2012	8429	4945	7794	21168	7.03	8.02	9.73	8.24
	(39.82)	(23.36)	(36.82)	(100.00)				
2013	9095	5284	8566	22945	7.90	6.86	9.91	8.39
	(39.64)	(23.03)	(37.33)	(100.00)				
Average Growth Rate					10.85	8.86	10.47	9.88
Source: http://data.icrisat.org/district-level-data/ Note: Figure in Parenthesis are percentage share in total GDDP								

2. Quantitative Data Analysis

The aim of Arthganga Project is economic development of the districts alongside Ganga river. This section talks about the data focusing majorly on five sectors namely – Primary, Secondary, Tertiary, Overall Analysis and Shortlisting of key sectors for GDP growth.

2.1 Primary Sector

1. Agriculture

Sahibganj is gifted with sufficient water supply and most of its land is located in the river valley regions. The land is generally fertile and cultivable. More than 93 per cent of land is cultivable in this district. Despite a large population of cattle, the yield of milk in the district is very poor. The extensive bed of the Ganges at Sahibganj and Rajmahal offers one of the best fields in the state for collection of fish spawn and for fishing.

Sahibganj is primarily an agricultural district. Nearly 89 % of the people lie in rural areas which means most of the population is dependent on agriculture. The major crops grown in the district are Rice, Wheat, Gram, Maize etc with major focus on paddy. Paddy is grown as Aghani, Bhadai and Garma crops. The Aghani paddy occupies a maximum of 86.25%, Bhadai covers 13.20% and Garma as low as 0.28%.

Table 3: Trends in Area under Principal Crops in Sahebganj District (in 1000 Ha)

Crop/Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	24.56	37.51	28.92	33.57	33.56	30.69	44.1
Wheat	1.62	3.71	3.35	3.35	3.23	3.58	3.14
Maize	2.34	1.46	1.34	1.33	1.47	3.02	15.64
Chickpea	0.66	3.74	2.37	2.06	1.73	1.19	9.37
Rapeseed and Mustard	0.5	3.25	2.11	1.83	1.63	2.75	14.05
PIGEONPEA	0.27	0.38	0.34	0.11	0.34	0.36	8.95
Total OILSEEDS	0.5	3.25	2.11	1.83	1.63	1.86	1.86

Source: http://data.icrisat.org/district-level-data/

Table 4: Trends in Production of Principal Crops in Sahebganj District (in 1000 Tons)

Crop/Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	38.09	55.38	51.69	58.74	46.47	58.99	79.49

Wheat	2.16	5.46	5.51	4.07	4.02	6.94	4.69
Maize	2.48	1.39	1.43	1.54	1.45	1.71	28.96
Chickpea	0.6	3.47	2.01	1.98	1.59	1.11	9.47
Rapeseed and Mustard	0.46	1.99	2.49	1.92	1.29	2.52	7.45
PIGEONPEA	0.57	0.58	0.47	0.16	0.32	0.67	3.97
Total OILSEEDS	0.46	1.99	2.49	1.92	1.29	1.63	1.63
Source: http://data.icrisat.org/district-level-data/							

Table 5: Variability in Area, Production and Yield of Principal Crops (2010-11 to 2017-18)

	Area (1000 Ha)			Production (1000 Ha)			Yield (Kg/Ha)		
Crop/Year	**Average**	**SD**	**COV**	**Average**	**SD**	**COV**	**Average**	**SD**	**COV**
Rice	33.27	6.28	18.88	55.55	12.89	23.21	1667.71	197.70	11.85
Wheat	3.14	0.70	22.24	4.69	1.50	32.03	1477.24	253.08	17.13
Maize	3.80	5.26	138.41	5.57	10.32	185.47	1091.71	385.15	35.28
Chickpea	3.02	2.97	98.29	2.89	3.04	105.08	929.71	49.43	5.32
Rapeseed and Mustard	3.73	4.63	124.15	2.59	2.26	87.34	856.71	230.88	26.95
PIGEONPEA	1.54	3.27	212.97	0.96	1.34	138.89	1389.29	557.63	40.14
Total OILSEEDS	1.86	0.81	43.24	1.63	0.64	39.11	910.40	180.41	19.82
Source: http://data.icrisat.org/district-level-data/									

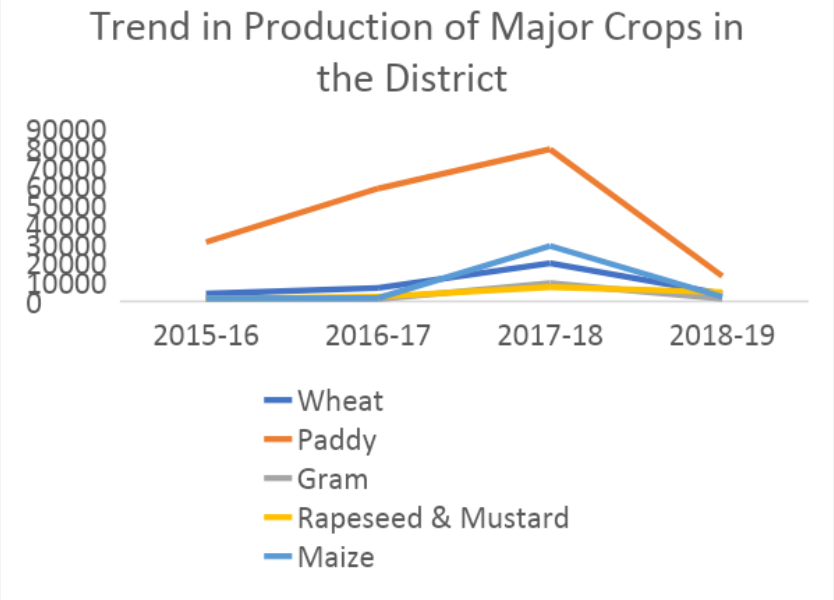


Figure 2

Barley is the most ancient crop of India. It is a Rabi crop sown in October-November. It is grown in Sahibganj with 1.2 thousand metric tonnes production. Gram is another important crop of state. It is also grown in Sahibganj district with a net production of 1.8 thousand metric tonnes. Besides gram other pulses like Mung (kidney bean) Khesari, Masoor (lentil) Arhar are grown.

2. Wetlands

There are many wetlands in the region, but some important wetlands are like Udhwa lake (Udhwa Bird Sanctuary). The region has a large number of tanks and ponds. The data in Table 6 represent the number of wetlands and their area representation in the district. There are around 73 wetlands sized greater than 2.25 Ha and 482 less than 2.25 Ha areas. The region consists of small wetlands, generally less than 200 Ha in the area, but there are 3 wetlands with areas of more than 200 Ha and 1 even more than 1000 Ha.

Only the Sahibganj district of Jharkhand falls directly into the Ganga river basin. The district has 555 wetlands having the area of 16118 ha. Like Uttar Pradesh and Bihar rivers and streams constitute nearly 65% of the wetland area followed by lakes and ponds 17.75% and wetlands <2.25 ha and riverine wetlands. The numerical relation of wetlands is represented below:

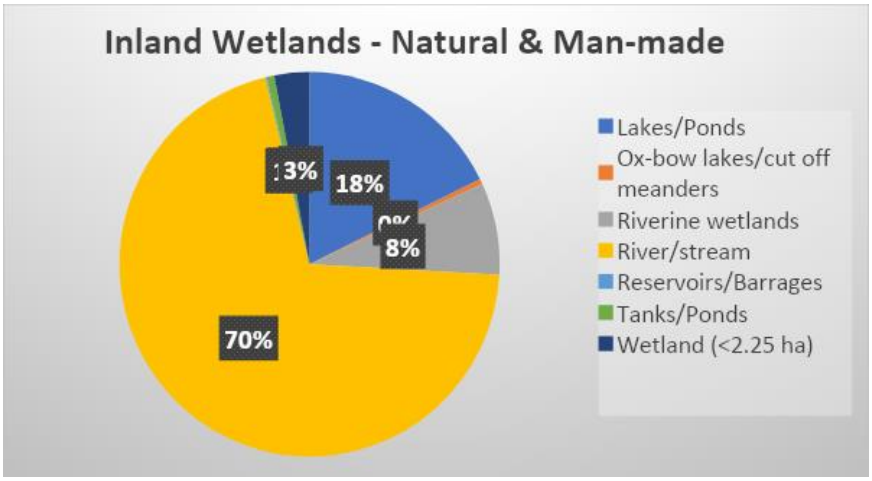


Figure 3 - % of area covered by wetlands

Table 4: Wetland Data of Sahibganj District

Wetland Types	Total Number of Wetlands:			Area (ha)									Aquatic Vegetation
Natural Wetlands	NRCD	NWIA	Diff.	<2.25	<5	<10	<20	<50	<200	<500	<1000	>1000	
Lake/ponds	10	10	0	0	0	0	2	2	3	2	0	1	9

Ox-bow lakes/cut off meanders	13	15	2	0	7	6	0	0	0	0	0	0	0
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	14	14	0	0	0	4	2	2	4	2	0	0	11
Waterlogged	0	0	0	0	0	0	0	0	0	0	0	0	0
River/Stream	0	13	13	0	0	0	0	0	0	0	0	0	0
Man-made Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	**AV**
Reservoirs/Barrages	3	3	0	0	1	2	0	0	0	0	0	0	1
Tanks/ponds	17	18	1	0	10	5	2	0	0	0	0	0	7
Waterlogged	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (555)	**57**	**73**	**16**	**482**	**18**	**17**	**6**	**4**	**7**	**4**	**0**	**1**	**28**

Source: NRCD (National River Conservation Directorate)-NWIA Inventory Data 2007, NWIA Wetland Atlas report

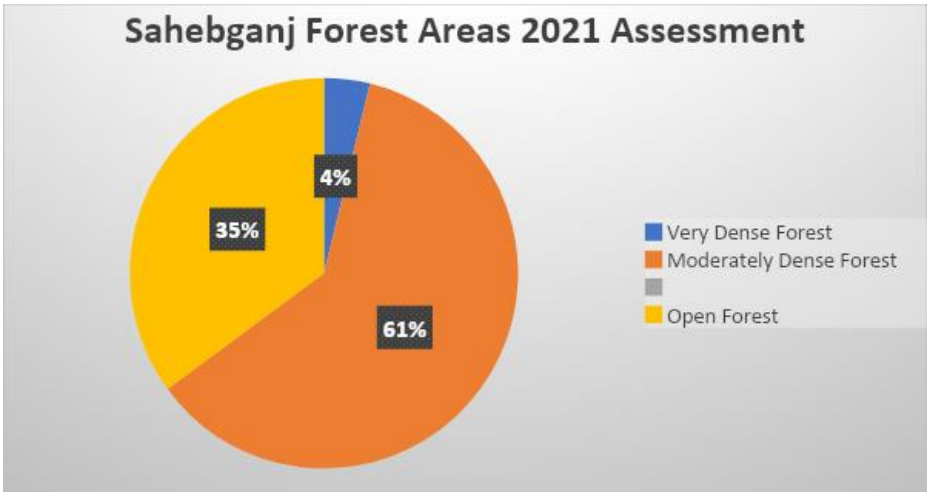
- The district comprises 555 wetlands; most of them are lakes, meanders and tanks. The lake wetland type with a large wetland size of more than 1000 Ha is found in the region.
- The wetland size is small in general
- The number of natural wetlands is more than man-made.

3. Forestry

The State of Jharkhand is rich in forests and mineral wealth. The most common tree found in the district is sal (Shorea Robusta). Some teak, though not of good quality, is also found. Some other trees found in the district are Jackfruit, Murga, Simal, Bamboo, Asan and Satsal. Sal and Simal logs and Jackfruit are exported in large quantities to the neighboring districts and also to the places outside Jharkhand. Owing to large scale unscrupulous felling, the region once known for its thick and extensive forests is now bereaved of much of its jungle wealth. The Forest department has undertaken afforestation of these areas.

The District of Sahebganj has a 1702 Km^2 total geographic area. The forest cover area as per the latest departmental report is 550 Km^2. This is 32.31% of the total area, which is a 4.45% increment to the previous assessment. The state has a total of 23,611.41 Km^2 forest area which is 29.62 % of the total geographic area of the state. Sahebganj district has 21 Km^2 of Very Dense Forest (VDF), 336 Km^2 of the area comes under the category of Moderately Dense Forest (MDF) and 193 Km^2 is open forest (OF) as per the latest assessment. Currently land of 4.79 Km^2 is under afforestation/reforestation schemes. The district consists of protected forest area and reserved forest area as 81.665 Km^2 and 46.881 Km^2 respectively. Udhwa bird lake

sanctuary is located in this district. This sanctuary is a natural abode for different types of birds who reside and migrate here.



4. Livestock

Table 5: Trends in Livestock population (in 1000 numbers) in Sahebganj

Category	2003	2007	2012	2019
CATTLE TOTAL	185.7	304.78	261.98	263.18
CATTLE ADULT MALE	52.24	86.43	77.23	44.76
CATTLE ADULT FEMALE	67.55	110.87	103.94	99.63
CATTLE YOUNG TOTAL	65.9	107.47	80.81	118.8
CATTLE SHARE IN LARGE RUMINANT (Percent)	79.76	82.06	83	84.97
BUFFALO TOTAL	47.12	66.61	53.66	46.55
BUFFALO ADULT MALE	10.81	15.79	14.48	7.73
BUFFALO ADULT FEMALE	20.69	25.71	22.18	17.43
BUFFALO YOUNG TOTAL	15.62	25.11	16.99	21.38
BUFFALO SHARE IN LARGE RUMINANT (Percent)	20.24	17.94	17	15.03
SHEEP TOTAL	3.46	2.2	4.53	3.71
SHEEP SHARE IN SMALL RUMINANT (Percent)	1.97	0.8	1.85	1.03
GOATS TOTAL	172.11	272.59	239.89	354.59
GOATS SHARE IN SMALL RUMINANT (Percent)	98.03	99.2	98.15	98.97
PIGS TOTAL	57.64	52.81	58.97	68.05
LIVESTOCK TOTAL	467.03	699.34	619.75	736.07
POULTRY TOTAL	559.13	690.3	396.91	-1

Source: http://data.icrisat.org/district-level-data/

5. Fisheries

The extensive bed of the Ganges at Sahibganj and Rajmahal offers one of the best fields in the state for collection of fish spawn and fishing. The spawn of Rohu, Katla, Mirga, Catfish and Hilsa is collected from the Barhait valley.

Table 6 – Fish Production in Sahebganj for the year 2015

Achievement of Fish Production in Sahibganj District of Jharkhand (As on November 2015)		
		(In Metric Tonne)
District	**Target**	**Achievement**
Sahibganj	7100	4725
Jharkhand	**120000**	**76230**

2.2. Secondary Sector

1. Industry

The traditional cottage and village industries practiced by the Santhals and the Paharias consist of tasar rearing, village black-smithy, carpentry, handloom weaving, rope making, bidi making, earthenware making, stoneware making, etc. There is no large-scale industry in the area mainly due to lack of infrastructure support, especially in areas of insufficient road connectivity and electrification.

2. Energy

The district receives most of the power supply from the Super Thermal Power Station at Kahalgaon. The Prime Minister, Shri Narendra Modi launched the Pradhan Mantri Sahaj Bijli Har Ghar Yojana - Saubhagya, at Deendayal Urja Bhawan, in New Delhi on September 25, 2017. Pradhan Mantri Sahaj Bijli Har Ghar Yojana - Saubhagya is to provide energy access to all by last mile connectivity and electricity connections to all remaining un-electrified households in rural as well as urban areas to achieve universal household electrification in the country. The electricity connection to households include release of electricity connections by drawing a service cable from the nearest pole to the household premise, installation of energy meter, wiring for a single light point with LED bulb and a mobile charging

point. In case the electricity pole is not available nearby from households for drawing service cable, the erection of additional pole along with conductor and associated accessories shall also be covered under the scheme.

Physical Progress under Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) in Sahibganj District of Jharkhand (As on 31st March, 2019)								
District	Status as on 10th Oct. 2017 (Base Data)		Status as per Data Validation/Reporting by States		Additional Households Electrifed from 1st Feb, Control Centre, etc to (Till 31st March, 2019)	Total Progress	Balance Un-electrified Households	Household Electrification (%)
	Total Households	Electrified Households	Balance Un-electrified Households	Total Households				
Sahibganj	249348	208186	41162	41162	639	41801	-	100
Jharkhand	6749036	5366642	1382394	1382394	148314	1530708	0	-

Table 7 – Progress of Saubhagaya Yojana in the district

2.2.1. Biogas

As per the Ministry of New and Renewable Energy (MNRE), Jharkhand has a potential for 18.2 GW of solar generation and 4.5 GW of biomass generation (MNRE 2020). Despite this, the uptake of renewable energy in the state has been quite low. JREDA and the Ministry of Power and state government have aimed to improve the condition of renewable energy adoption through various policy and incentive-based strategies. The Jharkhand State Electricity Regulatory Commission (JSERC) recently altered the bandwidths for Renewable Purchase Obligations (RPOs). The new regulation mandates that 25% of the total energy requirement of DISCOMs be sourced from renewable energy utilities.

Biogas plants data is unavailable for the district; however, biogas potential can be calculated by knowing the livestock population in the district.

Table 8: Biogas potential from livestock waste.

Livestock	Residue type	Total population as of 2012	Manure yield* (kg/day)	Total manure generation annually (kg)	Average collection (75%)	Dry manure after removing Moisture content	Manure required for biogas* (kg/m^3)	Biogas potential (m^3/yr)
Cattle	Manure	2,61,982	10	95,62,34,300	717175725	143435145	25	5737405.8
Buffalo	Manure	53,655	15	29,37,61,125	220320843.8	44064168.75	25	1762566.75
Sheep	Manure	4,534	1	16,54,910	1241182.5	248236.5	25	9929.46
Goat	Manure	2,39,886	1	8,75,58,390	65668792.5	13133758.5	25	525350.34
Pig	Manure	58,974	2.5	5,38,13,775	40360331.25	8072066.25	25	322882.65
Poultry	manure	3,83,511	0.1	1,39,98,152	10498613.63	2099722.725	25	83988.909

Assumption: manure availability=everyday, moisture content= 80%

Source: ***https://vikaspedia.in/energy/energy-production/bio-energy/biogas***

Table 9 Biogas potential from agricultural waste.

Crop	residue type	Total crop production (tons) (2017-18)	Residue production ratio	Residue amount (tons)	Average collection (70%)	Moisture content	Residue amount after removing moisture (tons)	Biogas potential [m3/(tons of dry matter)]	Overall biogas potential (m3)
Maize	straw	15240	1.5	22860	16002	15	13601.7	800	10881360
Wheat	straw	20026	1.5	30039	21027.3	30	14719.11	800	11775288
Sugarcane	Bagasse	NA	0.33	NA	NA	80	NA	750	NA

Crop data source: http://data.icrisat.org/dld/src/crops.html

2.2.2 Hydro power

The total installed capacity of Small/Mini/Micro hydel power in Jharkhand is 4050 kW, of which DVC owns 4000 kW of Tilaiya SHP and Bihar State Hydro-Electric Power Corporation owns 50 kW (5x10 kW of Portable Micro Hydel Sets) (BHPC). These are some future identified projects in Sahibganj as reported by MNRE.

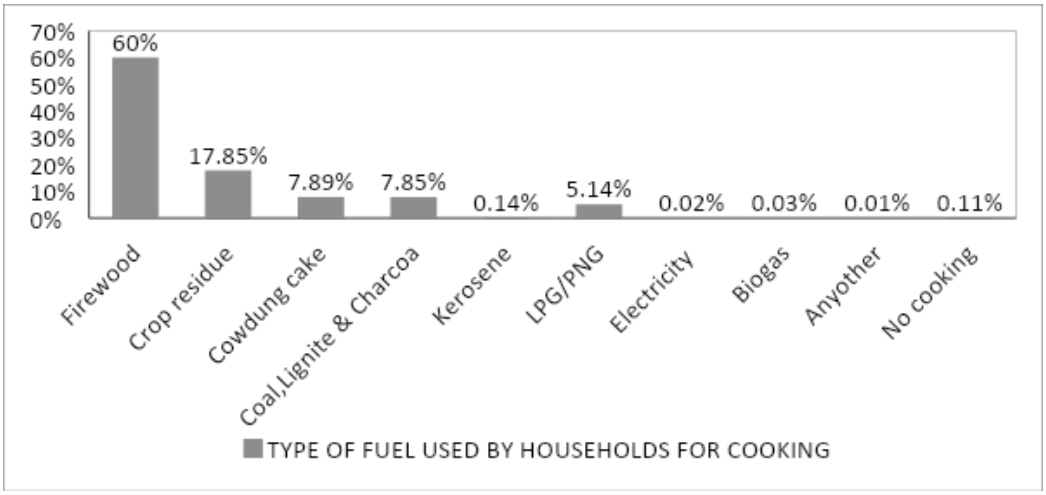
Table 10 Identified future small hydro projects in the district.

S. NO.	Name of Project	Discharge (cumecs)	HEAD (m)	Capacity (KW.)
1	Amarapara	15	30	1200
2	Barijori	15	30	1200
3	Borio	15	30	1200
4	Litipara	15	30	1200
5	Pakuria	15	30	1200
6	Pathna	15	30	1200
7	Sunder Pahar	8	30	1200
	Taljhar	15	30	1200

2.2.3 Biomass

The Jharkhand Renewable Energy Development Agency (JREDA) is the nodal agency for formulating the schemes and projects related to renewable energy. At present the state seems to be mainly working on solar energy and does not have any specific scheme for biomass energy production. However mini-grid systems are seen as future potential biomass utilizers as their generators would be powered by renewable energy sources. The total biomass availability of the district is 6552095 kt/year.

The district practices agriculture mainly and also depends on cottage industries. The crop intensity of the district is 106% with gross cropped area 62700 ha. Out of the total land area 59200 ha is the net sown area whereas 62400 ha land is fallow. Paddy has the maximum productivity which accounts to 31.74 q/ha, followed by maize (11.40 q/ha), and wheat (17.08 q/ha). The productivity of other crops such as gram, pigeon pea, black gram, lentils, peas, mustard etc. is less than 10 q/ha.



The graph above depicts the type of fuel used by the people of the district. Firewood is the most preferred type of fuel used by the people. Crop residues and cow dung cakes are also used by a large number of households. These three products are an important source for biomass energy production simply setting them to fire does not utilize them to their full potential. Since the district lacks any programs for biomass energy production the need is to start a full-fledged and planned project for utilizing the potential biomass wastes.

2.2.4 Solar

The state has high solar insolation around 300 days of clear sun and offers good sites having potential of more than 4.5 to 5.5 kWh/m^2/day, which the state intends to harness to support energy requirements of the state (State Policy , 2015).

As per district data published, the electricity consumption in 2014-2015 was 964 kWh for the domestic sector, 86 kWh for the commercial sectors, 26 kWh for the industrial sector and around 53 kWh was consumed for public lighting in the district. (District Data)

The district data currently holds no data about total numbers of solar panels installed in the district in the last 10 years. In both rural and urban areas, the data availability for solar plants is not available for the domestic and commercial sector. (District Data)

The current district solar energy production capacity through the photovoltaic solar energy plant is 1424.20 kW. Any quantitative data regarding the solar thermal energy plants and solar concentration power plants is not available. (District Data)

Jharkhand Renewable Energy Development Agency (JREDA) is currently working on the assessment of solar energy potential of the Sahibganj district. (District Data)

In the rural region, total 2469 households utilise solar energy as the main source of lighting. But this is just 5% of total households in the rural area. (District Data)

The numbers in the urban area are not very promising. Urban region currently has 0 households which are totally dependent on solar energy as a source of lighting. Percentage data for urban areas is not available. (District Data)

The current total solar generation energy generation capacity of the district is 1424.20 kW, which is 100% from the photovoltaic solar plants. (District Data). The

installed capacity of grid connected solar plants is zero. In the rural area 42 villages have off-grid solar power plants with the capacity of 569.20 kWp (peak factor). In 2020, a 50 kWp solar plant was installed at Government Polytechnic College in Sahibganj District. (District Data)

Currently the Jharkhand solar rooftop policy 2018 is underway, which has a 5-year target till 2023.

Description	Unit	FY 2018-19	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	Total
Rooftop solar power plant	MW	50	75	100	125	150	500

The minimum size of rooftop solar PV at a single location shall be 1kW. The current cost of solar cells/ plants for domestic purpose as per district data is given in the table below. (District Data)

Capacity	Rate (Rs/kW)	Subsidy (state)
1 kW to 3 kW	45000	18000
3 kW to 10 kW	42000	10920
10 kW to 100 kW	40500	8100

The cost data and subsidy for the commercial sector is not available.

Here's the list of Central and State government subsidies related to the solar energy: (District Data)

Schemes	Central	State
1. DDG	60%	40%
2. Saubhagya	60%	40%
3. GCRT (State Gov. Buildings)	0	100%
4. GCRT (Residential)	As per sl. No. 13*	
5.Solar Street light	0	Rate 13475, subsidy- 8000
6.High Mast	0	100%

DDG: Decentralized Distributed Generation, GCRT: Grid connected solar rooftop

*GCRT Residential Subsidy

Domestic Use up to 3KW plant	40% subsidy
Domestic Use 3 to 10 KW plant	40% up to 3KW and 20% on remaining capacity
Housing Society up to 500 kWp	20% subsidy

2.3 Tertiary Sector

1. Tourism

The northernmost district of Jharkhand, Sahibganj is located at a distance of about 420 km from the capital city, Ranchi, and makes for an ideal weekend getaway on account of its mesmerising beauties. From lakes to rivers and hills to historical sites, there are various tourist attractions here.

Table 12: Number of Houses used for Hotel, Lodge, Guest Houses, places of worship etc. (Total/Rural/Urban) in Sahibganj District of Jharkhand (2011)

District	Total Number of Census Houses	Hotel / Lodge/ Guest House etc.	Place of Worship
Sahibganj			
Total	260993	240	2190
Rural	223450	122	1897
Urban	37543	118	293

3. Qualitative Data

3.1 Agriculture & Allied Sector

1. Agriculture

Sahebganj, the district in the eastern portion of Jharkhand state is basically remote, deprived of proper communications and other developments. The agro climatic condition of Sahebganj has the characteristics of low water retention capacity of soil, particularly on upland, late arrival and early cessation of monsoon and uneven distribution of rainfall, poor water storage and moisture conservation systems for raising rabi crops, early drying of surface water reduces aquaculture and rabi production.

Agriculture is the means of sustenance in the district and is characterized by low productivity, low income in absence of appropriate technologies and lack of access to timely credit forces. Thus, a project on Integrated Farming System (IFS) on enhancing Sustainable rural livelihood security in Sahibganj and Pakur Districts of Jharkhand was introduced in this area to enhance the sustainable rural livelihood security among the farmers.

Major objectives of the project were as follows -

1. New strategies for sustainable systems for crop production and development of farming models and diversification in farming systems through crops, vegetables, fruits, aquaculture and organic farming. Livelihood improvement by diversification of second crop on mono-crop area, vegetable production, aquaculture, organic farming, dairy, poultry & piggery development and medicinal plant cultivation.

2. Introduction of new irrigation modules like flexi-dams, drip irrigation etc.

3. Creation of processing units for value addition and improved market.

4. Increased income by intervention of processing & standardization of farm produces through value addition.

2. Livestock

Acts and Rules related to District Sahebganj are explained in the below figure:

Dairy Entrepreneurship Development Scheme (DEDS)	**Dairy Processing and Infrastructure Development Fund (DIDF)**
• Funded by NABARD • Primary focus - uplift the dairy business in India and assist farmers in generating secondary allied income. • Objectives 1. To generate self-employment 2. To bring about upgradation of quality of milk 3. To encourage heifer calf rearing 4. To bring structural changes in the unorganized sector	• Implemented through National Dairy Development Board (NDDB) and National Cooperative Development Corporation (NCDC). • Set up to provide soft loans to modernise and raise the capacity of dairy cooperatives. • Funding support at an interest rate of 6.5 % p.a. • Aim -creating additional milk processing capacity of 126 lakh litre per day, milk drying capacity of 210 million tonne (MT) per day and milk chilling capacity of 140 lakh litre per day.

3. Biodiversity

Owing to large scale unscrupulous felling the region once known for its thick and extensive forests is now bereft of much of its jungle wealth. The Forest department has undertaken afforestation of these areas. The most common tree found in the district is sal (Shorea Robusta). Some teak, though not of good quality, is also found. Some other trees found in the district are Jackfruit, Murga, Simal, Bamboo, Asan and Satsal. Sal and Simal logs and Jackfruit are exported in large quantities to the neighboring districts and also to the places outside Jharkhand. The extensive bed of the Ganges at Sahibganj and Rajmahal offers one of the best fields in the state for collection of fish spawn and fishing. The spawn of Rohu, Katla, Mirga, Catfish and Hilsa is collected from the Barhait valley. Udhwa Lake Bird Sanctuary is a natural habitat for a variety of birds including Brahminy kites, fishing eagles, house swifts and palm swifts flying at dizzying speeds. A large variety of migratory birds from Europe and Siberia arrive here during winter and this makes it a haven for the birdwatchers. The migratory birds just adore to spend some quality time in the Udhwa Lake Bird Sanctuary that include: - Black-headed and Brown-headed Gull, Grey-headed Lapwing, Little-ringed Plover, Red and Green Shanks, Spotted Green Shanks, Common Sandpiper, Temmink’s Stint, Yellow and White Wagtail, Blue-throat, Western Swallow and others.

As per the Hindustan Times report, the Union government will set up eight biodiversity centres at different locations for restoration of the ancient 'Bhojpatra tree' and many other medicinal plants on the banks of Ganga from Gangotri to Gangasagar. Besides, the centres will work for conservation of Mahaseer (a rare fish), ghariyals, dolphins and turtles. The centres will be established on the outskirts of Narora, in Varanasi and Allahabad (UP), Rishikesh and Dehradun (Uttarakhand), Bhagalpur (Bihar), Sahibganj (Jharkhand) and Barrackpore (West Bengal) under the Centre's flagship programme 'Namami Gange' that is dedicated to Ganga cleaning and conservation.

A national discussion was held on the 28th International Day of Biodiversity on 22 May 2021, and it has been decided in the standards of National Education Policy 2020 that teachers should communicate all the options of environmental protection to the youth through education. For this, seminars should be organized. Discussion should be held so that the importance of environmental protection can be ensured to the next generation. According to Danik Jagran news report on 25 June 2021, Biodiversity park has been marked and to be built in the district.

3. Energy

1. Biogas

Biomass gasifiers capable of producing power from a few KW up to 1 MW capacity have been successfully developed indigenously. A large number of installations for providing power to small scale industries and for electrification of a village or group of villages have been undertaken. The Biomass Gasifier Programme has been requested to bring about better quality and cost effectiveness. The programmes on biomass briquetting and biomass production are being reviewed and a new programme on power production linked to energy plantations on wastelands is proposed to be developed. A total capacity of 55.105 MW has so far been installed, mainly for stand-alone applications. A 5 x 100 KW biomass gasifier installation on Gosaba Island in Sunderbans area of West Bengal is being successfully run on a commercial basis to provide electricity to the inhabitants of the Island through a local grid. A 500 KW grid interactive biomass gasifier, linked to an energy plantation, has been commissioned under a demonstration project. A 4X250 kW (1.00 MW) Biomass Gasifier based project has recently been commissioned at Khtrichera, Tripura for village electrification.

2. Hydropower

Under the Electricity Act 2003 and the National Tariff Policy 2006, the central and the state electricity regulatory commissions should ensure purchase of a certain

percentage of grid-based power from renewable sources. Under the Energy Conservation Act 2001, large energy-consuming industries are required to undertake energy audits and an energy labelling program for appliances has been introduced. At present no hydro power plant has been installed but there are several project sites that have been identified for small hydro power projects in the district. These projects should be installed strategically to minimize impact on the environment. On April 30, 2001, the State Government signed a Memorandum of Understanding with the Government of India to demonstrate its commitment to the reforms in the power sector outlined by the Union Government's Department of Power. The decision has been made to open the state power sector to private investment and to provide all necessary facilitation and incentives to investors. The distribution system is scheduled for privatisation at a later date. Rural electrification has been prioritised. By 2007, all 32000 villages are expected to be electrified. The current electrification rate is barely 15%. This will increase power demand while also providing opportunities for power generation through small-scale hydro power schemes.

3. Biomass

The district Sahibganj does not have any running projects for biomass energy production in spite of having large quantities of biomass in forms of municipal wastes, crop residues, food processing wastes etc. Although the district does not have a good cropping intensity still the biomass potential from agro-residuals is about 3.5 MWe. The district mainly produces paddy which provides husk- a potential biomass energy producer. The district has many rice mills, but unfortunately there are no arrangements for utilization of the rice husk which is produced. The rice husk, maize, organic municipal waste etc. can be used for production of starch based and cellulose based ethanol. The wood waste can be used to make briquettes, pellets etc. The need is to make people aware about biomass energy and to develop infrastructure in the district for biomass energy production.

4. Solar:

The state as well as the district currently do not have any promising figures when it comes to solar heater plants and solar PV plants in urban areas.

As per Ministry of New and Renewable Energy official, ‘Because of mineral dependency or poverty or both, Jharkhand lags on the Indian Government’s Renewable goals’ (Scroll, 2021).

Currently 15 out of 24 district courts in the state use solar energy for lighting. In 2019, Jharkhand announced to set up the country's first floating solar power plant of 150 MW capacity. As per estimate this will cost 600 crore and will provide

employment to around 1000 people. These solar plants will be installed over an area of 1.6 Km^2 at Getalsood and 0.8 Km^2 at Dhurwa Dam (The New Indian Express, 2019).

Currently the state has a variety of schemes from the state government and also from the central government. Jharkhand KUSUM Yojana is the central government scheme permitted by the government of Jharkhand for the farmers. This scheme enables farmers to set up high-capacity solar plants. Farmers can install the solar plants from 500 kW up to 2 MW. Under this scheme the beneficiary gets 30% subsidy from the central government and 30% subsidy from the state government. The government is offering to set up solar panels on arid land of farmers and help them earn money by supplying power to the nearest grid or substation. The payment could be as high as Rs 5 to Rs 7 per unit. The application for the scheme is accepted through online mode. This scheme is for grid connected solar projects. (JREDA website).

The state government also offers off-grid solar schemes. The Pradhan Mantri Sahaj Bijli Har Ghar Yojana or Saubhagya scheme is one such scheme which seeks to ensure universal household electrification to both rural and urban areas by providing last mile connectivity. Solar Water pump is also available to the district. As the district is majorly agriculture-based, farmers can leverage the production using such a scheme. This scheme can directly benefit the farmer's production. State government is also promoting solar PV powered cold storage systems. It is a cold storage facility for storage of fresh horticultural produce. The temperature and relative humidity can be controlled to maintain the freshness of the product. The desired room temperature (5^o -25^oC) and relative humidity (65-95 per cent) can be achieved. Energy output from the solar panel is sufficient to operate the storage. This scheme is very helpful for the farmers whose main products are fruit and milk-based products. (JREDA website)

The current state of Sahibganj district in urban solarisation is very nascent. The urban area requires aesthetics as well as effective power generation. A solar tree is a structure incorporating solar energy technology on a single pillar, like a tree trunk. It can be a solar artwork or a functional power generator. In 2020, the Council of Scientific and Industrial Research in West Bengal installed a 'solar tree.' This tree produces up to 11.5 kW. This tree has 35 panels each with a capacity of 330 watts.

This solar tree has the potential to save 10–12 tons of CO2 from being released into the atmosphere every year. (Hindustan Times, 2020)

During the pandemic it was observed that keeping the freezer and other medical equipment working is important for preserving medicines. So now JREDA has decided to equip all the government hospitals, Community health centres with solar energy. Solar PV panels of capacity 2-4 kW have been decided to be installed at primary health care centres. Out of the 1400 buildings identified for the purpose, installation of solar power plants in 783 buildings have already been completed (The New Indian Express, 2021).

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5. Wetlands

The wetlands are habitats for a variety of species. The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. The district has many potential sources and opportunities to harness valuable products using the scheme and start the pilot project. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. These businesses can be a great opportunity to be turned into a large-scale production hub using the right approach. The region has a good amount of production of handloom works and export materials. The data collected and analyzed shows the region's production and possible product that can be derived from the raw product. The list of sources and the possible products are mentioned below:

- The district stats show a good amount of rice, green gram, wheat, and maize in the region, which can be turned into products like flour.
- The district is famous for handloom weaving, stoneware works, which can turn into decorative items which are in demand in foreign countries.
- The region has a large production of dairy products, which lead to an increase in animal husbandry. Wetlands can support the growth of fodder for animals in the region.
- The region has recommended the production of jack fruits, simal, Asan trees, and their products are exported to the international market
- The region is known for the varieties of fishes like rohu, Katla, mirga and its products like fish oil, etc.

6. Tourism

Jharkhand holds 13th rank in the country as per total annual tourist footfall according to India Tourism Statistics Report 2012. With the increasing count of tourists, the state tourism sector needs to emphasize the tourist facilities such as accommodation, food etc. since these are the factors which can contribute to a wholesome experience of the tourists.

Among all the infrastructure components, accommodation is the most important part of tourism. Jharkhand Tourism Development Corporation Limited (JTDC), Government of Jharkhand (GoJ), is already operating several tourism infrastructure facilities across the State which includes accommodation, tourist information centers, wayside amenities etc. JTDC desires to upgrade and manage it for providing better services to the tourists.

Jharkhand Tourism Development Corporation Limited (JTDCL) intends to appoint an entity(ies) to undertake renovation, operation and management of 09 (Nine) Tourism Properties at Jharkhand on Renovate, Operate, Maintain and Transfer (ROMT) Basis under Public Private Partnership framework. Ganga Bhawan in Sahebganj is one of them.

6.1. Rajmahal

Situated on the right bank of the river Ganges, Rajmahal is a small but historically important town. It was the seat of Government during the Mughal period when Raja Man Singh, general of Emperor Akbar made Rajmahal the capital of Bengal in 1592. Even today relics of the old and prosperous Rajmahal are visible in this one-time capital of Bengal.

6.2. Shivgadi

This Shiva temple is located in the Barhait block 8 K.M north of Barhait and is inside the cave. Water from the mountain drips continuously on the Shivling. Devotees gather here in large numbers on Mahashivratri and the whole of Shravan month.

6.3. Moti Jharna

Moti Jharna is a natural attraction of Sahibganj District. The stream flowing in this place has its source at the Rajmahal Hills. This place is also a popular picnic spot of the district. Moti Waterfall is a village located in Talasari block of Sahebganj district of Jharkhand. The scene here is panoramic. As well as the root of water falling from the waterfalls entices the mind.

6.4. Fossil Park

The Rajmahal hills are home to plant fossils which are 68 to 145 million years old. Way back in 2008, the state government had signed a MoU with the Birbal Sahni Institute of Paleobotany (BSIP), Lucknow, and National Building Construction Corporation for setting up the fossil park. The state government sanctioned Rs 11 crore for setting up the infrastructure and released nearly Rs 4 crore in the last financial year 2018-19 for the park at Mandro, 28km from the district town.

6.5. Palamau Tiger Reserve

An abode to wilderness, the Palamau Tiger Reserve is a serene, wondrous and the only Tiger Reserve in the state of Jharkhand. Beside tigers, one can also have the chance to witness the glorious elephants, magnificent deer species and some agile leopards. Transgressing through this tiger reserve, is the lovely Koel river where the royal tiger takes the gulps of water gracefully.

6.6. Udhwa Bird Sanctuary

Udhwa Bird Sanctuary is spread in 5.65 square kilometers and is the only bird sanctuary of Jharkhand state. This avian habitat comprises two backwater lakes over river Ganges (Ganga) namely Patauda and Berhale. This Sanctuary is famous as a stop point for a large number of migratory birds that come here in winters from Europe and Siberia. The main birds include the pratincole, egret, wagtail, plover, lapwing, stork, ibis and heron, Wader, etc.

7. Forestry

Jharkhand being rich in forest and minerals, Sahebganj has a wide variety of forest covers. The state has a total forest cover of 29.62 % to the geographical area, compared to the district, it has 32.31% forest area. Forest Survey of India has enlisted some of the important tree species found in the district, these species are classified into the two categories as rural and urban tree species. Butea frondosa, Mangifera indica, Shorea robusta, Acacia auriculiformis, Zizyphus jujuba are the top rural tree categories found in the district whereas Mangifera indica, Cassia siamea, Azadirachta indica, Moringa species, Artocarpus integrifolia found in the urban area (FSI, 2019). The most common tree found in the district is Sal (Shorea Robusta). Sal, Simal logs and jackfruit are exported in the neighbouring districts and states.

Forests of Sahebganj district are mainly considered as tropical dry deciduous forests. Boswellia, Acacia, Butea, Tectona, Azadirachta, Lannea and Flacourtia are some of the common trees in this category of the forest. These all the species also have some medicinal use among the tribals. The Central Government through the Ministry of Tribal Affairs has an ambitious working scheme in collaboration with the Jharkhand Forest department to provide minimum support price (MSP) to the minor forest producers (MFP). This scheme covers 12 MFPs as 1. Saal seed; 2. Tamarind; 3. Mahua seed; 4. Chironjee; 5. Karaya Gum; 6. Wild Honey; 7. karanj seed; 8. Saal Leaf; 9. bamboo; 10. Tendu leave; 11. Myrobalan and 12 Lac.

The state government of Jharkhand has also launched the social-forestry scheme ‘Mukhyamantri Jan Van Yojana’. The important goals of this scheme are to conserve the groundwater levels through forestry, increase forest cover, Enhancement of NTFP based employment opportunities, and economic development of farmers through forestry products. The scheme promotes the cultivation of native trees in barren government lands, open public spaces and also promotes farmers to start agroforestry. The district government of Sahebganj provides saplings of all types of native plants through government nurseries at very reasonable rates.

Action Plan Development

1. Agriculture

A. Rainfed Agriculture

In Sahebganj, currently under rainfed conditions only paddy is grown in the district and the land remains fallow during the remaining period of the year. A large diversity of cropping systems exist under rainfed and dryland agriculture over an over-riding practice of intercropping to cover the risk of single crop failure. The soils retain a considerable amount of moisture after the harvest of the wet season which through proper management can be used for the second crop. The best suitable crop rotation considering the soil potential is recommended as under.

1. Rice – Rice
2. Rice-Wheat
3. Rice-Gram
4. Rice-Maize

B. Use of irrigation practices

The soils in the district are suitable for irrigation thus in order to increase agricultural production it is essential to follow irrigation practices. The best possible use of irrigation can be made by making available limited essential water for protective irrigation and using soil moisture in combination with irrigation. The irrigation practices along with modern inputs such as improved seed varieties, fertilizer the yield is expected to be higher i.e. 2.5 times than the rainfed agricultural practices. Two main resources of water are surface water and groundwater which needs to be tapped to increase agricultural production.

C. Production of wheat

The areas near Gangetic plains in the district hold good residual moisture after harvesting Paddy. The area is suitable for growing wheat. The Rabi crops invariably should be supported with productive irrigation through bore wells, lift irrigation through rivers, or canal water to increase the agriculture production.

D. Prawns & Aquaculture Project

The extensive bed of the Ganges at Sahibganj and Rajmahal offers one of the best fields in the state for collection of fish spawn and fishing. There is a good scope to

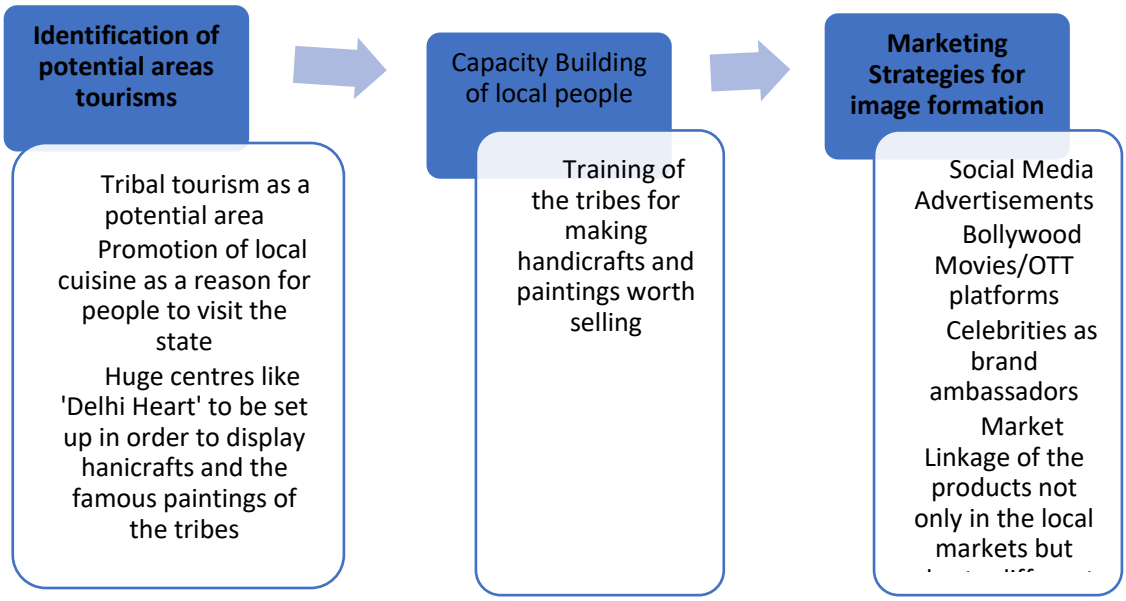
utilize inland water resources to produce fresh water prawns to ensure demand throughout the state and overseas. The state government should undertake steps for the development of aquaculture under the employment guarantee scheme.

2. Horticulture

A very small area of Sahibganj district is covered by land capability class IV (class IV type are soils which have very severe limitations that restrict the choice of plants or require very careful management or both). These soils are suitable for dryland horticultural activities as most of these soils occur at the foot hill thus have low moisture regime. The major fruit crops which could be profitably cultivated in the district are Mango, Guava, Jackfruit, Custard apple, sweet lime, tapioca etc.

3. Tourism

As the action for the industrial corridor is already in progress and the government has already taken up projects in nine districts to improve the infrastructure facilities for tourists. Following are some other ideas which can be implemented in order to increase the footfall in the district.



A. Tribal Culture as a domain of interest: The state of Jharkhand is dominated by tribal culture. The ethnic communities of Jharkhand include the legendary Asuras and Santhals, Banjaras, Birhor, Cheo, Gond, Ho, Khond, Lohra, Mal Pahariya, Munda, Oraon, Kol or Kawar and many more around 32 tribal groups. Each tribe

has its own tradition and culture which for a variety of tourists (both domestic and International) is an area of interest. As with the changing scenario, people now are much interested in the cultural life of tribals other than visiting beautiful places and relaxing.

B. Promotion of local cuisine: With every second person being a food blogger on YouTube, exploring local cuisine as a reason for visiting Jharkhand or any district in Jharkhand can be a very intelligent step while looking for potential areas of increasing footfall in the state. The promotion of this domain can be done by advertising of various OTT platforms, appointing a famous celebrity (belonging to UP or Jharkhand such as Pankaj Tripathi, Manoj Bajpayee as these celebrities have gained more popularity than the mainstream actors by their popular series) specifically for the promotion of local cuisine.

C. Promoting Sahebganj as a tourist destination: There is an urgent need to promote Sahebganj tourism to foreign visitors and all international markets. The tourism ministry should surely pursue aggressive online and other marketing strategies to promote Sahebganj as a must-visit location through seminars and talk shows, joint marketing programmes and use of publicity materials.

D. Art & Culture:- One of the most indigenous traditions in the tribes of Jharkhand is associated with the women practising the Kohvar and Sohrai paintings during special events of marriage, harvest which are then passed down to the younger generations in the form of tradition. The drawings are done through stretching the surface of the walls through nails and compass for edging the petals of a Lotus.

The tribes of Jharkhand have set a standard of their own in matters of wooden and metal masterpieces. Most of the sculptures are made up from Bamboo including the leaves. From the bamboo the door panels, spoons, boxes, rice huskers, bowls and many more include the fishing materials. From the leaves the Pattals are the common form. Sabai Ghaas is woven into pen stands, table mats, letter holders found mainly in the Chaibasa region. In the metals section Dokra has been the world wide attraction to the creation of the Malhar and Tentri tribes of Jharkahand. This forey different forms of animals and objects with core clay jacketed with metal casting. The works of Bell Metals or Kansa with a black finish is also an attraction of the Metal handicraft. Jewelry has also been one of the crafted items of gold, silver and white metal. The common items of craft are the choor, tarpat earrings, flat chain, heart shaped hair clips, Hasli, Mandli Chokers. Sculptures of animals (rhino), gods

and goddesses and Tribal personalities (leaders) carved out of wood set an example of their finest skills. The Clay Pottery is another creation from the soil of Jharkhand.

E. Appointing Brand Ambassador for endorsement Sahebganj: Tourism can be further endorsed by appointing a brand ambassador. It is essential to capitalise on their star value and fan following so that Sahebganj tourism can get a boost and be well accepted by tourists

4. Biodiversity

- **Prepare biodiversity management committee and forest management committee-** by involving local communities and government institutions for implementation of the scheme for biodiversity management, conservation, and sustainable use.
- **Implementation of the National biodiversity action plan-** for conservation, restoration, and maintenance of ecosystem service that benefits all people and results in a healthy planet.
- **School or college level clubs and nature camp program-** Students should be encouraged to form eco clubs and provide them the opportunity to learn, conserve, spread knowledge, and create a network of young leaders to enhance environmental sustainability.
- **Implementation of National Afforestation Programme:** with the help of villagers and government people to restore degraded forest area and increase forest area.

5. Energy

A. Biogas

- Installation of household biogas plants in each district to provide decentralized energy source and management of waste.
- Implementation of New National Biogas and Organic Manure Programme (NNBOMP), for Biogas Plant size ranging from 1 m^3 to 25 m^3 per day.
- Implementation of Biogas Power Generation (Off-grid) and Thermal energy application Programme (BPGTP), for setting up biogas plants in the size range of 30 m^3 to 2500 m^3 per day.
- Providing subsidies or incentives to promote biogas plants in the district.

B. Hydro power

- Implement a small hydro power program and encourage independent private producers in the district to set up small hydropower plants.
- Providing incentives for the capital subsidy, investigating the site, or for renovation and modernization.
- Implementation of river or canal-based hydro projects.
- Promoting small and mini-hydro projects and increasing private investment.

C. Biomass

The district requires a proper project developed considering the resources available in the district. As the data available from the district administration states that municipal wastes along with food processing waste, agricultural residue etc. are produced in large amounts, the foremost need is setting up of a systematic waste management system. This way there will be supply of the waste at one centre position from where it can be accordingly transported to the power stations. People should be encouraged to use briquettes, pellets instead of fire-wood, crop residue etc. as they last long and have low moisture content. Briquettes are comparatively cheaper as well. Rice husk gasifier-based power generation plants should be set up in the district to generate electricity. This would aid in fulfilling the electricity requirements of the district. Provisions should be made for setting up these power generation plants along with the rice mills. Also attention is needed in increasing the crop production of the district. The fallow lands should be made cultivable or utilized for setting up these power plants. This would surely increase the employment opportunities in the district and help in improving the economy and livelihood of the people. Authorities should pay attention to the potential of biomass in the area. Awareness programs should be started to give people knowledge about this form of energy. Those using biomass mass energy sources should be provided subsidies in conventional sources of energy.

D. Solar:

- The **unavailability of the data** is a major problem for the Sahibganj district. Accurate primary data collection about potential rural and urban solar capacity is an important assessment for promoting new schemes and policies to the people. Currently district data provides no study about the potential area, and potential commercial and public institutions that can harness solar energy. (JREDA website)

- As per census 2011, **only 32% of the rural** population had electricity access. While all the main areas of the district have been electrified still the supply of power in the rural areas is not yet sufficient and is an area of major concern. (Census, 2011)
- Major population in the district lives below the poverty line, these families run small scale businesses, the solar PV system can save huge cost and increase productivity by reducing their dependability on grid electricity, which can result in increased production and therefore developed economic conditions.
- JREDA currently has not developed any scalable plan for potential solar thermal power systems and concentrated solar power plants. **Solar thermal systems** can be directly implemented in the **government schools for midday meal programs** in rural areas.
- Concentrated solar power is a suitable option for the villages along the Ganga river in the district rather than coal based thermal plants for electricity.

6. Wetlands

The district comprises some of the healthy and wealthy wetland ecosystems. They directly or indirectly support millions of people and provide goods and services to them. They support all life forms through extensive food webs. They are a habitat to aquatic flora and fauna and numerous species of birds, including migratory species. They mitigate floods and recharge the groundwater. They need to be taken care of and action on different fronts needs to be taken. The action plan below gives a glimpse of the action and development required to protect, conserve, rejuvenate the wetlands existing and extinct.

1. Identification and Inventory
    - The Space Application Centre of ISRO has already made identification of wetlands on the scale of 1:50,000. They need to re-collect the information on the scale of 1:25,000 to gather precise data of small wetlands. Also, they need to re-collect the data on the scale of 1:50,000 to understand the present scenario and compare it with past wetland data.
    - Creating an open-source inventory database. Introducing the data with the total number of wetlands on the area basis.
    - Marking of the name of wetland, altitude, type on the district-wise maps.
    - Criteria for identification of wetlands as those prescribed under the Ramsar convention (9 criteria)
    - Produce regional and national wetland inventories, baseline assessments and monitoring programs.

- Data collection of pre and post-monsoon changes in the size of the wetlands

2. Condition
   - Quantification of woods, fish, species (especially endangered species) and valuable goods provided by the wetland ecosystem.
   - Measurement of the condition of the wetland like water quality, air quality, soil quality and other parameters.
   - Assessment of the impact of wetland degradation on public health, food and productive security, and poverty prevention.
   - Assessment of pre and post-monsoon conditions.
   - Assessment of the recent and past condition of wetlands
3. Research
   - To improve the health of the wetland, both central and state must fund schemes and research
   - Research of sustainable (environmental, economical, social) development of significant wetlands.
   - Research on rejuvenation and restoration of wetlands.
   - Scientific research and assessment on the vulnerability of wetlands to climate and other factors
   - Conduct research on the economic value of wetland ecosystems

4. Reviving Plan
   - Conduct extensive study before applying any reviving plan, as many species depend on wetlands.
   - Making local stakeholders a significant advisor. To document, highlight, apply traditional knowledge to wetland conservation
   - Formation of the steering committee of the technical experts of the different domains to assess the reviving/rejuvenation plan.
   - Monitoring of plan execution with regular interval data collection.
   - Marking of the wetlands based on wetland quality index.
5. Policies
   - National Plan for Wetland Development (NPWD)
   - Integrated wetland sustainable management policies
   - Wetland protection act following the pattern of Ramsar wetlands.
   - Providing some wetland of national importance
   - Establishment of an institution/centre to study the importance of wetlands against climate change/global warming.

7. Forestry

Sahebganj district earlier had thick and extensive forests. The region is now bereft of much of its jungle wealth. This district is also home to a variety of native tribes. Forest products and small-scale agriculture are the only livelihood options available to tribes. The Ministry of Tribal Affairs, Government of India has launched the scheme for the tribal people to support production, product development and preservation of natural heritage. Under this scheme institutions are to be created to achieve specific goals such as i) Market Intervention ii) Training and skill up-gradation of tribal Artisans, Craftsmen, MFP gatherers iii) R&D/IPR activity; and (iv) Supply chain infrastructure development. It is important to the government to let people and tribes know about schemes like 'Jan Van Yojana', 'Tribal Schemes'.

Like the neighbouring state of Bihar, the district can also implement 'Krishi Vaniki Yojana' which promotes agroforestry. Jackfruit, Murga, Simal, Bamboo, Asan and Satsal are the major species that can be pushed for agroforestry. Terminalia bellirica (Beheda), Terminalia arjuna Bedd (Arjun), Mangifera indica (Mango), Ficus religiosa (Pipal), Acacia catechu (Khair), Aegle marmelos (Bel) are some of the important native forest product yielding trees that can be focused for agroforestry.

'Van Dhan Vikas Karyakram' is another central government scheme that emphasizes the marketing of Minor Forest Produce (MFP) through Minimum Support Price (MSP) and the development of a value chain for MFP, targeting livelihood generation for tribals by harnessing forest wealth. This program aims to bridge the gap between traditional knowledge, forest products and the market by adding technology and IT to upgrade the economics of the region. For these programmes and schemes MFP collection centres, localised nurseries for native plants, information centres should be established at every block (Ministry of Tribal Affairs).

Afforestation on the riverbanks and open public spaces is another option that suits the Sahebganj district. The Miyawaki afforestation method has been adopted by many urban authorities in the world. This technique helps to build dense, native forests. This method ensures that plant growth is 10 times faster and the resulting plantation is 30 times denser than usual. It involves planting native species in the available area and becomes maintenance-free after the first three years. The most important aspect of this method is it requires as minimum as 20 square feet of area.

The combination of a small forest and home garden is known as homestead forest. With the combination of the Miyawaki method of afforestation and trading platform for these products, this combination can be beneficial for the local economy. Some of the major Indian cities like Mumbai, Chennai have also adopted this technique for afforestation. Afforestt is the firm which works in the development of Miyawaki Forest.

Recently, the state forest department declared 2 urban forests in the capital of the state, Ranchi. This type of urban forest can also be established throughout the Sahebganj district focusing mainly on tree species that yield non-timber products such as fruits, resin, aromatic flowers, etc.

Integrated Model Framework

1. Agriculture is the main source of livelihood for the district. Most of them are marginal farmers. Enhancement in their quality must be one of the key goals of Arth Ganga. The challenge in these sub-sectors is the environmental externalities. Apart from very high-water consumption there are land usage, soil degradation issues related to agriculture.

Thus, the way out in agricultural activities is:

- Promotion of organic farming
- Promotion of horticulture farming
- Low water techniques
- Crop diversification

2. This sector has high livelihood implications particularly artisans and direct and indirect employment generation through tourism. The investment-return ratio at individual level is very attractive though it requires significant investment in infrastructure creation from the government side. The challenges in this sector are twofold:

- There is a carrying capacity of the environment for the tourists which is particularly critical for the eco-sensitive zones.
- The high influx of tourists can affect flora and fauna.

Thus, the solutions could be:

- Focusing less on environmentally sensitive types of tourism such as religious and historical tourism while limiting the footfall for nature and adventure tourism.

- Focusing on eco-tourism, agro-tourism and reducing the aqua tourism in the river should be considered.

3. This sector has a very high positive environmental impact even though they are low on the livelihood generation. Most of renewable energy and biodiversity and Forestry falls in this category. This is perhaps the most critical category for conservation and long-term sustainability. To deal with the challenges in this sector are:

- Improving solar electrification through aggressive rooftop installations in all government buildings and business installations like petrol pumps, solar pumps etc.
- Exploring floating solar installations in large wetland regions where synergies in fishing and energy production can be exploited.

Recommendations

1. Biodiversity

- Provide Wildlife Corridors and Connections Between Green Spaces.
- Planting or seeding with native trees, flowers, fruits, vegetables and shrub species.
- Reduce the use of pesticides and fertilizers in the agricultural field.
- Reduce, reuse, and recycle to minimize our demand for resources.
- Use environmentally friendly products for cleaning, clothing, packaging.
- Aim for energy conservation in home, office, university, everywhere.
- Reduce single-person and short-distance car use.
- Incorporate renewable energy and/or energy efficiency into your home.
- Demand, and encourage sustainable products.

2. Biogas

- Implementation of various biogas generation schemes such as National biogas fertilizer management program, biogas-based power generation program, bagasse-based cogeneration projects in sugar mills power projects based on other biomass, biomass-based gasifier power projects, Industrial waste-based power projects, biomass-based cogeneration power projects for increase generation of biogas and solid waste management.
- Increasing awareness to the farmers and local citizens about the environment and indoor pollution, its effect on the human body, biogas potential, necessity of solid waste management, efficient use of agriculture and animal waste to produce biogas and fertilizer.
- Providing subsidies or incentives for promoting biogas plants (high upfront cost) for the village and industrial level.
- Strict policy measures are required to increase biogas production from municipal and industrial wastes.

3. Hydropower

- Implementation of a small hydro project in the district Ballia.
- Use existing infrastructure like a canal for hydro projects.
- Use of local people for construction or installation of hydropower projects.
- Educate local citizens about renewable energy, its necessity, employment and energy from hydro projects.

4. Solar:

- The Jharkhand government is currently considering a clean energy policy for each sector. Sahibganj district is one of the most backward districts. It is important for the urban area to equally participate in the solar energy generation cause. Solar Trees are a great option for urban areas. Solar trees can be installed at public lands, gardens, bus stops and even in local markets.
- The infiltration of information about monetary benefits and long term economic and environmental benefits is important for local public awareness programs.
- The Sahibganj District is an important hub on national waterway 1, and it also has a multimodal riverine terminal. The open water in river and district canals can be covered by solar PV panels.
- Sahibganj District produces various raw minerals and materials. Solar industry can be a great opportunity for manufacturing silicon and other mineral based parts.

5. Wetlands

The wetlands need to be intact, but at the same time, they need to be planned wisely to support the district economically, socially, and environmentally, which will lead to indirectly relieving of stress from the Ganga river to a large extent. It will also lower the local people's dependence on the Ganga river for their small-scale industry or basic daily needs. The following recommendations and interventions are required to get valuable products and solve the issues/ challenges faced by the local people of that region.

- It is recommended to rejuvenate and restore the water bodies of the district. This can be done by recharging old ponds, aquifers and lakes present and preserving them. This leads to the solution of water scarcity, water quality in the region. The government needs to take steps like water quality testing and quantification of water bodies at regular intervals and promote MNREGA schemes to rejuvenate extinct water bodies and promote rainwater harvesting.
- It is recommended to promote organic farming and a scientific approach near the wetlands to lower the pollution of the wetlands. Also, these practices help attract the market and increase the yield of fish. The government scheme will give a boost to crops like jack fruits, bamboo. Steps needed to be taken to promote techniques to increase production in organic farming with less cost in cultivation.

- It is recommended to promote animal husbandry and the stoneware/ earthenware in the area. This provides a boost to the economic growth of the local people. Sustainable development of industries will lead to minor exploitation of the wetlands as these are water-intensive industries. Awareness about the water utilities needs to be promoted between the local people to lower the water crisis.
- It is recommended to promote eco-tourism in the region. The wetlands must be allowed for a limited number of visitors. The economy generated by eco-tourism must be utilized in the maintenance of the hotspot. The awareness campaign like say no to plastics, let us make hills plastic-free must be organized. Strict action for littering, no plastic zone like action must be taken to conserve.
- It is recommended to increase waste management practices in the region by promoting plastic waste management, sewage disposal management, encouragement of the use of toilets by local stakeholders and increasing the number of bio-toilets in the region for public use. This also helps in maintaining the health of the riverine and groundwater

6. Forestry

Sahebganj district has a mixed economy due to agriculture and industry. The district is also home to various tribes which earn their daily cash through small scale agriculture and selling NTFPs. The major problem is lack of infiltration of schemes to these tribes. Region holds a variety of trees yielding fruits, flowers. Van Dhan Vikas Karyakram will be the great intervention for economic development of these people. Establishment of information & training centres, collection centres should be the priority for the district. Cluster based enterprises can be initiated by the local governments, these clusters can promote honey, fruits (mango, jackfruit, tamarind, mahua flowers), resins, raw rubber etc. Social forestry drives and agroforestry can be promoted and implemented as a program of district importance. The direct cash benefits to the NTFP can attract many native people in the creation, cultivation and preservation of small-scale forests.

7. Agriculture

- The major crops being cultivated are paddy, wheat, pea, maize, pigeon pea, potato, Fruits(Mango), and vegetables. The farmers are advised to adopt the improved varieties and technologies recommended for this zone.

- Farmers follow the agro advisory published by KVK(Krishi Vigyan Kendra) Sahibganj.
- Though the main crop of this district is Rice, the blocks are Sahibganj and Rajmahal, in which 72 villages are near Ganga due to flooding. Maize, Wheat, sugarcane (Rabi Season) are the main crops instead of Rice. Little amount of Rice (100-200 Ha.) is cultivated in between NH80 and the Rail line area of Rajmahal Block. In this area, main cultivation is done in Rabi season due to heavy flooding in Kharif season only a little maize is cultivated, and also drilling method is only used in Rabi season.
- Black gram is also cultivated in a considerably large area, but this suffers from wilting. Therefore, proper irrigation is needed.
- The four blocks Barhait, Taljhari, Borio, and Mandro, are situated in a hilly region where the soil is red laterite. Jhum farming is done here, which badly affects the area, and also soil erosion is one of the main problems. Therefore, introduction of the advanced farming method for hilly regions, and advanced farm machinery should also be used.
- In plain regions, the water table is situated in a 10-meter depth where bamboo boring is done for irrigation, but uncontrolled bamboo boring can largely affect the groundwater table. In hilly regions, sprinkler irrigation should be introduced, and wherever possible, drip irrigation should also be used.
- In this district, less organic farming is prevalent, although, in rajmahal traps, paharias cultivated the crops without using any fertilizers. Monetary help should be provided to farmers involved in organic farming.
- Vermicompost production training should be given to farmers.
- In this district, storage capacity is limited. The crops are transported in very little time of harvest so farmers did not get good prices for their crops. Therefore, a storage facility should be developed in this district.

- The farmers are already using the crop rotation as a suggestion provided by KVK Sahibganj to the farmers.
- In the Rajamahal trap, a large amount of Kalmegh (Medicinal plant) is available, but outside vendors buy this at a very low price. Thus, its processing and marketing units should develop.
- Farmers are trained regularly by KVK and also by an agriculture technology management agency(ATMA). Some farmers are also sent to Sikkim for training in organic farming.
- Mango is the major fruit in this area. The Langra variety of mango is very famous which needs more marketing. Mango in hilly areas is suitable for pickles. Pickle factory may be installed.
- Udhwa block is famous for its vegetable production.
- Mushroom cultivation may be promoted in this area.
- Beekeeping is also done by some people with more than 2000 boxes, but due to no honey processing unit, they are sold to outside vendors, which reduces their income.
- Government seed exchange programs should be popularized.

8. Tourism

- Different ecosystems like ghats, nature and wildlife along with historical monuments must be preserved, maintained. Since there is a demand for religious, historical and ecotourism, necessary policy decisions must be made to develop the said types of tourism along with their ecosystems.
- Although there is no formal ecotourism operation has been developed so far, there is a huge potential of ecotourism option available, where village level eco development committees, van suraksha samiti along with Ganga Prahari can serve as institutional mechanism to formalize the operation of ecotourism in the district. Many ghats like Mukteshwar Dham, Madan Mohan Malviya,

Kusum, Madhusudan, Mangal haat ghat etc. have multipurpose facilities in terms of yoga, cycling and nature trail.

- Different activities like holy dip, pilgrimage, swimming, hiking, wildlife watching attract tourists for ghat destinations. However, tourists do not have to pay anything for performing these activities. Hence, payment mechanisms must be in place to safeguard the ecosystems of ghats and raise sustainable finance for undertaking different recreational and religious activities.
- Hotels with good modern amenities would also encourage tourists.

Discussion during the Report Presentation

- The Rajmahal Madhu is very famous and the district wins an order of 4-5 Tons per month for export. Still the market needs to scale up.
- In Tourism, Rajmahal Fossils are of great interest
- There is a requirement of training in stick production of Agarbatti focusing of cost minimization.
- The IIML Report for Arth Ganga should be a regular Agenda item for next 6-8 DGC meetings.
- Hon'ble PM during the post-Budget webinar on Tourism had spoken about market potential of destination weddings. It was suggested that suitable Ashrams in Ganga Basin may be identified for such purpose to promote blissful experience, cost reduction, livelihood opportunities and better upkeep.
- Allocate separate space for Namami Gange Awareness and Jalaj Marketing kiosk in Melas/Congregatios/Fairs for providing better marketing opportunities to the Jalaj products.
- As Dilli Haat Centre – Namami Gange Awareness and Marketing Centre – is being launched soon, it was requested that every district to identify niche products with a creative story and link it with Jalaj in their area.
- To identify Arth Ganga Tourist Trails and organize Ganga Guide training
- Promotion of Natural Farming in Ganga Basin and training workshops should be organized on a regular basis. NMCG is supporting this initiative in coordination with MoA& FW and NCOF.
- Make plans for reuse of treated waste water for agriculture, industrial etc. purpose and also the sludge.
- Training of volunteers for Ganga awareness & Aarti workshops to promote regular aartis on Ghats.

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