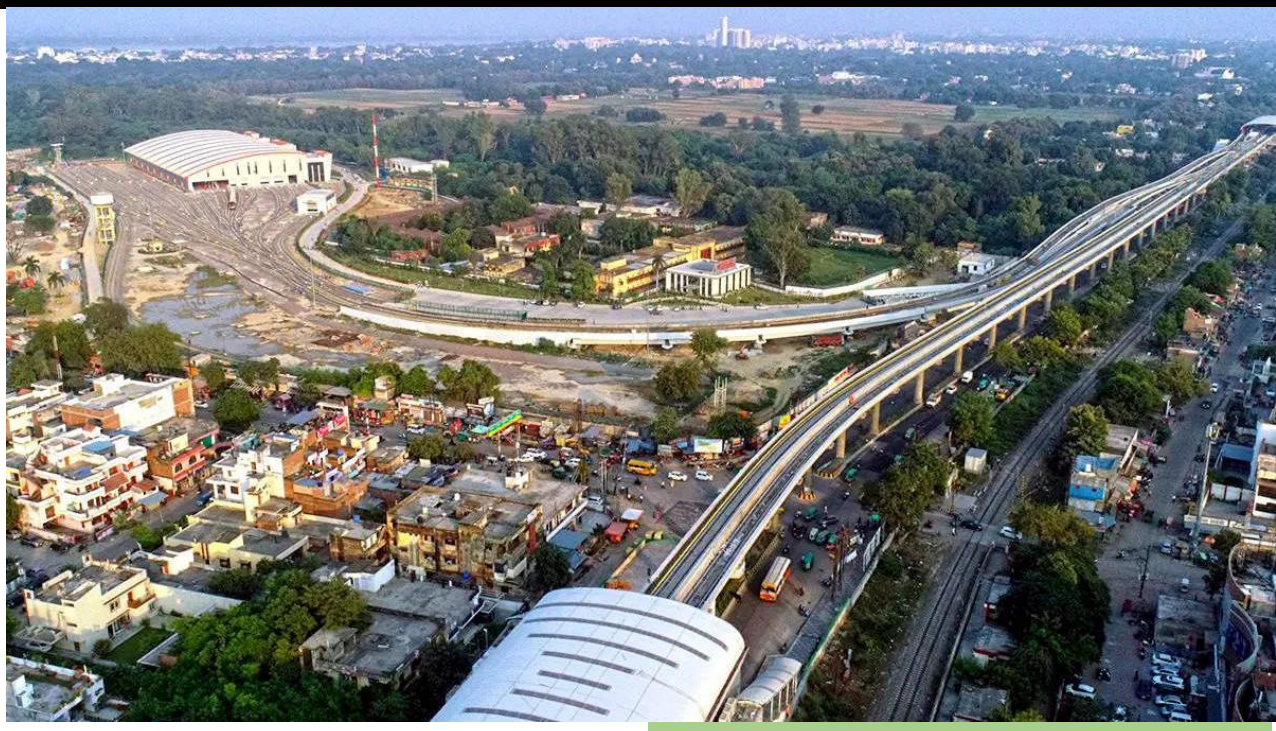
Arth Ganga Project: District Kanpur



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EXECUTIVE SUMMARY

Kanpur city, known as "Leather City of the World" or "Manchester of the East" for its textile industries, is an industrial city of the state of Uttar Pradesh. Ganga and Yamuna are the two main rivers of the district.

The total geographical area of Kanpur is 10,863 Km^2, which is divided into Kanpur Nagar (3155 Km^2) and Kanpur Dehat (3021 Km^2), out of this area, the total cultivable land is 234800 ha for Kanpur Nagar and 262800 ha for Kanpur Dehat. Kanpur is identified in the Central plain zone which is divided into four agro-ecological situations depending upon soil and topography characteristics. Major soil types in the district are Ganga Recent Alluvial Soil, Ganga Flat Soil, Ganga Up Land, Ganga Low Land, Yamuna Flat Soil, Problematic Soil, and Yamuna recent alluvial soil. Also, the cultivable wasteland for Nagar and Dehat is 8900 ha and 4300 ha; barren and uncultivable land constitutes 14800 ha and 16200 ha and the permanent pastures are 3700 and 400 ha respectively. In Kanpur Nagar, soil types are deep loamy, deep loamy with silt, and loam with slight saline or sodic. With the net sown area of 188900 ha and gross cropped area of 266000 ha, the Cropping intensity of the district is 113.3%. The net irrigated area is 151300 ha whereas the rainfed area is 37700 ha. In Kanpur Dehat, soil types are deep loam with moderately saline or sodic deep loamy, and deep loamy with silt. With the net sown area of 221900 ha and gross cropped area of 293400 ha, the Cropping intensity of the district is 132.2%. The net irrigated area is 155800 ha whereas the rainfed area is 66100 ha. The main farming system prevalent are, Rice – Wheat and Rice – Mustard, Jowar- Wheat and Bajra- Wheat, Rice – Gram and Maize – Potato – Wheat, Jowar – Pigeon Pea and Rice – Pea, and Maize – Pigeon pea and Rice Toria Wheat. The major crops are wheat, rice, jowar, pea, pulses, potato, etc. The tertiary sector grew with an average annual growth rate of 7.42%, with its share increasing from 51.29% in 2011-12 to 54.32% in 2018-19. The share of livestock in the GDP of the district increased from 29.08% to 34.88% during 2011-18, with an average annual growth rate of 8.21%. cultivable wasteland increased from 2.68% in 2009-10 to 3.31% in 2017-18, which is a cause of concern. The share of fallow land and barren and uncultivable (5.23% to 4.49%) land decreased during 2009-18. The net sown area has increased slightly over the years. The area for non-agricultural use increased slightly over the period from 13.69% to 15.49%. In 2017-18, the nitrogen share increased to 71.19%, while the phosphorus share decreased to 25.18%, and the potassium share fell to 3.61%.

The total forest cover of the district is only 66 km^2 (1.87%). There is no prominent forest cover in the district. Out of total forest cover, the maximum area is covered by Open Forest (59 Km^2) followed by Moderately dense forest (7 Km^2). Although the district does not have any wildlife sanctuary or national parks, Allen Forest Zoo has an area of 77 hectares, making it the largest open green space in Asia, which is built in a natural forest area. There are 367 species with 5 accidental species. The district comprises 1527 small and medium-sized mostly are waterlogged and lake/ponds/tanks. The number of natural wetlands is less than man-made. The district is home to different religious, heritage, and historical places. Allen forest zoo, Green Park, Kamala retreat,

Phool Bagh, Jajmau, Bithoor, Ghats, temples like ISCON, Mukteshwari Devi, Balaji temple, Ravana temple, etc. are places of tourist attractions. Despite numerous tourist attractions, the district does not show a promising increase in the number of tourists. The has been a slight increase in domestic tourists since 2015 whereas foreign tourists' numbers show the decline in the recent past. These disappointing numbers might be largely due to lack of maintenance of structures along with high air, water, and land pollution making it one the highest polluted cities in the world.

The main source of lightning is electricity (62.99%) closely followed by kerosene (35.63%) while only 0.45% is the usage of Solar energy. Electricity consumption in agriculture has increased from 449.81 kWh in 2011-12 to 657.05 kWh in 2019-20, a net increase of approximately 46%. The main fuel source is LPG/PNG (51.35%) followed by firewood (26.31%). The district has high biomass production. Biogas potential from animal and agricultural waste was calculated approximately as 1 crore m^3/year and 30 crores m^3/year respectively. Different government buildings have been installed with solar plants. Biomass-based co-generation, biomass gasifier, etc. are being encouraged. No hydropower plant exists nor future projects are proposed. The use of biomass as a substitute for other energy will support a sustainable economy and development.

The district needs to monitor and check pollution by upgrading industries' appliances and taking strict measures and implementing norms. Eco-tourism, agro-forestry, maintenance of tourist places, use of farm mechanization tools, practicing Organic farming and water harvesting along with focusing on growing medicinal crops, high-revenue crops, fruits cultivation, beekeeping, tobacco and sunflower cultivation, spices along with promoting fishery, etc. needs to be encouraged.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Kanpur Nagar district is a part of Kanpur division is the district of Uttar Pradesh state with its headquarters located at Kanpur city. It belongs to the track known as lower doab of Ganga and Yamuna. It is situated on the bank of river Ganga. The district encompasses an area of 3155 sq. km. and in terms of geographical area it occupies 38th rank in the state in 378th in India. In the year 2019, there was a total 1.36% forest area of total geographical area.

The district is administratively divided into 03 tahsils namely Kanpur, Bilhaur and Ghatampur. There is 1 Lok Sabha constituency and 10 assembly constituencies in the district. Moreover, the district comprises 3 sub-districts, 10 towns and 1003 villages. The total population of the district is 4,581,268 in which 1,565,623 live in rural and rest 3,015,645 in urban areas. In the total population of the district of 4,581,268 as much as 34.3 per cent are workers and rest of 65.7 per cent are non-worker. Among worker 26.83 per cent are main workers and rest of 7.49 per cent are marginal workers of total population. The extent of workers in rural parts and non-workers in urban parts is higher. In the district among workers, 12.63 per cent are cultivators and 66.54 per cent other workers. Total 10.71 per cent of female workers are engaged as cultivator

The agriculture sector in the district does not show the over bearing prominence, as it enjoys in the other districts of the state. Kanpur City aptly described as industrial capital, has brought about tremendous expansions of non-agricultural activities. The dominance of agriculture sector is only marginal over non-agriculture sector. Yet the role of agriculture cannot be underplayed as the economy of the rural side of the district depends on it. There are three crop seasons namely Kharif, Rabi and Zaid. The main crops of Kharif are paddy maize, urd, sugar cane and arhar. Main crop of Rabi is wheat and oil seeds as the main crop of Zaid.

Kanpur comes on the top of the industrial map of Uttar Pradesh and occupies a place of importance among the industrial cities of the country. It has grown up into a textile town. Tannery and leather goods industries follow next in strengthening the industrial structure of the town. The infrastructure available in the district, attracted a large variety of industry, large as well as small scale, making the city boom with industrial activities A good variety of industries, tannery and leather goods industries and industries related to plastic goods, chemical, medicines, fertilizers, food and food products edible oil, motor and automobile workshop are spread in different parts of the district. Some of the important factories in Public Sector are British India Corporation tannery and footwear corporation, H.A.L, Artificial limb manufacturing corporation, Indian field and Gun factory & Lohia Machines Ltd. are large scale industries under government and private sectors.

Kanpur is famous for its quality leather which it exports in a huge quantity across the world. The other main industries in the district are fertilizers, chemicals, two wheelers, soaps, pan masala, hosiery and engineering. The only unit of Indian Institute of Pulse Research (an institute if ICAR) and one of the three units of Indian Sugar Institute is located in the district which depicts its well-built agrarian nature of industries.

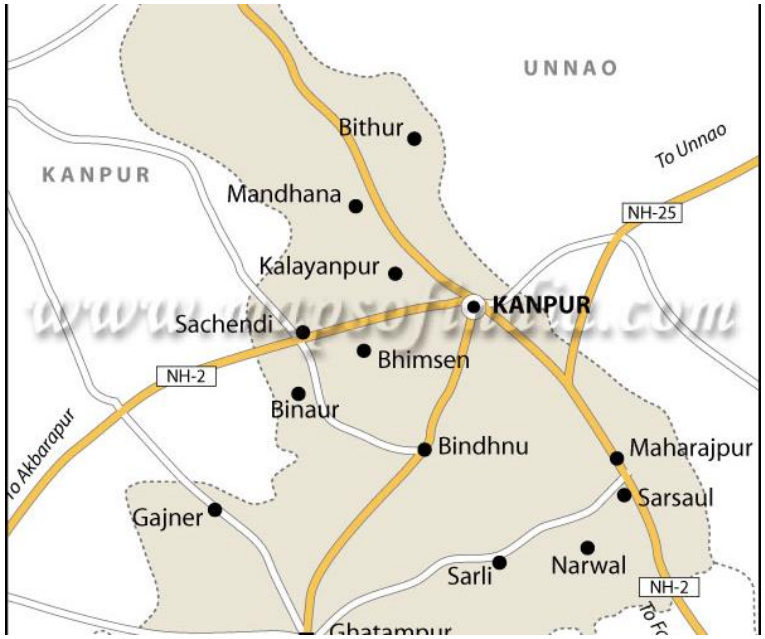


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF KANPUR

Table 1 demographic overview

1.3 AGRO CLIMATIC PROFILE OF THE DISTRICT

1.4 ECONOMIC PROFILE OF KANPUR

The primary sector does not have a significant impact because it only shares, on average, 7.42% of the district economy. Though, it grew with an average annual growth rate of 5.86%. The share of the secondary sector decreased from 41.28% in 2011-12 to 38.88% in 2018-19. It increases with

an acceptable average annual growth rate of 6.06%. The tertiary sector occupies more than 50% of the share in the district economy. The sector grew with a magnificent average annual growth rate of 7.42%, with its share increasing from 51.29% in 2011-12 to 54.32% in 2018-19. Overall the district economy grew with an average annual growth rate of 6.59%. The growth in the tertiary sector is more than in the other two sectors.

Table 1: Trends in Gross District Domestic product in Kanpur City at Constant Prices (base 2011-12) in Rs Crore

Year	Sector-wise GDDP (Rs, crore)				Annual Growth Rates			
	Primary	Secondary	Tertiary	Total GDDP	Primary	Secondary	Tertiary	Total
2011-12	1590.27	8834.92	10976.58	21401.76	-	-	-	-
	(7.43)	(41.28)	(51.29)	(100)				
2012-13	1677.63	8426.08	10427.99	20531.70	5.49	-4.63	-5.00	-4.07
	(8.17)	(41.04)	(50.79)	(100)				
2013-14	1696.46	8974.27	11673.88	22344.61	1.12	6.51	11.95	8.83
	(7.59)	(40.16)	(52.24)	(100)				
2014-15	1578.17	8380.48	12552.60	22511.25	-6.97	-6.62	7.53	0.75
	(7.01)	(37.23)	(55.76)	(100)				
2015-16	1696.49	9339.14	13793.15	24828.78	7.50	11.44	9.88	10.29
	(6.83)	(37.61)	(55.55)	(100)				
2016-17	2315.41	11639.81	14975.63	28930.85	36.48	24.63	8.57	16.52
	(8.00)	(40.23)	(51.76)	(100)				
2017-18	2394.44	13480.03	15966.41	31840.88	3.41	15.81	6.62	10.06
	(7.52)	(42.34)	(50.14)	(100)				
2018-19	2249.63	12845.01	17946.37	33041.01	-6.05	-4.71	12.40	3.77
	(6.81)	(38.88)	(54.32)	(100)				
Average Growth Rate					5.86	6.06	7.42	6.59

Source: UPDES
Note: Figures in Parentheses are percentage share in the total GDDP

We further break down the primary sector GDP to find out which subsector is lagging and which one is driving the primary sector growth. Table 2 shows that agriculture, including the horticulture sector, grew at an average annual growth rate of 4.27% from 2011-12 to 2018-19. However, its share declined from 64.27% in 2011-12 to 57.48% in 2018-19. On the other hand, the share of livestock increased from 29.08% to 34.88% in the same period, with a remarkable average annual growth rate of 8.21%. It shows the importance of livestock in Kanpur City and the increased dependency of citizens on livestock products. The share of forestry and logging in the total agriculture and allied sector is small, around 5.9% in 2018-19, but it also grew significantly with an average annual growth rate of 11.23%. The fishery and aquaculture subsector share is very minimal, around 1.75% in 2018-19, but it grew significantly with an average annual growth of

26.84%. Mines and quarrying also recorded a remarkable annual growth rate of 21.57%, and its growth is consistent over the years. This can have serious environmental issues like deforestation, soil erosion, etc., with long-term effects on the health of local citizens. Overall, the Primary sector performed well during the time period of the study, with all its subsectors doing well. More work can be done on improving the agriculture (including horticulture) sub-sector.

Table 2: Trends in Gross District Domestic product from Agriculture and allied activities in Kanpur City at Constant Prices (base 2011-12) in Rs. Crore

Year	Agriculture	Livestock	Forestry and Logging	Fishing and Aquaculture	Total Agriculture and allied	Mining and Quarrying	PRIMARY SECTOR
2011-12	994.17	449.85	92.46	10.46	1546.95	43.32	1590.27
	(64.27)	(29.08)	(5.98)	(0.68)	(100)		
	-	-	-	-	-	-	-
2012-13	1003.41	443.55	161.18	10.96	1619.11	58.52	1677.63
	(61.97)	(27.39)	(9.95)	(0.68)	(100)		
	[0.93]	[-1.40]	[74.32]	[4.77]	[4.66]	[35.10]	[5.49]
2013-14	1021.47	463.48	133.20	11.31	1629.46	67.00	1696.46
	(62.69)	(28.44)	(8.17)	(0.69)	(100)		
	[1.80]	[4.49]	[-17.36]	[3.12]	[0.64]	[14.49]	[1.12]
2014-15	907.83	451.69	136.54	12.08	1508.15	70.02	1578.17
	(60.19)	(29.95)	(9.05)	(0.80)	(100)		
	[-11.13]	[-2.54]	[2.51]	[6.87]	[-7.44]	[4.51]	[-6.97]
2015-16	921.71	575.05	95.05	12.34	1604.14	92.34	1696.49
	(57.46)	(35.85)	(5.93)	(0.77)	(100)		
	[1.53]	[27.31]	[-30.39]	[2.10]	[6.37]	[31.88]	[7.50]
2016-17	1307.11	716.89	130.80	15.10	2169.90	145.51	2315.41
	(60.24)	(33.04)	(6.03)	(0.70)	(100)		
	[41.81]	[24.66]	[37.62]	[22.41]	[35.27]	[57.58]	[36.48]
2017-18	1319.99	722.96	87.91	15.24	2146.11	248.33	2394.44
	(61.51)	(33.69)	(4.10)	(0.71)	(100)		
	[0.99]	[0.85]	[-32.79]	[0.92]	[-1.10]	[70.66]	[3.41]
2018-19	1240.56	752.69	127.23	37.75	2158.23	91.40	2249.63
	(57.48)	(34.88)	(5.90)	(1.75)	(100)		
	[-6.02]	[4.11]	[44.72]	[147.68]	[0.56]	[-63.19]	[-6.05]
Average Growth Rate	4.27	8.21	11.23	26.84	5.57	21.57	5.86

Source: Compile from UPDES
Note: 1. Figures in () are percentage share in the total agriculture & allied GDDP

2. Figures in [] are annual growth rates.

Table 3 shows the percentage share of subsectors in secondary and tertiary sectors. Within the secondary sector, the manufacturing sector had a share of approximately 47.68% of the secondary sector in 2018-19. The share shows consistency over the year and has increased by an average growth rate of 6.51% over the years. The construction subsector has around 33% share of the secondary sector and has increased from 33% in 2011-12 to 36.57% in 2018-19 with a remarkable average annual growth rate of 8.29. The share of electricity, gas and water supplies decreased from 18.93% to 15.75% in the same period, with a low annual growth of 3.05%.

The construction subsector, thus, makes an important contribution to the growth of the secondary sector. Within the tertiary sector, the public administration subsector made up the highest share of (25.32%) in 2018-19, followed by real estate and professional services (24.55%), transport, storage and communication (19.68%), and Trade & Hotel (11.44%). Average annual growth is observed highest in Transport, Storage & Communication (14.5%) followed by Public Administration (8.15%) and Financial Services (6.2%) and lowest in Real Estate (5.08%). All the subsectors in secondary and tertiary sectors have performed well during the study period. More work needs to be done to improve electricity, gas and water supply and real estate subsectors. Transport and Communication and Public Administration sub-sectors are the major contributors to the Tertiary sector's growth.

Table 3: Trends in percentage share of Non-Agriculture sub-sectors in DGDP at Constant Prices (base 2011-12) in Rs Crore

Year	Manufacturing	Electricity, Gas, Water Supply	Construction	SECONDARY SECTOR	Trade and Hotel & Restaurant	Transport, Storage & Communication	Financial Services	Real Estate and Professional Services	Public Administration	Other Services	TERTIARY SECTOR
2011-12	48.00	18.93	33.08	100	12.48	12.79	9.00	28.39	27.19	10.15	100
2012-13	48.30	20.13	31.58	100	12.44	14.70	10.16	31.42	19.29	11.98	100
2013-14	47.99	20.31	31.71	100	12.21	15.12	9.57	28.94	22.74	11.41	100

2014-15	44.88	21.73	33.39	100	11.22	17.07	9.64	28.38	22.11	11.58	100
2015-16	52.49	17.82	29.69	100	12.17	18.46	9.67	27.56	20.93	11.21	100
2016-17	48.58	15.64	35.77	100	13.01	16.91	9.31	26.34	23.33	11.10	100
2017-18	51.17	15.61	33.21	100	13.06	16.88	7.89	26.43	24.94	10.79	100
2018-19	47.68	15.75	36.57	100	11.44	19.68	8.24	24.55	25.32	10.77	100
Average Growth Rate	6.51	3.05	8.29	6.06	6.31	14.50	6.20	5.08	8.15	8.23	7.42
Source: Estimated from statistical handbooks											

2 QUANTITATIVE DATA ANALYSIS

2.1 Agriculture and Allied Activities

2.1.1 Trend in Land Use Pattern

The total declared area of the district is 3013.26 sq. km². The forest area represents 1.87% of the total declared area. The share of cultivable wasteland increased from 2.68% in 2009-10 to 3.31% in 2017-18, which is a cause of concern. The share of barren and uncultivable land decreased from 5.23% in 2009-10 to 4.49% in 2017-18, however, the decrease could have been more significant. The share of area under trees and gardens has been consistent over the years (1.04%). The fallow land also shows a remarkable decline over the period. The net sown area (NSA) is around 63% of the total reported area and has increased slightly over the years. The area for non-agricultural use increased slightly over the period from 13.69% to 15.49% (Table 4). Overall, the land use pattern shows that the acreage for non-agricultural use has increased significantly.

Table 4: Trends in Land-use Pattern in Kanpur City (as % of the total reported area)

Year	Total Reported Area (ha)	Area under forest	Cultivable wasteland	Current Fallow	Other Fallow	Barren and uncultivable land	Land other than agriculture	Pasture Land	Area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2009-10	301326	1.88	2.68	10.57	2.13	5.23	13.69	1.22	1.04	61.55
2010-11	301326	1.87	2.68	9.71	2.13	5.16	13.82	1.22	1.04	62.38
2011-12	301326	1.87	2.98	8.31	2.90	4.91	14.08	1.22	1.04	62.70
2012-13	301326	1.87	2.66	9.37	2.12	5.11	14.85	1.22	1.02	61.78
2013-14	301326	1.87	2.73	8.88	2.45	4.63	14.88	1.22	1.04	62.29
2014-15	301326	1.87	2.73	9.74	2.47	4.63	14.94	1.22	1.04	61.36
2015-16	301326	1.87	2.73	7.41	2.36	4.62	15.37	1.22	1.03	63.39
2016-17	301326	1.87	2.73	7.41	2.36	4.62	15.37	1.22	1.03	63.39
2017-18	301326	1.87	3.31	8.07	1.26	4.49	15.49	1.27	0.86	63.38

Source: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.2 Trends in Operational Land Holdings

In Kanpur City district, the total number of operational farms decreased from 254 thousand in 2010-11 to 239 thousand in 2015-16, a net decrease of 5.9%. While in the state, their numbers increased from 23,325 thousand in 2010-11 to 2,822 thousand in 2015-16, a net increase of 2.13%. Most land positions in the district are marginal and small. These two size categories represented around 93% in the district in 2015-16, while the corresponding proportion in the state was 92.81% (Table 5). The two agricultural censuses of 2010-11 and 2015-16 report no significant change in the percentage share across the various categories of landholdings.

Table 5: Distribution of Operational Holdings by Size-categories of farms (in %) in Kanpur City

	Agri, Census	Marginal Holdings (0-1 ha)	Small Holdings (1-2 ha)	Semi-Medium Holdings (2-4 ha)	Medium Holdings (4-10 ha)	Large Holdings (10 & above, ha)	Total Holdings ('000 No.)
Kanpur City	2010-11	80.98	12.27	5.25	1.48	0.03	254
	2015-16	78.44	13.94	6.23	1.33	0.05	239
							[-5.9]
Uttar Pradesh	2010-11	79.45	13.01	5.72	1.71	0.11	23325
	2015-16	80.18	12.63	5.51	1.58	0.10	23822
							[2.13]

Source: Compiled from Statistical Diary 2018-19, UPDES. Figures in [] are percentage increase/decrease in 2015-16 over 2010-11.

2.1.3. Trends in Area, Production and Yield of Principal Crops

i- The Trend in Cropping Patterns

Rice and Wheat dominate the agriculture of the district. Table 6 shows the area devoted to various crops over the last eight years. In 2017-18, Wheat made up the highest share of GCA (38.79%), followed by Rice (12.4%) and Maize (8.27%). These three crops together constitute around 59.46% of the GCA. The area shared by the cereals has remained consistent over the years (around 67%). The main pulses produced are Urad, Gram, and Arhar. The total pulse acreage has also remained consistent throughout the study (around 12.5%). Thus, the food grains cover a majority (around 80%) of the GCA. Mustard is the only major oilseed crop produced, and the total oilseed acreage has also remained consistent over the years (around 5.3%). The area under sugarcane is almost negligible. The acreage of Potato has remained consistent over the years (around 4.5%). In

general, there is no significant change in the cultivation pattern reported in the district during the study period. The average cropping intensity is 138.64.

Table 6: Trends in Cropping Pattern (as % GSA) and Cropping Intensity

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	12.27	12.54	12.43	12.48	12.48	12.61	12.61	12.40
Wheat	39.22	38.72	39.15	38.87	39.02	39.43	39.43	38.79
Maize	8.36	8.63	8.64	8.48	8.31	8.40	8.40	8.27
Other Cereals	7.07	7.22	7.29	7.23	7.33	7.41	7.41	7.29
Total Cereals	66.92	67.11	67.51	67.06	67.15	67.85	67.85	66.75
Urad	2.57	2.63	2.86	2.90	2.86	2.89	2.89	2.85
Gram	6.46	6.25	6.14	6.03	6.07	6.13	6.13	6.03
Arhar	2.45	2.51	1.95	1.87	1.90	1.92	1.92	1.89
Other Pulses	1.42	1.47	1.66	1.62	1.45	1.46	1.46	1.44
Total Pulses	12.89	12.86	12.60	12.42	12.28	12.41	12.41	12.21
Total Foodgrains	79.81	79.96	80.11	79.49	79.24	80.06	80.06	78.77
Mustard	5.65	5.31	5.27	5.50	5.25	5.30	5.30	5.21
Till (Pure)	0.86	1.18	0.94	0.98	0.97	0.98	0.98	0.96
Other Oilseeds	0.20	0.23	0.15	0.11	0.11	0.11	0.11	0.11
Total Oilseeds	6.71	6.73	6.36	6.58	6.32	6.38	6.38	6.28
Sugarcane	1.12	1.10	1.13	1.12	1.11	1.12	1.12	1.11
Potato	4.54	4.42	4.35	4.42	4.54	4.58	4.58	4.51
Net Sown Area	71.63	71.02	71.22	71.57	70.59	73.69	73.69	72.48
Gross Sown Area (in 1000 Ha)	262.42	266	261.38	262.26	261.93	259.23	259.23	263.48
Cropping Intensity	139.61	140.80	140.41	139.72	141.66	135.71	135.71	137.96

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

ii- Trends in Per Hectare Yield of Principal Crops

Table 7 shows that the yield per hectare of most crops varies from year to year. However, the yield for most crops (except oilseeds) has increased in the latter years of the study. It can be due to improved district irrigation facilities and better infrastructure. Wheat and Rice are the major crops in the district, and their per hectare yield (40 qtls and 30.58 qtls, respectively) are also high. Per hectare yield of total cereals increases from 27.83 qts in 2010-11 to 35.89 qts in 2017.18. Similarly, per hectare yield of total pulses also increases from 12.9 qtls in 2010-11 to 15.88 qtls in 2017-18.

The yield of total oilseeds has decreased from 11.17 in 2010-11 to 9.93 in 2017-18, which is a cause of concern. It can be due to the non-availability of hybrid seeds. The per hectare yield of sugarcane is quite low (394.54 qts in 2017-18). Similarly, the yield of Potato ranges from 93 qtls/ha to 366 qtls. In summary, all crop yields show year-over-year fluctuations with the lowest

in 2014-15 and 2015-16. The lack of homogeneity of yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

Table 7: Trends in Per Hectare Yield of Principal Crops in Kanpur City (Qtls)								
Crop/Year	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Rice	22.50	27.14	23.78	25.47	23.28	21.70	31.59	30.58
Wheat	34.78	34.64	35.55	36.82	14.59	21.11	41.51	39.99
Maize	12.61	13.45	14.82	18.07	12.57	26.81	31.63	35.89
Total Cereal	27.83	28.67	28.94	30.31	15.39	20.70	35.03	35.89
Urad	6.69	5.84	5.23	4.55	3.99	4.88	6.78	6.60
Gram	14.65	12.70	13.06	5.83	7.31	8.86	13.31	17.87
Arhar	15.24	25.00	24.97	28.02	7.64	5.44	13.57	24.47
Total Pulses	12.90	13.45	13.13	9.91	6.41	7.84	11.85	15.88
Total Food Grains	25.42	26.23	26.46	27.12	14.04	18.75	31.52	32.87
Mustard	12.43	12.08	13.81	11.92	8.76	12.02	13.24	11.31
Till (Pure)	1.98	2.62	2.00	0.35	0.41	0.63	2.00	1.98
Total Oilseeds	11.17	10.45	11.92	10.22	7.52	10.28	11.46	9.93
Sugarcane	437.20	471.72	553.04	540.08	497.56	474.10	596.37	394.54
Potato	180.20	175.01	112.66	111.54	92.77	144.96	150.03	366.23
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

iii- Trends in Production of Principal Crops

Table 8 shows the trends in the production of the main crops over the years. Rice, Wheat, and Maize dominate the production. In 2017-18, Rice (99.27 thousand tonnes), Wheat (408.72 thousand tonnes), and Maize (78.16 thousand tonnes) formed a major part of the total cereal production (631.15 thousand tonnes). Coming to pulses, Gram and Arhar occupied the highest production. Gram had a production of 28.4 thousand tons and Arhar had a production of 12.17 thousand tons in 2017-18. Although there is a significant variation in the production of these pulses over the years, they still represent around 80% of the total. Urad is another crop that accounted for around 10% of the total pulses production in 2017-18.

Mustard production was 15.53 thousand tons, which represented more than 94% of the total oilseed production in 2017-18. Sugarcane is another important crop whose Production ranges between 115.007 thousand tons to 173.84 thousand tons, indicating high variation in the production. Potato production varies from 110.24 thousand tons to 435.22 thousand tons over the years. Looking at the annual production data of various crops, we find that their production has increased on average during the period. Still, at the same time, it fluctuated over the years, partly

due to changes in nature and partly due to market conditions. Proper insurance arrangements are the need of the hour to get assured income and take more risk and diversify their production.

Table 8: Trends in Production of Principal Crops in Kanpur City District (in 1000 Tons)								
Crop/Year	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Rice	72.47	90.53	77.28	83.33	76.06	70.91	103.22	99.93
Wheat	357.90	356.76	363.74	375.38	149.15	215.75	424.32	408.72
Maize	27.66	30.87	33.45	40.22	27.38	58.38	68.88	78.16
Other Cereals	30.67	33.66	36.27	34.15	18.15	18.99	19.71	44.34
Total Cereals	488.70	511.82	510.73	533.07	270.74	364.03	616.12	631.16
Urad	4.50	4.09	3.91	3.46	2.99	3.66	5.09	4.95
Gram	24.81	21.13	20.94	9.22	11.62	14.08	21.16	28.40
Arhar	9.81	16.67	12.70	13.78	3.80	2.71	6.76	12.18
Other Pulses	4.53	4.12	5.69	5.82	2.22	4.76	5.10	5.56
Total Pulses	43.65	46.00	43.23	32.28	20.63	25.21	38.10	51.09
Total Foodgrains	532.36	557.83	553.96	565.35	291.38	389.24	654.22	682.25
Mustard	18.44	17.07	19.04	17.19	12.04	16.52	18.19	15.54
Till (Pure)	0.45	0.82	0.49	0.09	0.10	0.16	0.51	0.50
Other Oilseeds	0.77	0.80	0.30	0.37	0.30	0.34	0.28	0.40
Total Oilseeds	19.66	18.70	19.84	17.65	12.44	17.02	18.97	16.43
Sugarcane	128.27	137.70	164.03	158.73	145.04	138.20	173.84	115.01
Potato	214.51	205.92	128.12	129.35	110.25	172.27	178.30	435.22
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

To understand the variability across the years (Table 9), we calculated the mean, standard deviation (SD), and coefficient of variation (COV) of the area, production, and yield of the main crops. Among the areas under different crops, the lowest variability is observed in wheat (0.36%), followed by sugar cane (0.63%) and Rice (0.98%), and the highest in Arhar (13.56%). The variability in the area under total pulses (2.5%) is much more than the variability in the area under total cereals (0.54%). Since Rice and wheat dominate the production, the variability in the area under total food grains is very low (0.86%).

Table 9: Variability in Area, Production, and Yield of Principal Crops (2010-11 to 2017-18)									
Crop/Year	**Area (1000 Ha)**			**Production (1000 tons)**			**Yield (Qty. /Ha)**		
	Average	**SD**	**COV**	**Average**	**SD**	**COV**	**Average**	**SD**	**COV**
Rice	32.69	0.32	0.98	84.22	12.41	14.74	25.75	3.47	13.47
Wheat	102.38	0.37	0.36	331.46	96.75	29.19	32.37	8.84	27.31
Maize	22.10	0.45	2.04	45.62	20.05	43.94	20.73	8.75	42.22

Total Cereal	176.24	0.94	0.54	490.80	121.03	24.66	27.85	6.43	23.08
Urad	7.35	0.31	4.21	4.08	0.73	17.85	5.57	1.00	17.91
Gram	16.13	0.42	2.61	18.92	6.65	35.14	11.70	3.77	32.26
Arhar	5.38	0.73	13.56	9.80	4.96	50.66	18.04	8.16	45.20
Total Pulses	32.77	0.82	2.50	37.52	10.63	28.33	11.42	2.95	25.81
Total Food Grains	208.77	1.79	0.86	528.32	129.81	24.57	25.30	5.82	23.01
Mustard	14.02	0.41	2.95	16.75	2.21	13.20	11.95	1.41	11.83
Till (Pure)	2.57	0.25	9.86	0.39	0.25	65.10	1.50	0.83	55.28
Total Oilseeds	16.95	0.55	3.26	17.59	2.41	13.71	10.37	1.26	12.12
Sugarcane	2.93	0.02	0.63	145.10	19.50	13.44	495.58	61.33	12.38
Potato	11.77	0.19	1.63	196.74	103.47	52.59	166.68	80.81	48.48
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

The variability of production depends on the variability of the cultivated area and the variability of the yield. Therefore, the variability in the production of different crops is greater than in the cultivated area of all crops. The highest variability in production is observed in Till (65.10%), followed by Potato (52.59%), Arhar (50.66%), and maize (43.94%). High variation in the production of pulses is partly due to variation in the land area under them and partly due to the vulnerability of pulses to pests which are a major hindrance to the adoption of pulses by farmers. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in sugar cane (13.44%), followed by mustard (13.20%) and Rice (17.74%)

In the case of yield, the greatest variability is estimated in till (55.28%), followed by Potato (48.48%) and Arhar (45.20%). Yield variability in total cereals (23.08%) and total food grains (23.01) is lower as compared to that in total pulses (25.81%). Sugarcane, Rice, and mustard are the most consistent crops overall years. Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

Table 10 compares the share of the main crops in the total GCA and their share in the total value of agricultural output (VOP). It is significant to note that total Foodgrains and total oilseeds, on average, have a relatively larger share in GCA than their share in VOP, while Wheat, Potato, and Sugarcane have, on average, a greater share in VOP than GCA. Kanpur is mainly a food grain production district; therefore, food grains account for around 80% of the gross area of the crops. Similarly, total foodgrains account for nearly 80% of the total value of the agricultural product.

Three crops - wheat, paddy, and Potato together accounted for, on average, around 56.21% of GCA and a similar share in the total agricultural product as well. Overall, the total agricultural GCA has remained consistent over the years (around 262 thousand hectares) while the total value of the product has increased significantly and became more than double what it was in 2011-12, that is, (Rs.1045.3 Cr..) in 2011-12 to (Rs.2580.14 Cr.) in 2017-18.

Table 10: Share of Principal crops Total GCA and Total Value of agriculture products in Kanpur City

Crop	% Share in	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wheat	GCA	39.22	39.40	39.15	38.87	39.02	39.43	39.43	38.79
	VOP	42.80	42.46	42.63	41.39	22.37	26.64	46.03	28.64
Paddy	GCA	12.27	12.76	12.43	12.48	12.48	12.61	12.61	12.40
	VOP	14.21	42.46	21.04	18.83	22.04	14.18	8.98	11.23
Total Cereals	GCA	66.92	68.29	67.51	67.06	67.15	67.85	67.85	66.75
	VOP	62.94	64.80	69.95	70.44	56.12	56.47	64.24	48.11
Total Pulses	GCA	12.89	13.08	12.60	12.42	12.28	12.41	12.41	12.21
	VOP	12.93	13.34	13.41	12.96	13.71	18.91	18.70	16.61
Total Food Grains	GCA	79.81	81.38	80.11	79.49	79.24	80.06	80.06	78.77
	VOP	75.87	78.14	83.36	83.40	69.83	75.38	82.93	64.72
Total Oilseeds	GCA	6.71	6.84	6.36	6.58	6.32	6.38	6.38	6.28
	VOP	5.27	5.28	5.80	5.52	7.31	8.35	4.95	2.76
Potato	GCA	4.54	4.50	4.35	4.42	4.54	4.58	4.58	4.51
	VOP	16.42	14.00	7.43	6.53	16.18	10.45	8.51	30.92
Sugarcane	GCA	1.12	1.12	1.13	1.12	1.11	1.12	1.12	1.11
	VOP	2.33	2.46	3.30	4.42	6.56	5.31	3.55	1.56
Paddy + wheat + Potato	GCA	56.03	56.67	55.93	55.77	56.04	56.62	56.62	55.71
	VOP	59.34	60.70	66.97	64.64	50.97	46.13	58.56	41.43
Total Agriculture	GCA (1000 Ha)	262.42	261.38	261.38	262.26	261.93	259.24	259.24	263.48
	VOP (in Cr Rs)	1045.30	1176.27	1241.59	1006.65	618.85	728.93	1493.42	2580.14
Per Worker VOP (Rs.1000 at current prices) in Kanpur City		-	33.01	38.09	41.97	30.66	38.02	48.98	54.58
Per Worker VOP (Rs.1000 at current prices) in UP		-	40.66	48.69	52.50	52.11	56.48	61.97	69.69

Source: http://updes.up.nic.in/spiderreports/intialisePage.action
And District-wise Indicator reports

Table 10 shows that the total value of agricultural produce per agricultural worker in Kanpur City district increased from Rs. 33.01 thousand in 2011-12 to Rs.54.58 thousand rupees in 2017-18, a net increase of 65.34% at current prices, while in UP it increases from Rs. 40.66 thousand to Rs.69.69 thousand, a net increase of 71.40%. Thus, the total value of agricultural output per agricultural worker is much higher in the state than in the district, but the rate of growth of total value in the district is greater than in the state. The ratio of per worker output of the district to the state average has slightly decreased from 0.81 in 2011-12 to 0.78 in 2017-18.

2.1.4. Consumption of Chemical Fertilizers

Table 11 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2010-11, nitrogen represented 63.68% of the total fertilizers used, while the proportions of phosphorus and potassium were 28.47% and 7.83%, respectively. In 2017-18, however, the nitrogen share increased to 71.19%, while the phosphorus share decreased to 25.18%, and the potassium share fell to 3.61%. The use of nitrogen is more than the recommended ratio, while the Phosphorous and potassium ratio is less than the recommended ratio. The table also shows that fertilizer consumption varies from year to year, which can be due to several factors, including rainfall patterns, cultivation patterns, etc. Although the overall use of chemical fertilizers has reduced in the district from 427.85 kg/ ha in 2010-11 to 157.10 kg/ ha in 2016-17, with a sudden increase in 2017-18 (414.38 kg/ha) but still the authorities can take steps to further reduce their consumption as chemicalization of agriculture degrades soils and water resources and increase the non-point sources of pollution in River Ganga. The use of organic fertilizers and biofertilizers can help to reduce the soil and water dregradation.

Table 11: Trends in Use of Chemical Fertilizers in Agriculture (Kgs/per ha GSA)

Fertilizer/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Nitrogen	272.49	292.52	193.54	107.22	115.22	105.06	106.22	295.02
Phosphorous	121.84	130.38	82.90	28.53	33.60	39.44	42.28	104.36
Potassium	33.52	22.76	8.93	3.87	6.96	7.44	8.60	15.00
Total	427.85	445.66	285.37	139.62	155.78	151.94	157.10	414.38
Gross Sown Area (Ha)	262418	266000	261380	262262	261932	259235	259235	263480

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.5. Irrigation Structure and Status

The types of irrigation systems and the percentage of the net and gross irrigated area to the net and gross cropped area, respectively, are described in table 12. The length of the canals (955 km) and the number of ground pump sets (73) have remained almost constant since 2011-12. The

number of Government tube wells increased from 298 in 2011-12 to 359 in 2018-19. The number of wells has remained consistent (166) over the years. Shallow, medium, and deep tube wells increased by 8.37%, 173%, and 46.86%, respectively, in 2018-19 compared to 2010-11. The district's net and gross irrigated areas have shown variability over the years, with an average of 70.03% and 70.92%, respectively.

Table 12: Types of Irrigation Systems and percentage of the net and gross Irrigated Area

Name/Year	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18	2018 -19
Length of Canal (KM)	955	955	955	955	955	955	832	832	832
No. of Govt. Tube wells	298	298	342	342	385	404	391	359	359
No. of Wells	166	166	166	166	166	166	166	166	166
No. of Ground-level Pump set	73	73	73	73	73	73	73	73	73
Shallow Tube well	42137	42320	42580	42795	43155	43687	44753	45664	45664
Medium Tube well	1278	2015	2495	2891	3006	3132	3323	3493	3493
Deep Tube well	2930	3585	3930	4056	4116	4163	4243	4303	4303
% Of NIA	70.22	80.07	64.87	63.99	71.27	69.89	69.89	70.06	-
% Of GIA	67.19	66.63	68.64	69.04	68.64	91.72	67.57	67.96	-

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

Canals and groundwater (GW) both are the main source of irrigation in the district. The canal's share in the NIA (around 23%) has remained consistent over the years, with a slight fall observed in 2013-14 and 2014-15. The share of wells and tube wells in NIA (around 76%) has also remained consistent over the years, with a slight increase observed in 2013-14 and 2014-15. Table 13 also shows that the development of the GW in the district has been quite high and that only about 15% of the GW has yet to be exploited.

Table 13: Source-wise Area under Irrigation in Kanpur city (in %)

Source/Year	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18
Canal (surface Irri.)	23.47	22.76	21.04	19.27	16.96	23.26	23.26	23.20
Wells And Tube-wells (GW Irri.)	76.45	77.02	78.75	80.61	82.91	76.65	76.65	76.71
Others	0.08	0.22	0.21	0.12	0.13	0.09	0.09	0.09
NIA (1000 ha)	131.99	151.27	120.76	120.12	131.79	133.50	133.50	133.80
% Of Remaining GW to Total GW	15.47	-	12.06	-	15.47	15.47	20.76	-

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

Table 14 shows that a majority area under Rice (average, 100%), Wheat (average, 100%), Potato (average, 100%), and Sugarcane (average, 100%) is irrigated. Percentages of the irrigated area under pulses (average, 11.37%) and oilseeds (average, 49.01%) are relatively less.

Table 14: Trends in Crop-wise Irrigated Area in Kanpur Nagar (as % Of cropped area)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	100	100	99.57	99.57	100	100	100	100
Wheat	100	100	100	100	100	99.82	99.82	99.82
Total Cereal	79.28	22.50	79.04	78.65	79.30	79.30	79.30	79.30
Total Pulses	9.98	10.25	10.68	12.09	12.02	12.02	12.02	12.02
Total Foodgrains	68.09	67.54	68.29	68.25	69.06	69.06	69.06	69.06
Total Oilseeds	44.65	42.40	59.27	62.71	45.78	45.78	45.78	45.78
Potato	100	100	100	100	100	100	100	100
Sugarcane	100	100	100	100	100	100	100	100

Source: Compiled from Statistical Abstract, Uttar Pradesh

2.1.6 Electricity Intensity in Agriculture

Electricity is one of the main energy sources used in agriculture. Table 15 shows that per capita electricity consumption in agriculture has increased significantly from 449.81 KWH in 2011-12 to 657.05 KWH in 2019-20, a net increase of approximately 46%. This is a cause of concern as this can result in an increased burden on non-renewable resources and create waste disposal problems. The percentage share of agriculture in the total electricity consumption in the district is very minimal. This can be due to high electricity consumption in secondary and tertiary sectors. Since electricity consumption has increased over the years, it is very important for the authorities to switch to more sustainable modes of electricity production, such as solar panels.

Table 15: Trends of Electricity consumption in Agriculture

Division/ Year	2011-12	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (KWH)	449.81	439.4	502.2	657.08	665.7	630.69	657.05
% Of electricity consumed in Agriculture sector to total consumption	0	0	0	0	0	0	0

Source: District-wise Development Indicators file.

2.1.7. Status of Agriculture Markets

Table 16 shows the marketing infrastructure in the district. It has four main markets and six sub-markets, which have remained constant over the period. The number of regulated mandis per lakh hectare of Net area sown had decreased from 5.33 in 2013-14 to 2.16 in 2017-18, which is a

notable issue as it is very important for farmers to have proper access to mandis for them to be able to sell their produce.

Table 16: Status of Agriculture Markets in Kanpur City

Category/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Main Markets (No.)	4	4	4	4	4	4	4
Sub Markets (No.)	6	6	6	6	6	6	6
Total Markets (No.)	10	10	10	10	10	10	10
No. of Regulated mandis per lakh Ha. of net area sown	5.33	3.32	-	2.09	2.16	5.24	-

Source: Compiled from Statistical Abstract, Uttar Pradesh and District-wise Development Indicators file.

2.1.8. Status of Organic Farming

To promote sustainable agricultural practices and improve the farmers' livelihood, the Government of India launched PKVY and Namami Gange schemes. Under these schemes, farmers are incentivized to form groups to do organic farming and sell their products with PGS certification. Under the programme, the beneficiary farmers get Rs.12000, Rs. 10000, and Rs.9000 per hectare, respectively, in the first, second, and third year of conversion.

The transition period for the full conversion from conventional to organic is considered three years. During this period, crop yield, on average, is expected to decline by 10—15 percent. But after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate for the yield losses and motivate them to do organic farming. There is a need to set up an integrated processing unit for organic products. Monitoring of the project should be periodically done through MIS, Geo-tagging, and monthly physical and financial reports.

However, the policy-related issue is what would be after the three years? Will the government protect their income? There may be a possibility that the beneficiary farmers may revert to conventional farming in the absence of the regulatory framework. In this context, two things need to be thought of—a well-designed regulatory and monitoring framework and introduction of payments for ecosystem services for the organic farmers after the transition period so that they may carry on the activity on a sustainable basis. Organic and zero-budget farming will provide ecological services in terms of soil health, human and animal health, saving of water, protection bio-diversity, etc. To sustain the organic farming initiative, a long-term system of payments for ecological services may be evolved to retain the existing farmers and motivate others to move towards this sustainable farming system. There is no assured market for these products, and farmers do not get premium prices. They sell their products at the same prices their

conventional counterparts do. Certification and quality check and monitoring mechanisms are yet to be set up.

Table 17 shows the details of the establishment of organic clusters under the Paramparagat Krishi Vikas Yojana in the district. The district has 35 groups in eight development blocks. The highest number of groups are in Chaubeypur (8), closely followed by Kalyanpur (7), Bilhaur (6), and Sarsol (6). These four blocks together consisted of about 77% of the total groups. Significantly high variation can be seen in the number of farmers per group across the various development blocks. It is reported that the maximum limit of land under a cluster per farmer is 2.00 hectares. Hence, the majority of the beneficiary farmers are small and marginal. No organic cluster under the Namami Gange scheme has been reported till now.

Table 17: Status of Organic Farming PGS Groups under PKVY and Namami Gange Schemes in Kanpur City (as on June 30, 2021)

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Bilhaur	PKVY	6	277	46.16	47.5	3.54
2	Chaubeypur	PKVY	8	281	35.125	36	6.03
3	Ghatampur	PKVY	1	50	50	50	0
4	Kalyanpur	PKVY	7	214	30.57	30	6.92
5	Patara	PKVY	1	29	29	29	0
6	Sarsol	PKVY	6	270	45	46	4.81
7	Shivrajpur	PKVY	5	225	45	43	3.39
8	Vishnu	PKVY	1	32	32	32	0
9	District Total (Kanpur City)	PKVY	35	1378	39.37	42	8.32
		Total	35	1378	39.37	42	8.32

Source: Compiled from https://pgsindia-ncof.gov.in/

Since per hectare use of chemical fertilizer is quite high in district agriculture, a gradual shift of farmers from conventional to the organic farming system is likely to positively impact water quality and soil health along with farming sustainability. However, being a knowledge-intensive system of farming, farmers need proper training to know the practical details of the integrated sustainable farming system. Since economies of scale in both production and marketing matter in organic farming, some institutional framework may be needed in the forms of SHGs/ farm cooperative/PFOs/contract farming, etc. Organic farming could be an economically viable option in the district if the government builds strong marketing networks linking farmers, processors, and distributors with the easy certification process and minimizes farmers' risk by protecting their farm income through payments of ecosystem services. A long-term system of incentive and regulation needs to be evolved to retain the existing farmers and motivate others to move towards the sustainable farming system in the district.

The major problem for the growth of organic farming observed are:

- The major concern of the farmers was poor marketing of the organic products and not being able to fetch a premium.
- Scaling up organic production is another problem. The problem of marketing is even more serious in the case of perishable vegetable crops. Contract farming companies and Farmer Producers' companies can be encouraged.
- To benefit from the scheme, farmers practice organic farming only on a small part of their land (less than one ha).
- Although organic farming clusters are formed, the farmers allocated a part of their lands to organic farming and practiced conventional farming in the rest of the area, which may contaminate the organic produce and fail the purpose of the cluster approach in organic farming.
- The knowledge and awareness level regarding practices under organic farming was inadequate among farmers.

2.2. Trends in Livestock

Livestock forms an integrated part of the rural economy. From Table 18, we can infer that the number of indigenous and exotic male cattle has decreased considerably from 78932 in 1997 to 8358 in 2019 and from 13848 in 1997 to 2695 in 2019, respectively. However, on the other hand, the number of indigenous and exotic female cattle has increased considerably from 88295 in 1997 to 113707 in 2019 and from 40524 in 1997 to 50506 in 2019, respectively. Thus, the total number of cattle decreased only slightly from 221599 in 1997 to 175266 in 2019, thus, a net decrease of 20.9%. Similar inferences can be drawn from the buffalo data as the number of male buffalo decreased, but the number of female buffalo increased; thus, a net increase of 123% in 2019 as compared to 1997 is observed in the total population of buffalo. A significant reduction in the population of indigenous sheep is observed (26%) in 2019 as compared to that in 1997, and during the same period, the population of exotic sheep also decreased significantly by 89%, thus, indicating a decrease in the total sheep population by 35%. The total population of goats increased from 155578 in 1997 to 292141 in 2019, a net increase of 87%. The total pig population decreased considerably from 43441 in 1997 to 7464 in 2019.

It is significant to note that the number of female cattle and buffaloes has substantially increased over the period, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock. The livestock subsector has around 31% share in the agriculture and allied activities sector and grew at a significant average annual growth rate of 8.21% from 2011-12 to 2018-19.

Table 18: Trends in Livestock population (in numbers) Kanpur City

	Category	1997	2003	2007	2012	2019

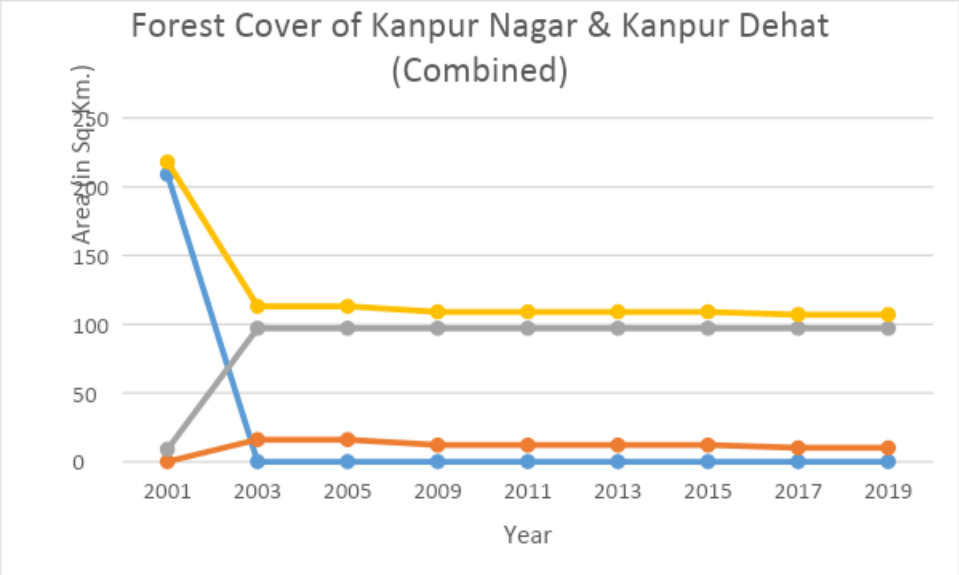
Indigenous Cattle	Total Male	78932	70190	74336	42552	8358
	Total Female	88295	89721	87931	103873	113707
	Total	167227	159911	162267	146425	122065
Exotic Cattle	Total Male	13848	9143	9827	10726	2695
	Total Female	40524	17383	16794	38546	50506
	Total	54372	26526	26621	49272	53201
Total Cattle		221599	186437	188888	195697	175266
Buffalo	Total Male	60570	73950	94596	84098	24089
	Total Female	160702	204999	239688	289979	469956
	Total	221272	278949	334284	374077	494045
Sheep	Total Indigenous Sheep	11388	9382	6942	8000	8414
	Total Exotic Sheep	1987	124	17	1014	202
	Total Sheep	13375	9506	6959	9014	8616
Goat	Total	155578	208210	242403	243810	292141
Pig	Total Indigenous Pig	34732	163413	182675	53682	6754
	Total Exotic Pig	8709	2840	3579	3142	710
	Total Pig	43441	166253	186254	56824	7464
Total Livestock		662634	853438	959597	881760	-
Total Poultry		104822	140033	559170	732224	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And http://dahd.nic.in/animal-husbandry-statistics						

Table 19 shows that the Kanpur City district has an active network of cattle hospitals and development centres, which are very necessary for the livestock sub-sector to grow. The number of cattle hospitals has remained consistent around 33 over the years. Similarly, the number of cattle development centre (74) and man-made reproduction centre (86) has also remained consistent over the years. There are very few pig development centres in the district (4), which might be one of the reasons for the declining pig population in the district.

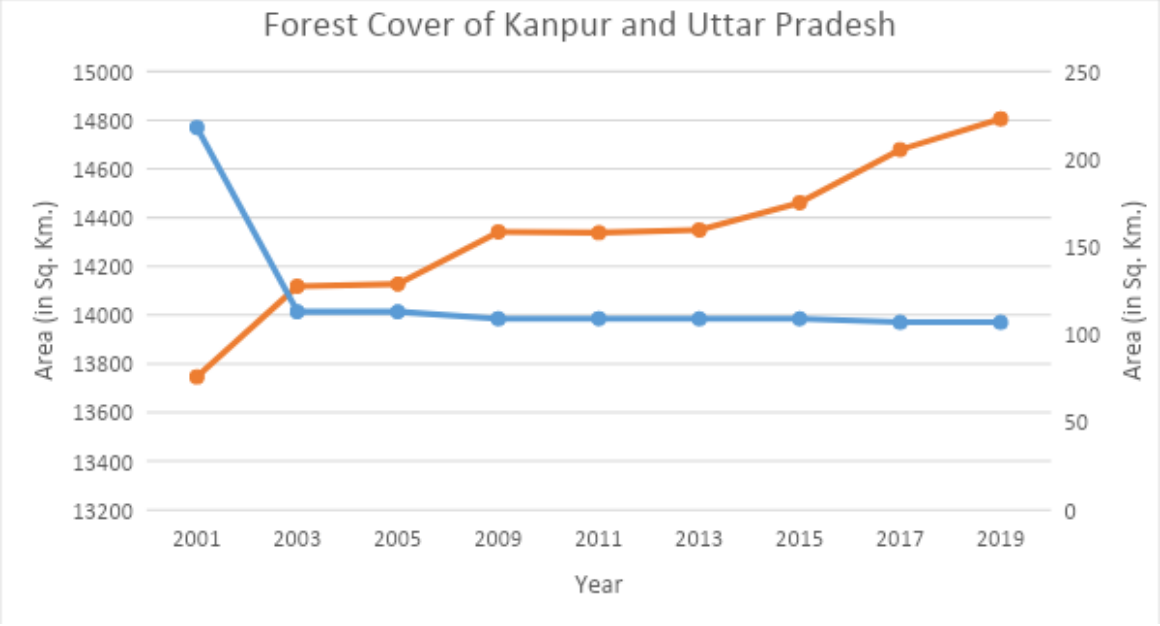
Table 19: Year-wise number of Cattle Hospitals and Development Centers

Category	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Cattle Hospital	33	33	33	33	33	33	32	32
D- category Cattle Dispensary	4	5	5	5	5	5	5	5
Cattle Development Centre	70	74	74	74	74	74	74	74
Man-Made Reproduction Centre	86	86	86	86	86	86	111	111
Pig Development Centre	0	4	4	4	4	4	5	5
Poultry Unit	181	620	620	390	342	400	200	200
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3 Forestry



According to the FSI data, the forest cover of Kanpur district (combine) has decreased. The district has open forest i.e. 97 sq. km., followed by medium dense forest i.e. 10 sq. km.. There is no extent of very dense forest in the district.



The forest cover of Uttar Pradesh has increased between 2001 and 2019, but the forest cover of Kanpur has decreased.

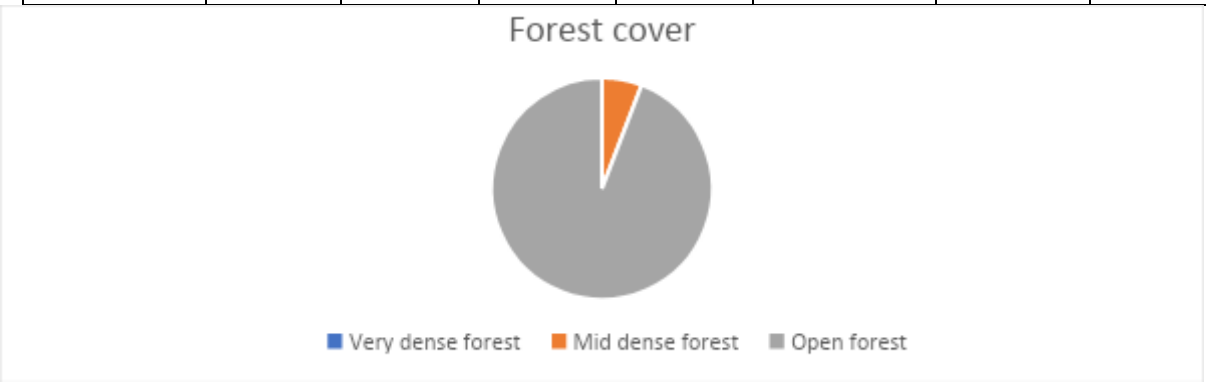
2.3.1. Biodiversity: No national park and wildlife sanctuary present in the district. The district's biodiversity data includes crop production, livestock population, bird species, and forest cover. The crop production trend shows a reduction in the non-grain crop but increases in all other crops. Allen Forest Zoo has an area of 77 hectares, making it the largest open green space not only in Kanpur, but also in Asia. It is home to a diverse range of natural plants and wildlife. It is one of India's zoos that was built in a natural forest area. White Asian tigers, Asiatic lions, cheetahs, leopards, jaguars, hyenas, black, grizzly, and sloth bears, rhinoceros, hippopotamus, monkeys, languor, baboons, musk deer, antelopes, chimps, and orangutans are among the mammals found here.

Table 1 Bird species recorded in the district Kanpur Nagar.

Number of species	367
Number of rare/accidental species	5
https://avibase.bsc-eoc.org/checklist.jsp?region=INggupah	

Forest cover Kanpur Nagar (in sq. km.)

Geographical area	Very dense forest	Mid dense forest	Open forest	Total	% of Geographical area `	Change with respect to 2017 assessment	Scrub
3155	0	7	59	66	2.09	0	3.00



2.4 Tourism

Kanpur is an industrial city in Uttar Pradesh, and this became a reason for Kanpur to flourish its tourism simultaneously. Famous for its leather industry, the town became Manchester of the State during the British Raj, and it eventually led to the development of tourist spots and heritage sites. The city is located on the bank of the holy river Ganga and hence became a sacred spot for Hindus. Indian Institute of Technology let the technological and industrial growth of the town. A Central railway station allowed Kanpur to attract more travellers.

Domestic/foreign visitors in different years in a particular city

ANNUAL TOURIST VISITS STATISTICS- Kanpur Uttar Pradesh				
Year	**Tourist-Domestic**	**Tourists-Foreigner**	**% Change in domestic tourist**	**% Change in foreign tourists**
2013	303979	22721		
2014	427848	23921	40.75	5.28
2015	429128	24266	0.30	1.44
2016	434045	24343	1.15	0.32
2017	2741610	21062	531.64	-13.48
2018	2773936	21245	1.18	0.87
2019	2927069	8866	5.52	-58.27
2020	677077	1427	-76.87	-83.90

Table-1; Source: Dept. of Tourism, Uttar Pradesh Government

a. The above-given data table is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Kanpur for tourism from 2013 to 2020. The tourist visits are bifurcated into two different groups – Domestic and Foreign tourists. The table also embraces data which show the change in the number of tourists compared to previous years.
b. The data table shows that the number of domestic tourists in 2014 increased 40% compared to 2013.
c. 2015 seems not a good year for tourism, as it witnessed only a 0.3% increase in the number of domestic tourists compared to 2014. Although only if the numbers are considered, there is a slight increase in the number of domestic tourists.
d. 2016 data also shows that the year was not good for tourism. The number of domestic tourists increased only 1.15% compared to 2015 data.
e. In the year 2017, Kanpur witnessed a drastic increase in the number of tourists. The number of tourists in 2017 increased five times compared to the previous year. Kanpur, in the year 2017, embraces the highest number of tourists.
f. 2018 contained almost the same number of tourists, which is a good sign of the sector's growth. In this year, Kanpur witnessed a 1.18% increase in the number of tourists.
g. 2019 data shows that Kanpur witnessed a 5% growth in domestic tourists compared to the previous year's data.
h. The year 2020 is the exception year for all the economic activities. Due to pandemic conditions, the hospitality and tourism sector suffered the most. As a result, Kanpur recorded a loss of 76.8% domestic tourists this year.
i. The number of foreign tourists increases from 2013 to 2016, although the growth rate is shallow.

j. The number of foreign tourists decreases in the year 2017. The numbers reduced by 13% compared to the previous year.
k. In 2018 Kanpur recorded positive growth in the number of foreign tourists, although the rate is 0.87%.
l. In the year 2019, Kanpur faces a drastic fall in the number of foreign tourists. The number of tourists lowered by 58% this year.
m. In 2020 the number of foreign tourists further lowered by 83 % in Kanpur compared to the previous year data.

Domestic and foreign visitors in different years in Uttar Pradesh

The Indian and Foreign Tourist visits in Uttar Pradesh from 2016 to 2020						
				Percentage increase/ reduce in comparison to the previous year		
Year	**Indian**	**Foreigner**	**Total**	**Indian (%)**	**Foreigner (%)**	**Total**
2016	213544204	3156812	216701016	3.4	1.69	3.37
2017	233977619	3556204	237533823	9.56	12.65	9.61
2018	285079848	3780752	288860600	21.84	6.31	21.6
2019	535855162	4745181	540600343	87.96	25.5	87.14
2020	86122293	890931	87013224	-83.92	81.92	-83.9

Table-2; Source: Dept. of Tourism, Uttar Pradesh Government

a. The above-given graph shows the number of visitors who visited Uttar Pradesh from 2016 to 2020. In the year 2016 number of domestic tourists increased to 3.4% compared to 2015, and foreign tourists increased to 1.69%. In the year 2017, the growth rate increased to 9.56% in domestic tourists and 12.65% in foreign tourists.
b. Data shows that 2018 had been a fruitful year for Uttar Pradesh tourism. Uttar Pradesh encountered a 21.6% increase in tourist numbers from the previous year, a significant change in numbers. However, the patten is not similar in Kanpur
c. 2019 was a year when the global event Kumbh Mela 2019 was organized in Prayagraj (a District in Uttar Pradesh). The results are visible in the numbers (given in the data table above), 87.14% increase in the number of tourists compared to 2018. The data also shows foreign visitors increased to 25% in 2019. The enhanced response of tourists shows the consumer behaviour, which majorly depends on advertisements. A commodity that has been presented to be associate with the emotions of consumers has a high potential to sustain and perform better than its competitors.
d. The surge in the number of tourists in Kumbh Mela 2019 is attributed to expensive advertisements, extra-standard facilities, and a political campaign. All this together made the event a mega event. Security aspect in such organization is a significant factor which

influences the success and failure. Kumbh Mela 2019 witnessed extra tight security and surveillance to prevent stampedes and violence in the Mela.

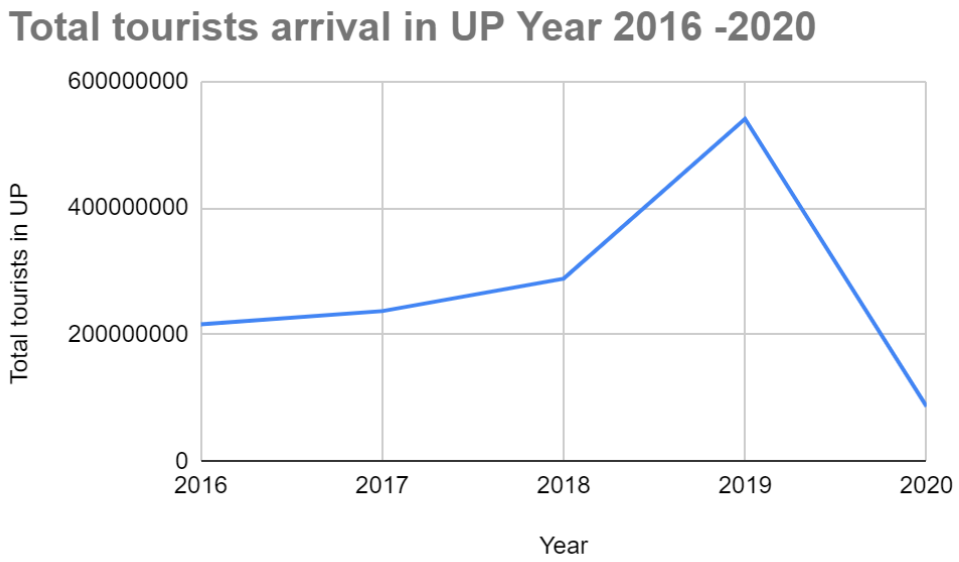
e. Such grand organization of events are also a factor on which the number of tourists to other districts (especially domestic tourists) and states (especially foreigner tourists) depend. Although the number of tourists did not significantly increase in Kanpur during Kumbh Mela 2019.
f. The scenario of foreign tourists is worse compared to state data. Even the mega event Kumbh mela could not increase the number of foreign tourists in Kanpur. This signifies the lack of transfer of information.
g. The district witnessed the increased growth in number of domestic tourists but not in foreign tourists. It is necessary to understand the shortfalls before working on upcoming policies and agendas.

Budget allotted/ Expenditure in different years by tourism dept.

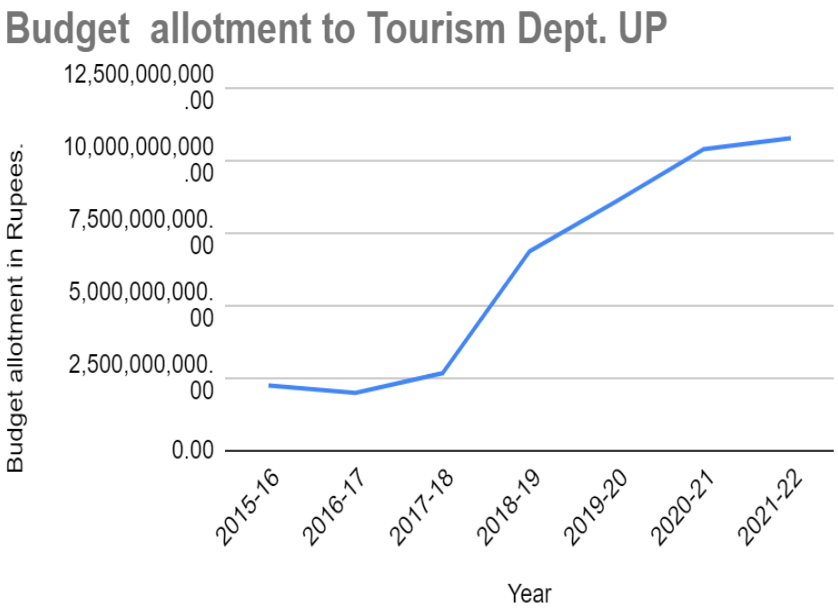
Budget -Department of Tourism, in Different Years		
Year	**Budget in Rupees**	**Per cent increase or decrease**
2015-16	2,245,098,000.00	
2016-17	1,992,912,000.00	-11.23%
2017-18	2,671,016,000.00	34.03%
2018-19	6,870,209,000.00	157.21%
2019-20	8,596,205,000.00	25.12%
2020-21	10,382,037,000.00	20.77%
2021-22	10,759,153,000.00	3.63%

Table-3; Source: Dept. of Tourism, Uttar Pradesh Government

The above-given table shows the budget sanctioned for the Department of Tourism, Uttar Pradesh, from the Financial Year (FY) 2015-16 to 2021-22. In the initial FYs, which are 2015-16, 2016-17, 2017-18, the amount sanctioned to the department is significantly low. In the FY 2018-19 Department received a 157.21% increased budget. Which followed a 25% increase in the next FY-2019-20. A similar trend is visible in the number of tourists, skyrocketing of tourists is found in the same years. This directly implies that the money spent is directly proportional to the tourists in particular FY.



Graph-1; Source: Dept. of Tourism, Uttar Pradesh Government



Graph-2; Source: Dept. of Tourism, Uttar Pradesh Government

The trendlines graphs 1 and graph 3; mentioned above show the trend of budget allotment to the Tourism and increase in tourist arrivals. Before 2020 the trendlines follow a similar pattern: the money allotted to the Department is directly proportional to the Tourist arrival in the State. 2020 is an exception during which pandemic seized the tourism activities.

2.5 Wetlands

The district has vast wetlands consisting of lakes and ponds like Rahnas Jhil (43.66 Ha), Shyamsi Jhil (28.41 Ha), Moti Jhil (11.45 Ha). Table 1 represents the number of wetlands and their area representation in the district. There are around 338 wetlands sized greater than 2.25 Ha and 1189 less than 2.25 Ha areas. The region consists of small and medium-size wetlands only, generally less than 200 Ha in the area.

Table 1: Wetland Data of Kanpur District

	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	11	17	6	0	6	2	2	1	0	0	0	0	8
Ox-bow lakes/cut off meanders	3	5	2	0	0	0	1	2	0	0	0	0	2
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	7	11	4	0	0	1	3	2	1	0	0	0	7
Waterlogged	18	19	1	0	3	7	3	5	0	0	0	0	7
River/Stream	0	87	87	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	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanks/ponds	126	129	3	0	81	27	14	3	1	0	0	0	94
Waterlogged	62	70	8	0	10	16	21	13	2	0	0	0	27
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (1527)	227	338	111	1189	100	53	44	26	4	0	0	0	145

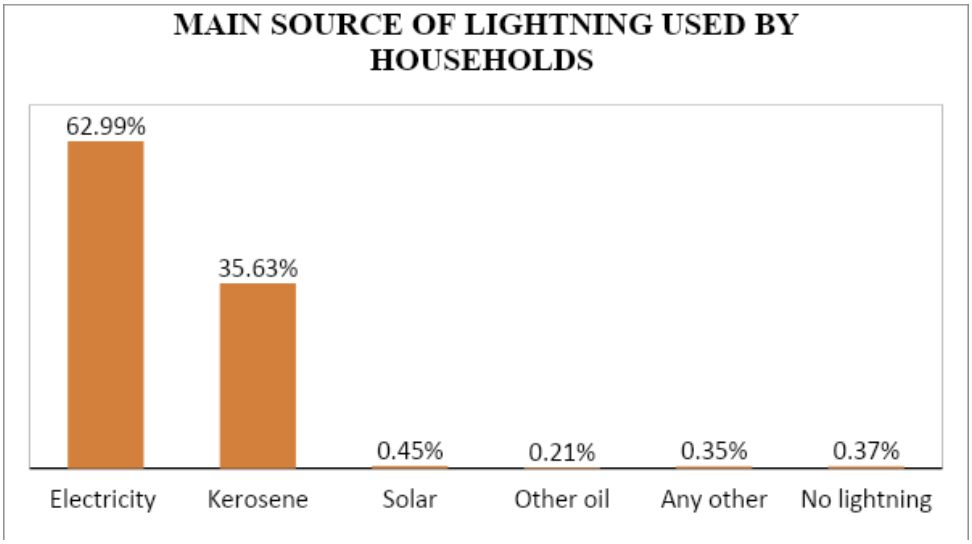
Source: (National River Conservation Directorate, 2008), (Space Application Centre-ISRO, 2007)

- The district comprises 1527 wetlands; most are waterlogged and lake/ponds/tanks.
- The wetland size is small and medium-sized in general.
- The number of natural wetlands is less than man-made.
- Half of the wetlands (>2.25 ha) have aquatic vegetation.

2.6 Energy

2.6.1. Solar Energy

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the nodal agency which looks after the growth and expansion of renewable energy in the state. UPNEDA takes efforts to develop the capacity in renewable energy sources such as solar energy, small-scale hydro-electricity and biomass-based electricity production in the state. Various capacity solar power plants are being installed for electricity generation from solar energy. According to the 2011 census (as depicted in figure), 62.99% households in the district use electricity as the main source of lightning, followed by 35.63% households using kerosene and only 0.45% using solar as the main source of lightning. This depicts that despite having a good industrial base the district still lags in utilizing solar energy to fulfill its power consumption.



Fig

The annual reports on UPNEDA website mention the various solar plant units installed in the district Kanpur Nagar. Different government buildings have been installed with solar plants such as a 1000 kW solar rooftop plant has been installed in CSJMU, Kanpur, a 135 kW solar unit plant has been installed at NSI Kanpur in Kalyanpur, a 100 kW solar plant at Kanpur Development Authority in Arya Nagar, a 90 kW plant at ITO Kanpur, Arya Nagar, a 50kW plant at India Thermit Ltd. in Sishamau, a 40 kW plant at PRS building ALD UP, in Kanpur Cantt. , a 19.9 kW plant at New chocing complex in Sishamau, a 15 kW plant at HPCL , Rasulpur Gogumau, Kanpur, a 14 kW plant each at New driver running room CNB as well as Old Driver Running School in Kanpur Cantt. , a 10kW plant at Officer Rest House CNB Building, Kanpur Cantt, a 70kW plant at Vikas Bhawan Kanpur, a 80-90 kW each at KESCO as well as KESCO collection centres at Kanpur, a 75 kW plant at BSNL Saket Nagar Kanpur and a 45 kW capacity solar plant at BSNL Lajpat Nagar Kanpur. In institutions such as Chatrapati Sahuji Maharaj Krishi University solar plant of 15 kW capacity, Ganesh Shankar Vidyarthi Medical College, solar plant of 139 kW capacity and in Indian Institute of Pulse Research- a solar plant of 179 kW capacity has been installed.

2.6.2.Biomass Energy

Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the nodal agency which makes efforts to develop the capacity in renewable energy sources such as solar energy, small-scale hydro-electricity and biomass-based electricity production in the state. Biomass-based co-generation in the state sugar mills and rice husk based-electricity generation projects are being encouraged. Kanpur Nagar is an industrial district but its economy also depends on agriculture to some extent. The district has fairly good cropping intensity of 113.30% with 188900 ha of net sown area and 266 ha of gross sown area. The major crops and their productivity is the district has been recorded as – rice: 2286 Kg/ha, wheat: 3107 Kg/ha, maize: 1444 Kg/ha,

juar: 1285 Kg/ha and rapeseed mustard : 1059Kg/ha. The district's biomass generation from agro-residues is 602.3 kT/Yr and that from forest and waste land is 81 kT/Yr [Kumar et. al. (2017)].

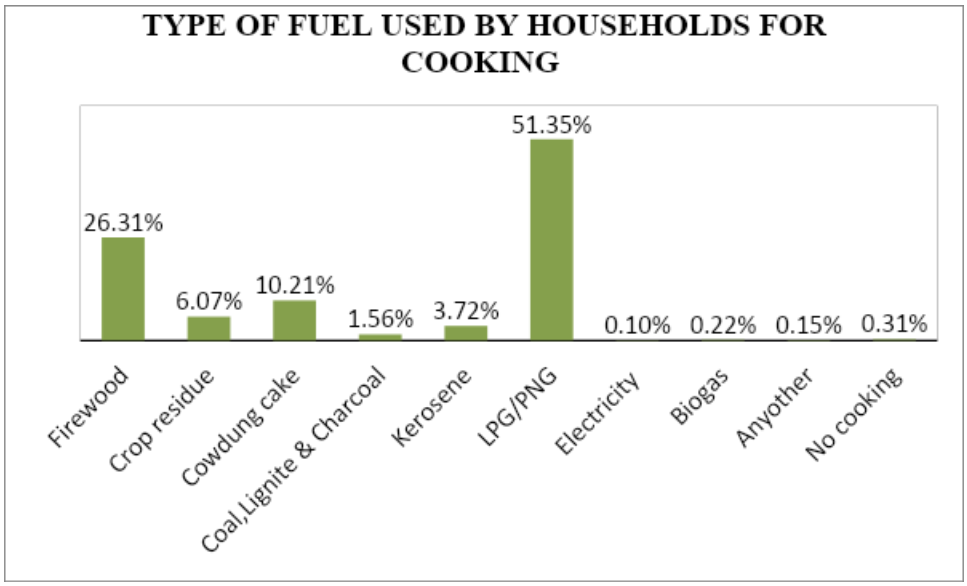


Fig. 1

According to 2011 census (as depicted in figure),, 51.35% households use LPG/PNG as a cooking fuel which is quite appreciable as compared to other districts. 26.31% households use firewood, 10.21% use cowdung cake and 6.07% use crop residue as cooking fuel. A biomass gasifier at M/S B. Ken at Panki, Kanpur has been reported from the Kanpur Nagar district.

2.6.3.Biogas Energy

Rajapurwa Biogas Plant exists in the district and has capacity to produce 55 m^3 of methane gas. Biogas potential has been evaluated by average livestock and agricultural waste production. Biogas potential from animal and agricultural waste calculated approximately as one crore m^3/year and thirty crore m^3/year respectively. This amount of biogas generation can efficiently complete the energy demand of the district.

2.6.4.Hydropower Energy

Kanpur is located on the Ganges (Ganga) River in the Lower Ganges-Yamuna Doab, about 45 miles (72 kilometres) southwest of Lucknow. Available data shows no hydropower plant exists in the district, and no site has been investigated for future projects.

3 QUALITATIVE DATA ANALYSIS

3.1 AGRICULTURE, ALLIED ACTIVITIES,

3.2 FORESTRY

Uttar Pradesh has forest and tree cover of 21720 sq. km, which is 9.01% of its geographical area. The existing flora in Uttar Pradesh can be classified into three categories-

- Wet tropical desiduous forests.
- Dry tropical desiduous forests.
- Tropical throny forests.

To increase forest resources in the country, Ministry of Environment, Forest and Climate Change is implementing a number of Schemes under which financial assistance is provided to State/UT Governments. Some of major schemes of the Ministry are National Afforestation Programme (NAP) and Green India Mission (GIM), Integrated Development of Wildlife Habitat (IDWH), Intensification of Forest Management Scheme (IFMS), Project Tiger and Project Elephant including funds under Compensatory Afforestation Fund Management and Planning Authority (CAMPA).[1]

3.2.1. Biodiversity : The National Green Tribunal (NGT) has approved the construction of a Biodiversity Park (Bio Diversity Park) in the Ganga basin, near to the Irrigation Department's guest house at the Ganga Barrage in Kanpur.

3.3 ENERGY

As per the data of the year 2013, Kanpur district energy consumption is around 11,312 TJ/year and 3.9 GJ/capita/year. GHG emission of 760,747 Ton CO_2 equivalent and 0.264 Ton CO_2 equivalent/capita has been evaluated for the district.

5.5.1. Solar

The district Kanpur Nagar has been progressive in the solar energy sector. A lot of government buildings along with quite a few institutes have been installed with solar energy plants in the district. According to an article in Energetica INDIA, Solar module manufacturer and EPC services provider Vikram Solar has commissioned a 85 MW solar power project for state-owned National Thermal Power Corporation Ltd (NTPC) at Bilhaur town in Kanpur Nagar district in UP. The 85 MW solar photovoltaic (PV) project has been spread across 400 acres of land, used about 3.5 lakh solar modules and includes a 33/132 kV switchyard. The expected energy yield of this

[1] https://pib.gov.in/newsite/PrintRelease.aspx?relid=148508

project in Uttar Pradesh (UP) is 200 million units (MU). The plant is expected to reduce 4.57 tonnes of CO2 and can power 88,905 houses per year.

According to an article in NBT- NTPC to set up 225 MW solar power plant in Kanpur. NTPC has been awarded the 225 MW Solar Energy Plant at Bilhaur in the bidding conducted by UPNEDA. The unit will have two plants of 140 and 85 MW. This will be NTPC's biggest plant in UP in the field of solar energy. According to senior officials of NTPC, the price of electricity from this power plant will be Rs 3 to 3.50 per unit. The bids were floated by UPNEDA for setting up a solar power plant. In the bid, NTPC offered to provide electricity at the lowest cost, after which the company got the Solar Plant Award at Bilhaur.

5.5.2. Biomass

The district Kanpur Nagar has a lot of potential to develop itself into a hub of biomass energy production center as it has a variety of sources of biomass wastes in form of agro-wastes and industrial wastes. The district has a foundational setup of biomass energy in the form of an ethanol unit at National Sugar Institute. An article in Jagran mentions that Governor of the state Anandiben Patel said 'the production of sugar has increased now its turn of ethanol production. Also an article in The Times of India mentions "Nano grain based ethanol unit opened at National Sugar Institute ". This unit is integrated with existing molasses based Ethanol Unit and thus now the system would be "Multi Feed Stock Based Ethanol Unit " capable of working on different qualities of molasses and various grains viz. rice, maize, millets and sorghum etc.

The district is paying attention to sugarcane residue primarily, but attention is also required for the wastes from industries. The district has well established leather industries which should have biomass plants to utilize the biomass wastes. Tanning by-products can be processed thermally, mechanically – like briquetting – used as a substrate for methane fermentation or dried, burnt, pyrolyzed and gasified (Chojnacka et. al., 2021). Also the wastes from the food industry also need attention.

5.5.3. Biogas

The Rajapurwa Biogas Plant, which collects roughly 1400 kg of human waste from a 50-seat toilet complex through subterranean pipelines, is one of Kanpur's most important plants. A digester converts the waste into around 55 m^3 of methane gas. Kanpur's National Sugar Institute has developed biogas generating systems from bagasse and other agricultural waste. Five catties are projected to create enough manure to make 2 m^3 biogas plants to cover the cooking and lighting needs of a family of 4-5 persons.

5.5.4. Hydropower

No data and news articles have been presented for hydropower development and future plans for the district. Neither sites have been investigated so far nor exist at present in the district.

3.4 TOURISM

Best Time to Visit

Kanpur is subjected to harsh climate conditions. Summers are scorching hot, and temperatures drop dramatically in the winter sometimes, the difference in temperature ranges between 40-45 degrees Celsius. October-November is the favourable time to visit Kanpur because temperature lies in the range 20-30 degrees Celsius during these months.

Kanpur Tourist Places

Kanpur is an industrial town, but numerous historical and tourist places can be found here. There are many sightseeing places in Kanpur. Kanpur tourism boasts of several beautiful tourist places ranging from temples to wildlife to its rich heritage and many temples and shrines.

Places of interest

Historical tourism

Jajmau: The Jajmau Mount on the eastern end of Kanpur is believed as an ancient site. During 1957-58, excavation resulted in antiques, coins, sculptures, and stones from 600 BC to 1600 AD. In ancient times according to ritual stories, Jajmau had another name Siddhapuri and was the kingdom of King Yayati, the Purani. In present times Jajmau occupies the Siddhnath and Siddha Devi temples and the tomb of Makhdum Shah Ala-ul-Haq, the famous Sufi saint. The tomb was erected by Firoz Shah Tughlaq in the year 1358. A mosque build by Kulich Khan in the year 1679 is also situated here in the Jajmau.

Bithoor : Bithoor is located 27 kilometres away from Kanpur city on Kannauj Road. According to Hindu mythological stories, Lord Brahma came to Utpalaranyabecause this place was known at that time for the creation of mankind. Bithoor, according to mythology, first witnessed the creation of mankind and called it Brahmavarta or the seat of Brahma. Later, Lord Brahma erected a Shivalinga still worshipped as Brahmeshwar Mahadeva at Bithoor ghat or the Brahmavarta Ghat.

A small pond inside Valmiki Ashram, famous as Sita-Kund. Sita' Rasoi' is still preserved, and a 'Swarga Naseinee' or Deep Malika Stambha is used for illumination.

Kos Minar : Kos Minars were built to ensure distance along royal routes from Agra to Lahore, Agra to Ajmer, and Agra to Mandu in south India, similar to milestones in the current date. During the Mughal Period, ruler Sher shah Suri constructed a road and built a pillar to determine the distance called Kos Minar. The distance between the two pillars was 1 *kos* which is around 2 miles. Kos Minars are solid round pillars, approximately 10 mitres high, on a platform built with bricks and wrapped over with lime. As milestones in ancient times, Kos Minars were an essential part of communication and travel.

Ghats : Bithoor in Kanpur, once famous by 'Bavan Ghaton ki Nagari' (city of 52 Ghats), is left with only 29 Ghats. Major ghats are Tuta Ghat, Patkapur Ghat, Khanderao Ghat, Rishikul Ghat,

Chhappar Ghat, Maharaj Peshwa Ghat, Bramhavarta Ghat, Jhansi Rani Ghat, Mahapatra Ghat, Hanuman Ghat, Kalvari Ghat, Chhatta Ghat, etc. The most beautiful ghat is the Patthar Ghat. At the Kalvari Ghat, a large Ganesh Temple built by the Peshwas can be crowded with devotees. Other popular places for tourists at Bithoor are the Tripura Sundari temple, Pantha Devi temple, Gyaneshwar Mahadev temple, Shivananda Ashram, Janki temple, and Sri Gayatri Dham.

Heritage tourism

Famous archaeological sites near Kanpur are the 'Shiv temple' at Nimbia Khera, the Jagannath temple at Behta Buzurg and the Lala Bhagat Pillar. In Nibiya Khera, an ancient Shiva temple from the 9^{th} &10^{th} centuries is located at Behta Buzurg. Lala Bhagat owns the famous Kukkutadwaj, known as Lala Bhagat Pillar, placed at the mid-point of the Temple. There is red sandstone, six and a half feet high sculpture, octagonally designed with a tiny inscription that dates back to the 1st century.

Musanagar : The ancient Temple of Muktadevi built-in Treta-Yug by Raja Bali is located at the heritage site of Musanagar. A massive fair is organized at Muktadevi temple at the Kartik Poornima festival in October -November. Musanagar is an archaeological site, and excavation produced a considerable number of artefacts and specimens of the post-Harrapan, Shunga, Mauryan and Kushana periods.

Religious tourism

Mukteshwari Devi : Mukta Devi Temple is positioned at the bank of the Yamuna river. Many anecdotes are associated with the foundation of the Temple. People believe that the Devi appears in three different forms throughout the day - a child, a young lady and an elderly lady. Devotees visit Mukteshwari temple to seek fulfilment of wishes, marriage, get married to a person of a girl's choice, and health and prosperity.

Balaji Temple : Balaji Temple is situated 2 km away from the Musa Nagar Highway. This Temple is like the Temple of Balaji (Lord Hanuman) near Jaipur Rajasthan. The Temple consists of the power to remove the problems of Bhoot badha (possession by evil spirits). Devotees go to this Temple to seek fulfilment for relief from possession by evil spirits.

Nibiya Khera – Brick Temple : Nibiya Khera is a village in Kanpur Dehat district of Uttar Pradesh. This ancient Temple was constructed back in the 11th or 12th century. The main hall entrance has a small sub-temple at each of its four corners, due to which this Temple is called 'Panchayatan shaili (design)'. The primary door of the *garbh greh* is made of sandstone, with the

statues of Brahma Vishnu and Mahesh adorning at the top. Shiva's statue in the centre professes makes it a SHIVA temple. Symbolic sculptures of nine planets are also worshipped here.

The Kanpur Memorial Church-All soul's cathedral: Kanpur Memorial Church, earlier known as All Souls Cathedral, was constructed by the British Raj in 1875 to honour the death of the English soldiers during the historic Siege of Cawnpore. Walter Granville, a British architect, designed the Church in Gothic style with red brick Lombardic structure.

The Church is fringed on one side by a cemetery that has the graves of the British soldiers. It is also on its eastern wing, one memorial garden is situated. Some statues and sculptures in the Church are symbolically representing the statue of World peace. It was built by Baron Carlo Marochetti. The Church is located on Albert Lane near Cawnpore Club in Kanpur Cantonment.

RadhaKrishna Temple (JK Temple) : Shri Radhakrishna Temple, also known as the JK temple, was built about half a century back by the JK Trust of the Singhania family. JK temple exhibits an exceptional blend of ancient and modern architecture in its building.

The Temple comprises five temples dedicated to Hindu deities, most notably Radha and Krishna. The other four shrines are dedicated to Lord Hanuman, Lakshmi Narayan, Ardhanarishwar and Narmadeshwar. The Radhakrishna Temple is situated on First Street in Sarvodaya Nagar locality of Kanpur, close to a magnificent park and lake.

Jain Glass Temple : The Temple was built by the Jain community, dedicated to 24 Tirthankars of Jainism. Erected under the vast canopies, the Temple contains the statues of Bhagwan Mahavir and the Tirthankars. As the name suggests, the entire Temple is built with glass and enamel. Its conventional architectural style captures a massive crowd of locals as well as visitors.

The Temple reflects a great work of architecture with the walls and ceilings decorated with mirrors and the floor constructed with marble. It is situated in Khas Bazar, General Ganj, Kanpur, not so far from the city.

ISKCON Temple : Iskcon temple or Sri Radha Madhava Mandir is located in mainawati marg in Bithoor. Iskcon temple in Kanpur is known for its beauty and attracts lakhs of spectators every year. Iskcon Temple is located in a vast area committed to Lord Krishna. This Temple provides you tranquillity and calm because of its serene atmosphere. The Temple glows like a white pearl and is surrounded by greenery, gardens, gaushala, and guest houses. The best time to visit the ISKCON temple is on Janmashtami because Lord Krishna is worshipped with great pomp. The restaurants inside the temple campus offer north and south Indian cuisine. This Temple and its aura fill you with positivity and energy.

Panki Hanuman Temple: Panki Hanuman Temple, also known as Panchmukhi Hanuman temple, is an ancient temple on the boundaries of Kanpur, adjacent to Panki Railway Station and is dedicated to Hanuman. The Temple receives devotees from all over the country. The Lord Hanuman here in Panki Temple is seen as a gift from the celestial activity. It is believed that the appearance of the Lord changes a day thrice. With the rise of the Sun in the morning, the face of Hanuman is seen as bright and childish as Bala Hanuman. During noon the face of the Lord

Hanuman is seen as a youth (Brahmachari). By evening the Lord Hanuman is seen as a Mahapurush (Thejasvee).

Ravana Temple : Ravan temple is also known as Kashi temple. It is one of the famous temples of KanpurThe Temple is situated in the shivala area inside the *kailashmandir*. The Temple was built in 1890; there are only five temples of Ravan in India, and one is Kashi Temple. Doors of the Ravan temple remains shut 364 days a year and opens once a year on the festival of Vijayadashami only for few hours in the morning and closes again before burning of Ravan till the Vijayadashami next year. Thousands of devotees come and worship Ravana for the prosperity, good health and safety of their families.

Tapeshwari Devi Temple: The Temple can be found at birhana road in Kanpur, Uttar Pradesh. This Temple is devoted to Sita, mata wife of Ram. A famous anecdote about this Temple is that when Lord Rama banished goddess Sita from Ayodhya, she stayed in bithoor with her sons Luv and Kush. Sita Mata used to come to this place every day for meditation and prayers. All festivals are celebrated here. On the occasion of Durga Puja, Navratri and Deepavali, thousands of devotees visit Temple to worship Mata Sita.

Kanpur Zoological Park/Allen Forest Zoo : Also known as Kanpur Zoological Park, Allen Forest Zoo is one of the oldest zoological parks in India. The Allen Forest Zoo is located about 7 kilometres from the city. One of the unique features which make the part different from other zoos is that the animals here live in their natural habitat instead of cages. The Zoo is home to various animal species, including the rare musk deer, rhinoceros jaguars, tigers, lions, langurs and cheetahs.

Allen zoo is the largest Zoo in Asia in terms of Forest Cover. The place serves as the best destination for leisure and recreation purposes for all age groups.
Allen forest was built during the British Raj between 1913-1918 by George Berney Allen. The Zoo was made from 1971-1973 under the supervision of IFS officer RS Bhadauria. An otter spotted by a fisherman from the Chambal River was the first animal to arrive at the Zoo.

Main Attractions in the Zoo:

• The pleasant and green environment in a highly polluted industrial city.
• Easily approachable from the central city and essential places in the town by affordable means of transport.
• A vast lake (about 18 hectares) that attracts many resident and migratory birds, which nests and breeds giving impetus for in situ conservation of resident and migratory birds. It creates a water ecosystem in the forest.
• Inexpensive entrance tickets, with outstanding visitor amenities like lawns, kiosks, benches, shades, toilets etc.
• Animals are nicely exhibited and placed in forest-like habitats, giving the visitor a feel of rich forest.
• A visit to the Zoo, teaches us a lot.

• Exhibits on Dinosaurs fascinate children very much, and other major attractions for them are Aquarium, White Peacock, Tiger, Leopards, Chimpanzee etc.

Green Park

Green Park (also known as Green Park Stadium) is one of the most famous playgrounds of Kanpur., The Park serves as a playing ground for the UP-cricket team and some international cricket matches. Green Park has a capacity of 60,000 spectators and is situated on the bank of the river. Sports Department Uttar Pradesh controls the operations. Green Park is the only international cricket stadium in Uttar Pradesh that has hosted national/international matches, although Lucknow's Ekana Stadium is under construction. The stadium hosted the 500th test played by the Indian team. IPL matches are also played here.

Kamala Retreat

Kamla Retreat is a rich tourist resort in Kanpur built by Shri Padma Pat Singhania in the year 1960. The Park is a private estate turned resort owned by the Singhania family. The resort consists of a museum with several archaeological and historical mementoes and artefacts dating back to the ancient past. Apart from the museum, the retreat has other attractive spots such as a zoo with various species of birds and reptiles, a swimming pool with high-tech equipment for creating artificial waves.

The retreat has witnessed several great guests, such as Pt J.L. Nehru and Chow En Lai, the first prime minister of the Republic of China before 1962. Prior permission is required to visit the Park.

Phool Bagh

Phool Bagh, also known as Ganesh Vidyarthi Udyan, is located in the central part of the city near the Kanpur Central railway station. Phool Bagh also possesses the popular Kanpur Sangrahalaya/museum and Cawnpore Union Club. The garden has hosted several modern historical public assemblies addressed by some of the most outstanding leaders and speakers such as Mahatma Gandhi, Indira Gandhi, A.B Vajpayee and Ram Manohar Lohia.

It is the official museum of the city. The Park is also used for political rallies and meetings. During the rule of Queen Victoria of Britain, Phool Bagh was named after her as Queen Victoria Garden.

Data analysis

- The change in the number of domestic tourists is inconsistent in Kanpur. The growth rate follows no trend. In the year the number of domestic tourists increased by 40% compared to previous year data. While in the year 2015 the rate of growth drops to 0.3% and in the next year (2016) 1.15%.
- In the year 2017 Kanpur witnessed a 531% increase in growth rate, which is huge. There is a need to figure out the cause of the massive response from the domestic tourists, so that can be used in policymaking. However, in the same year foreign tourists' growth rate dropped by 13% compared to previous year data.
- It is required to find the reason why a particular demographic of travellers are coming in a huge number in a particular year. Research should focus on why foreign tourists decreased in a particular year.

- In the year 2019, when the other districts such as Prayagraj in Uttar Pradesh and other cities were receiving huge numbers of domestic as well as foreign tourists, Kanpur faced reverse conditions. Kanpur witnessed just 5% increase in Domestic tourists and -58%(loss) in foreign tourists.
- Need research to figure out the reason why Kanpur failed to attract tourists from a city just 200 kilometres.
- In the year 2017 Uttar Pradesh witnessed a 12.6% increase in foreign tourists whereas Kanpur faced a drop in number by 13.5%. There is a need to figure out the reason why Kanpur failed to attract foreign tourists in a particular year.
- Till 2019 budget allocation trendline and number of tourists in Uttar Pradesh follows a similar pattern. That is, the number of tourists increased as the budget increased from 2106 to 2019. Total number of tourists in Kanpur also follows similar pattern

3.5 WETLAND

The wetlands are the source of many ecosystems and habitats for various species. The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. These businesses can be a great opportunity can be turned into a large-scale production hub using the right approach. The region is known for the leather industry and leather goods that title the Kanpur city as "Leather City of the World" and is predominantly nicknamed the "Manchester of the East" for its textile industries. 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:

- Jowar, rice, and wheat production are recommended as commercial crops in the region, leading to flour.
- Water scarcity and salinity are issues seen in the major areas of the district
- oil production in the region like mustard, linseed, castor seeds which can turn into a valuable market for oil production in the region.
- The district is famous for its historical values and has ponds like turtle pond, fly ash pond, and moti jheel worthy of turning into an eco-tourism spot.

4 ACTION PLAN DEVELOPMENT

4.1 AGRICULTURE

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4.2 FORESTRY

The state of Uttar Pradesh announced its new State Forest Policy on October, 2017 in place of State Forest Policy, 1998.

The objectives of State Forest Policy, 2017 are as follows:

- Improvement of existing natural and planted forest by conservation, development and scientific and thoughtful management.
- Formulation and implementation of scheme of afforestation and soil conservation in different types of degraded land of state viz. usar, khadar, ravines and blank forest.
- Special emphasis on forest dweller centric forest management.
- Increase of tree cover by social and agro-forestry plantation on private land.
- To get carbon credits on the plantations which is planted according to international standards.
- To endeavor for the reduction of siltation of water and reservoirs and effects of floods and droughts through controlled measures over soil-erosion.
- To promote plantation over non-forest land.
- To prepare and implement strategies for conservation and improvement of biodiversity and wild life in the state.
- To develop eco-tourism destination.

In July 2019, government of Uttar Pradesh taken the initiative to plant 22 crore saplings. The Forest Department involved the farmers as stakeholders to plant seedlings in their fields. Farmers are expected to sow quality planting material such as clonal plants, which are not available in the UP forest department nurseries. There is also the need to have minimum support price (MSP) for the timber produced by farmers with buy-back arrangement. This in turn will motivate them to plant more trees, which would benefit the economy as well as the environment.[2]

Projections & Monitoring Matrix

Outcome indicators can be forest produce, buyback of products by the state, annual gross income generated by these outputs, contribution of the forest output in the district domestic product.

4.2.1. Biodiversity : To increase plantations in the district, environmental programs should be organized and incentives should be provided to local people for conservation of forest, as a very low percentage of area is under forest.

4.3 TOURISM

Ecotourism Projects: Travelling to places where flora, wildlife, and cultural legacy are the main attractions is known as ecotourism. Ecotourism aims to provide visitors with a better understanding

[2] https://www.teriin.org/article/special-drive-tree-plantations-uttar-pradesh-faces-several-challenges

of how humans affect the environment and create a greater appreciation for our natural ecosystems. There is a huge opportunity to develop ecotourism projects in the Kanpur district. The project will minimize the negative aspects of conventional tourism on the environment and enhance the cultural integrity of local people. Also, this project will boost the tourist inflow in the district. Lakes, Ponds, forests and protected ranges can be protected to give Kanpur a new face in tourism.

Sustainable Tourism : It is a type of tourism in which all the needs and desires of a tourist/ and other stakeholders of the tourism industry is fulfilled without compromising the ability of the future generation to utilize the tourism. Several goals of Sustainable Developments Goals are also seen associated with sustainable tourism. Such as life below water and life on land are impacted by human activities if the tourism place is a water body of forest area; hence it is the duty of all of us to take care of sustainability aspect in the tourism. Sustainability for locals/natives can be provided by including them in trade and business activities.

There is a sense of responsibility of different stakeholders associated with tourism to develop sustainable tourism. In which each stakeholder takes care of other stakeholders and biotic and abiotic factors. For example, reducing the Carbon footprint per visitor, using eco-friendly vehicles to roam around, supporting local businesses.

One example of sustainable tourism is promoting tourists to travel off-season. It will reduce the impact of seasonal unemployment on the marginal traders and other workers in the tourism sector.

Offering eco-friendly services is another example of sustainable tourism. Providing tourists with a cycle to roam around nearby places with help in reducing carbon footprint and it economical. It is aimed at the minimum negative impact on the environment created by tourism activities.

UP Tourism Policy, 2018

The vision of this policy is to establish Uttar Pradesh as a preferred tourism destination in India by 2023, achieve the country's highest tourist arrival and tourism receipts, and ensure the best visitor experience.

Targets

- To attract investments with a target of INR 5,000 Crore per year
- To provide employment to approximately 5,00,000 people per year
- To impart training to 10,000 tourism service providers over the next five years.
- To convert 10 heritage buildings (Buildings with heritage value) to heritage hotels per year.
- To attract 1,00,000 tourists to national parks and wildlife sanctuaries in Uttar Pradesh per year.

Incredible India- Bed & Breakfast Scheme

- The essential feature of this scheme is the invention of the 'Home Stay' facility.
- This scheme aims to provide easy, relaxed and low-cost accommodation to tourists in tourist places and cities.

- The scheme was launched in 2008.
- This scheme applies to all Cities in Uttar Pradesh.
- The scheme is categorized into "Silver" and "Gold" based on Quality of service provided, status accommodation, facilities provided.
- The registration fees for the silver category is Rs.1000/- and Rs.2000/- for Gold category accommodation.

Beautification of Ghats

Beautification of ghats involves constructing benches, pakka ghats, bathing cubicles, electrification of ghats, changing rooms, and providing safe drinking water, i.e. Dhruv ghat, Ram ghat, Hanuman Ghat, Laxman Ghat, Chappar Ghat, Kaurav Ghat, Shravan Ghat etc. It is scheduled to divert the drainage pipelines carrying sewerage water and industrial waste towards bhramvat ghat towards Ganga upstream.

Restoration of Historic Places

Indian Institute of Technology(IIT-Kanpur) and the Archaeological Survey of India (ASI) have signed an agreement with two organizations from Italy, planning restoration and protecting historical monuments in the city and vicinity. The activities under this MoU will be coordinated by professor Mukesh Sharma, Department of Civil Engineering, IIT-Kanpur.

All institutes seek to promote collaboration and activities and partnership in scientific studies and skill sharing, exchanging knowledge, experience, academic materials and publications, conducting workshops, undertaking joint field studies and technology development to restore and protect monuments on a reciprocal and equal basis.

Renovation of Zoo

Monkey section – In the monkey section, some open enclosures are to be renovated to introduce new animals. Steps will be taken to convert the wet moated compartments into dry moated compartments. The space of the seven cells of the Kapi grih enclosures are to be expanded, and a keepers gallery has to be constructed.

Exotic animal section, aquarium and Nocturnal animal house –The fish aquarium to be renovated to include big aquaria so that the fishes get sufficient space to move. The nocturnal animal house is to be renovated to add chain-link fenced enclosures to provide the animals with their biological needs, fresh air and sunlight.

Conservation Breeding Centre

In the wilderness zone, away from the main display zone, a future conservation breeding centre for swamp deer, Rhinoceros, Sarus crane, Red Jungle Fowl and animal rescue centre for Leopard and Monkey can also be developed. This area is away from visitors with the least disturbance and suitable for creating rescue and conservation breeding centres. The master plan is aimed to provide strategic planning for the planned development of the Kanpur Zoological Park in the coming years, i.e. 2013-2014 to 2024-2025. The proposals in this plan are based on the availability of different resources like water, space, vegetation, climate, visitors" profile, ex-situ

conservation measures, conservation education, and research need. While preparing the master plan, due care is taken to follow the recommendations of the Central Zoo Authority.
The vision is to plan the city as a centre of historical-tourist importance. There is a need to maintain the roads and improve car and two-wheeler parking stops, proper traffic management, effective law and order situation, supportive political system, good hotels with a range of cuisine in it, water resorts and better local transportation system.

Upgradation of Visitors' Amenities

1) Lawns – The lawns which are present, but barren are Elephant park lawn, monkey park lawn, Nocturnal animal house lawn, Zebra enclosure lawn. Orangutan enclosure lawn, Aquarium lawn, which will be revived.
2) Toilets –Repair of all the toilets will be taken up. Each bathroom to have a facility for handicapped persons. Four more toilets are proposed to be constructed.
3) Hand pumps –Taps are available in various places, but these are in miserable shape, and the pipelines are old. These have to be repaired and renovated. Powercut is a recurring problem. The power cut will be for about 6 to 8 hours a day. To have a continuous drinking water facility, more handpumps are proposed. RO plants at various places are proposed to provide safe drinking water to the animals and visitors.
4) Rainwater shelters – Four new rainwater shelters will be constructed. More dust bins and benches are to be constructed. The dust bins should be placed so that atleast one dust bin is available at every three hundred meters, so that the visitors can properly dispose of waste materials without littering the Zoo.
5) Zoo train – Kanpur Zoo is spread over 76 hectares and has a road network of 8 kilometres. More than 4 hours is needed for the visitors to see all the animals housed in 55 enclosures. This is very tiresome for many visitors, especially aged people and children. Many avoid visiting Zoo due to this difficulty. The government of Uttar Pradesh has opted to establish a zoo train and has allotted the necessary funds for its establishment. Initially, a proposal for lying out of 3.5 kilometres of railway line starting from the entrance and across the lake was submitted to Central Zoo Authority.
6) Zoo Canteen – Zoo has a large area, and it takes about 4 hours for the visitors to see all the animals properly. Students from colleges and schools also come in large numbers. Outside food is discouraged by the zoo administration. So, visitors are put to great difficulty because of the lack of refreshments inside the Zoo. It is proposed construct 2 new canteen and a few food kiosks inside the Zoo for the convenience of the visitors.

SWOT analysis of Tourism in Kanpur

S.no	Strength	Weakness	Opportunity	Threat
1.	● Location- Kanpur is Located near to two most	● Could not attract tourists from Kumbh Mela 2019.	● Religious tourism. ● Zoo can be an	● Rapid developm ent projects can be

	popular tourists' spots of the state which is Lucknow and Allahabad. • Numerous Temples make Kanpur a Religious tourist centre. • A number of Ghats. • IIT which attracts a number of foreigners can be converted to tourists. • International Cricket stadium. • Bithoor connected to Kanpur. • Rich Heritage	• Lack of Cleanliness. • Dirty Ganga water. • Underdeveloped Ghats. • Crematorium activities at Ganga Ghats. • Algal bloom/ Eutrophication due to addition of nutritive substances in Ganga stream. • Traffic and narrow roads.	ecotourism site. • Development of Ghats for adventure tourism and cruise shipping.	dangerous for Ganga and its ecosystem. • Industrial wastage dumping to Ganga stream. • Leather Tanneries. • High Population density of the town.

	tourism sites.			

Projections and Monitoring matrices

Sector	Intervention	Strategy	Total cost	Expected Outcomes
Tourism	**Research**	● Based on various data and matrices, it is possible to predict the reason and motivation for tourism. Through extensive qualitative and quantitative research, it is also possible to determine the variables affecting tourism in Uttar Pradesh. ● Research must be free from all the political pressures and influences. ● The researchers must ensure that the field data and secondary data are correct and not modified while entering the new records. ● Need to involve unbiased researchers.		A well-researched document as a reference for other processes. Factors that affect tourism in Uttar Pradesh. Define the determinant of tourism activity.
	Planning	● Action plans can be developed for intervention based on the research and analysis of different data and reports. ● Developing an Action plan is vital		Planning to be based on research and previous lessons. Realistic planning for

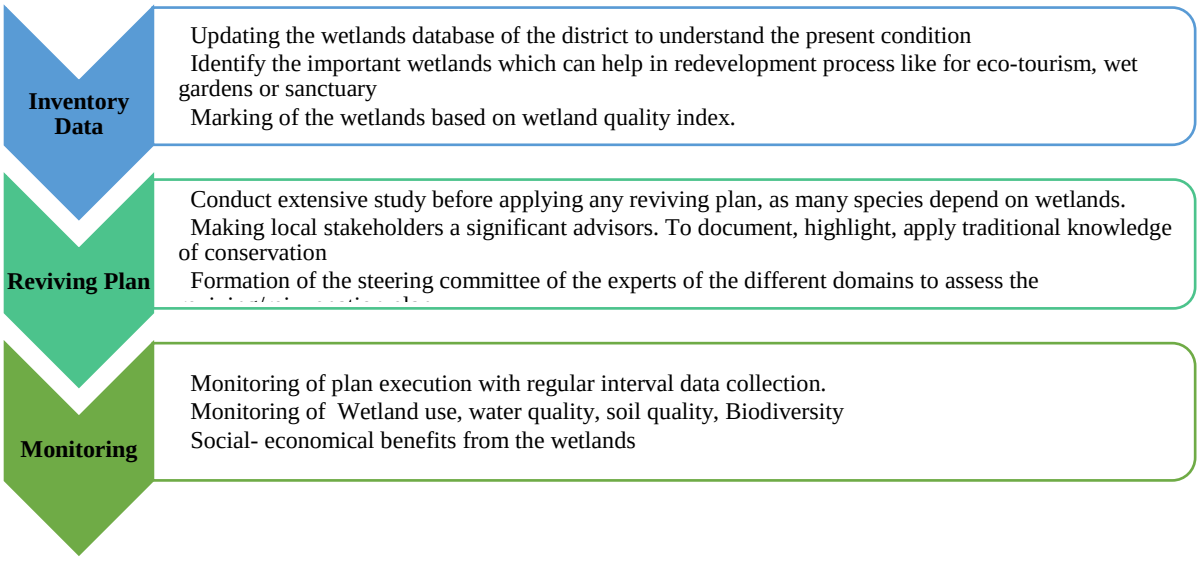
		because results depend on how it is planned. ● Planning must consider the social status of the State and the image in the tourists' minds. ● No place should be given to non-practical projections. ● Planning about when to organized Mahotsav/ festivals/ fairs to pump the local economy. ● Separate planning for different demographics of tourists for comfort and leisure tours. For example, while planning the tour packages and tariffs, it is crucial to consider the demography of tourists. Foreign tourists ask much for hygiene while local tourists ask much for discounts. Hence these concerns must be included. ● Need to develop the sites as per a set of standards to attract a wide range of tourists.		successful implementation. .

		• Brand Manufacturing to increase tourism activity. • Organizations of grand events. • Use of allocated budget.		
	Implementations	• Various schemes can be developed, such as tourist packages, tariff plans etc., to attract more and more tourists. • Mahotsav and Fairs to be organized to rejuvenate the local economy and attract tourists. • Developing tourist circuits • Developing eateries • Connecting tourism with local culture and food. • Extensive marketing for advertisement. • Famous face as brand ambassador. • Extensive branding and marketing. • Development of tourism spots and heritage sites. • Availability of information on government		To attract more number of tourists and maximize the revenue from tourism. To improve the image of the State and not let the other social factor affect the revenue of tourism.

		websites along with tour packages. ● An extensive market research for the development of strategies		
	Impact Assessment of results	● Calculating what the touch points are. ● The reason for failure ● The reason for the success ● Lesson for next planning		To learn the lesson and find out the root cause of success and failure, to be used further with modification

4.4 WETLANDS

The district is comprised of 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 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 must be taken. The action plan below gives a glimpse of the action and development required to protect, conserve, rejuvenate the wetlands existing and extinct.



4.5 ENERGY

4.5.1 Solar

Solar panel installations have been done regularly in the district Kanpur Nagar especially in the government buildings. The trends of solar energy development have been quite progressive. The district needs to bring advancement in the progress by making more and more industries incline towards the solar energy. This can be done by making net metering available to the industries especially to the small scale ones. Like, Kusum Yojana, the concerned authorities can construct solar parks and through feeder segregation technology, solar power could be supplied to the industries. Not only this the government can cut off the rates of utility supply for those using off grid solar power to fulfill a percentage of their power requirement. Promotion of solar energy important as the district deals with a lot of pollution, due to many industries running in the district. Solar energy would keep the district away from pollution and there there would be a clean and green development. For the farmers suitable component of Kusum Yojana should be popularized and made easily available to them.

On the whole a survey should be done to recognize the requirement of the plans that would be beneficial for the people in the in the district.

Projection and monitoring

The first thing which should be done is to conduct awareness programs about the pollution that is rising in the district and how solar energy would help control it. People in the district need to understand that the industries add a lot of contaminants to the environment. These industries require power to run so if the power supplied to them is solar then indirectly there would be some cut off in the pollution. The next which should be done is to provide net metering services to the industries especially the small scale ones. The infrastructure required for the grid connected solar panels should be improved. This would incline more and more people towards the solar energy. Lastly, attention should be paid on developing solar feeder segregation; this would supply

uninterrupted power to the farmers. Hence they could bring advancement to the farming activities. So to bring a sustainable development to the district Kanpur Nagar solar energy should be promoted in the district.

4.5.2 Biomass

The district Kanpur Nagar has quite a good number of sources of biomass wastes, but has been unable to wisely utilize them for biomass energy production. There needs to be systematic planning for the district which solely works for biomass waste. A proper waste management system is required for the district to reduce the pollution and make the pollutants a source of clean and green energy.

The agricultural wastes are not only the source of biomass wastes but also the industrial wastes. So in the urban areas or in the outskirts of the urban areas there can be these biomass plants solely working on the energy production from the biomass wastes. The source can be those industries which produce biomass wastes, especially the leather and the food industries. Entrepreneurs should be encouraged to tie up with these industries and should utilize the wastes produced by them and make use of it in producing power, bioethanol, etc. These can then be sold back to the industries and the government as well.

The district is doing a lot for the sugarcane since it is home to the National Sugar Institute, but there is a need to pay attention to other agricultural wastes as well from the wheat and the rice fields. The biomass plants for the wastes from these fields can be set near to the villages by the villages, panchayats, small entrepreneurs, etc.

Projection and monitoring

To begin with, the concerned authorities need to spread awareness about bioenergy and its advantages. People need to be told how the industries are deteriorating the environment and how the biomass based plants could be of advantage. Followed by this should be a full-fledged plan for the district which includes all types of wastes. The state's Industrial waste based power projects, Biomass based gasifier power projects and bagasse based cogeneration projects in the sugar mills are best suited for the district. Entrepreneurs should be encouraged and the industries themselves should have their own biomass plants.

The next thing which needs to be planned is the transportation system. There should be a transportation system fully dedicated for this purpose in the rural as well as the urban areas.

The power plants and the transportation system would provide employment to a large number of people. And this would also lead to the development of the district in a sustainable manner.

4.5.3 Biogas

Open dumping of solid waste in Panki cause about 25 Gigagram of methane per years, hence construction of biogas plant should be done at this location.

* Akanksha Kaushal, M.P. Sharma, Methane Emission from Panki Open Dump Site of Kanpur, India, Procedia Environmental Sciences, Volume 35, 2016, Pages 337-347, ISSN 1878-0296, https://doi.org/10.1016/j.proenv.2016.07.014.

4.5.4 Hydropower

Neither sites have been investigated so far nor exist at present in the district. Many villages in the district are affected by high water levels in Ganga river. The most impacted places are Gujaini, Meherban Singh Ka Purva, Mardanpur village, Banpurwa, Kanchanpurwa, Tatyatope Nagar, Raipurwa, and Village Bihari Purwa. Therefore, canal site near these village area need to be investigated that can serve electricity in future too.

5 RECOMMENDATIONS

5.1. Agriculture and allied sectors

- Groundwater shares over 95% of NIA in the district and number of medium and deep tube-wells increased substantially during the study period, indicating the depletion of water table. Therefore, Drip and Sprinkler irrigation systems should be encouraged, especially for vegetable and fruits cultivations. It will help to increase the water use efficiency and productivity of crops. To reduce groundwater exploration, the district needs to construct more tanks and ponds under MGNREGA. Moreover, conjunctive use of surface water and groundwater should be enhanced.

- Farmers should be sensitized to the overuse of fertilizer and pesticides application. They should be trained on the uses of fertilizer and chemical pesticides applications.

- The share of livestock in the total value of agriculture and allied sectors increased significantly from 29% in 2011-12 to 355 in 2018-19, with annual average growth rate of 8.21% The number of female cattle and buffaloes has substantially increased over the period, indicating the growth of livestock products, including milk. Dairy farming need to be promoted through creating an efficient marketing network, adoption of cross-breed and setting up dairy and dairy-based processing units. Goats and poultry farming can be promoted to improve local livelihood.

- Fishery & aquaculture has a huge scope for raising income and livelihood through effective implementation of PM Matsya Yojana. The fishery cultivation should be promoted by providing proper training and institutional support. Agro-forestry can also improve farmers' income.

- Organic farming should be encouraged to boost soil health, reduce water-use and ensure ecological, economic and social sustainability of agriculture. It could be an economically viable option if the government builds strong marketing networks linking farmers, processors, and distributors with the easy certification process and minimizes farmers' risk by protecting their farm income through payments of ecosystem services. A long-term system of incentive and regulation needs to be evolved to retain the existing farmers and motivate others to move towards the sustainable farming system.

- Training to prepare the Vermicomposting and Green manuring should be organized for the farmers. Moreover, salt-tolerant crops varieties and gypsum application should be promoted in the salt-affected areas.

- Farmers should follow the crop advisory under the drought condition and adopt techniques like drought resistance variety and maintaining moisture of soil by covering the soil. More farmers should join the Agromet Advisory Services provided by the K.V.K. for crop production

- About 93% of farmers in the district are small and marginal with landholdings less than two hectares. They can contribute substantial to livestock, vegetables and other labour-intensive allied farm activities.

- Poly house and greenhouse could be commercially used for the high revenue crops, like capsicum, chili, onion, garlic, and strawberry, flower like rose and marigold for much returns to the farmers. Medicinal crops like tulsi, mentha, lemongrass, etc. and fruits like papaya, mango, guava, and banana should also be promoted by establishing local market, processing units and cold storage.

- Since electricity consumption in agriculture has increased over the years, there is a need to promote the use of solar energy in agriculture.

- Agriculture production is vulnerable to natural and market risks. A compulsory and subsidized crop insurance system must be adopted to protect farmers' livelihood and income.

- A new institutional framework needs to be set up at the district level where the concerned line departments' technical, human and financial resources may be pooled or converged together to provide customized solutions to the farmers related to technology, training, marketing needs and advisory services.

- Resource conservation technologies like zero tillage and laser leveller can be extensively applied for Wheat and Maize to reduce the cost of production and sowing time.

- In the salt-effected areas, farmers should use gypsum and salt-tolerant crops varieties.

- The district has the scope to introduce high-revenue crops like dragon fruit, strawberry, and mushroom farming and fruits cultivation like mango, guava, lemon, ber, and amla, which should be encouraged.

- There is a scope for beekeeping that should be encouraged among the farmers by providing training.

- Expansion of tobacco and sunflower cultivation could be beneficial for the farmers.

- The district has scope for farm mechanization tools mainly for combine harvester for wheat and paddy and adopting resource conservation technology like zero tillage for wheat and maize.
- There is a needs to construct some water harvesting ponds to facilitate the irrigation, mainly in the water shortage blocks.
- In the salt-effected areas farmers should use gypsum and salt-tolerant crops varieties.
- Organic farming such as the use of vermicomposting and green manure should be encouraged through training to boost soil health.
- The district has a scope to introduce medicinal crops like tulsi, mentha, ashwagandha lemongrass.
- The district has the scope to introduce high-revenue crops like dragon fruit, strawberry, and mushroom farming.
- There has a large scope for fruits cultivation like mango, guava, lemon, ber, and amla, which should be encouraged.
- There is a scope for beekeeping which should be encouraged among the farmers by providing training.
- Expansion of tobacco and sunflower cultivation could be beneficial for the farmers.
- Spices crops like onion, garlic have a huge scope, which should be encouraged. Farmers also could be encouraged for turmeric cultivation.
- There is a need to introduce farmer-level greenhouse and poly house for high revenue vegetable and fruits cultivation.
- The district has a huge scope for the fishery, which should be encouraged through proper training.
- There is a need to up-gradation of local breeds for cattle and buffaloes and provide market access for milk to encouraged the farmers.

5.2. Forestry

Kanpur Nagar and Kanpur Dehat, located on the bank of river Ganga and Yamuna. According to ISFR 2019, 107 Sq. Km. The area is covered with forest. As discussed above, the forest cover of Kanpur Nagar & Kanpur Dehat has decreased slightly from previous assessment 2017. Only open and medium dense forests are found in the district. There is a wide scope of Afforestation on waste land, trees outside forest (on the sides of the roads, banks of rivers etc.). Government can promote the afforestation, agroforestry activities by providing output based incentives.

5.2.1. Biodiversity : More no. of wastewater treatment plants should be constructed near industrial areas (Panki industrial area, Fazalganz, Uptorn industrial estate etc.) and direct flow of effluent to river Ganga should be restricted.

5.3. Tourism

Maintaining heritage buildings:

Kanpur is noted for its distinct architectural landscape and rich historic history. In collaboration with the Archaeological Society of India (ASI), the state government is working hard to restore the old history and monuments. However, there is still a lot more work to be done. This will finally be included in the tourist map as a new destination point with an economic value. Regular maintenance of tourist spots and the different roads connecting it with the city's centre is necessary to provide tourists with an enjoyable experience. Information and contact details of authentic tourist guides on the government tourism website may be helpful for tourists and encourage them to visit more places and eventually more business. Acquiring a license by local tourist guides from government bodies is generally a complex process that discourages genuine candidates from getting the license. Easy to apply and get the license can benefit tourism

Accessibility

There is an immediate need to improve road infrastructure. The traffic flow will be boosted by good highways and approach points to a specific tourist site.

Safety and security

The system should undoubtedly make provisions that the policies and procedures designed to ensure the safety and security of tourists are implemented effectively. For all travellers, Uttar Pradesh's image must be promoted as a safe and secure tourism destination.

Promotion and selling

Cross-selling tourism hotspots in neighbouring states can assist boost tourist inflows. Package deals should be devised and implemented for the benefit of both tourists and the government. Discounts and special offers on group travel are one way to encourage visitors to bring their families along on business trips.

Appointing brand ambassador

Appointing a brand ambassador can help promote Kanpur tourism even more. It is critical to capitalize on their celebrity and fan base for UP tourism to get traction and warmly receive visitors.

Upgrading the skills

The hospitality business should be appropriately groomed and capable of offering the best service possible to tourists. Investing in training schools will assist the young generation in concentrating on their work and acquiring the necessary skills to make the experience worthwhile. Also, training sessions for guides can benefit individual guides and help them earn livelihood and the tourism sector to embrace more tourism. These training sessions can also help know the actual number of

available tourist guides in the city. And the same information can be uploaded on the website for customer support.

- Tourists are a source of income for the natives; developing local marketplaces such as specialized malls for locally made handicrafts can give a place to sellers and buyers simultaneously. Usually, local markets (selling original articles) are scattered throughout the city; a specialized marketplace will help the sellers showcase their product at excellent places, and buyers can find a wide variety of ranges at the same site.
- Letting tourists know about community-based initiatives such as women-led Self Help Groups and Social Enterprises will support tourism and such industries. As it can bring business to enterprises.
- Development of COVID 19 protocol friendly tourism packages to boost the tourism sector economy after the pandemic.
- Ghats can be developed on the verge of international standards to attract more and more foreign tourists.
- Supporting tourism can also help flourish other sectors such as local handicrafts, restaurants and eateries, travel agencies, local vendors and many more as all of these are in a symbiotic relationship.

Key Observations – Kanpur Tourism

- In the year 2017 Kanpur witnessed 531% increase in number of tourists, which is huge. There is a need to figure out the cause of massive response from the domestic tourists, so that can be used in policymaking. However, in the same year foreign tourists' growth rate dropped by 13% compared to previous year data. Focused research to find the reason of niche tourist attraction in a particular year.
- Number of international tourists is less than 10% of domestic tourists during 2013 to 2020

- In the year 2017 Kanpur witnessed 531% increase in number of tourists, which is huge. There is a need to figure out the cause of massive response from the domestic tourists, so that can be used in policymaking. However, in the same year foreign tourists' growth rate dropped by 13% compared to previous year data. Focused research to find the reason of niche tourist attraction in a particular year.
- Number of international tourists is less than 10% of domestic tourists during 2013 to 2020

5.4. 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.

- Introduction of improved cultivars and production technologies for pulses and oilseeds.
- Diversification through introducing vegetable, mushroom, beekeeping, fruits, medicinal plants, dairy, poultry etc. for nutritional security
- It is recommended to rejuvenate and restore the water bodies of the district.
- It is recommended to promote eco-tourism in the region as the region can develop with flower gardens around the wetlands area and biodiversity by creating a market for selling handicrafts nearby.
- Development of wetlands to hold water for recharging of the groundwater table.
- Technical development of water treatment using wetlands to remove salinity and heavy metal from drinking water.
- Discontinuous direct use or discharge of Ganga river/ groundwater by leather industries. Alternatively use the wetlands nearby in sustainable manner

5.5. Energy

5.5.1. Solar

The district Kanpur Nagar has been quite progressive in solar energy sector. The district needs to pay attention in inclining more and more industries towards the solar energy hence pollution won't curb the way of development in the district.

5.5.2. Biomass

The district Kanpur Nagar has a lot of industrial waste along with the agriculture waste. If the biomass waste is utilized wisely it would reduce pollution and bring development in the district. The state's Industrial waste based power projects, Biomass based gasifier power projects and bagasse based cogeneration projects in the sugar mills are best suited for the district. Hence the authorities need to pay attention and make people aware for the better utilization of the biomass wastes.

5.5.3. Biogas

- ISKCON works towards protection of cows in Kanpur and the government should support this by providing incentives for cows and through connecting biogas plants from cow gaushalas.

5.5.4. Hydropower

- It is recommended to build a multipurpose canal from river Ganga near villages Mardanpur, Banpurwa, Kanchanpurwa etc.

6. Discussion during the Report Presentation

- The report has been shared again and the discussions will be taken up regarding the same.

- 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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8 APPENDICES

Table 2 Crop production in the district.

Crop/Year	2015-16	2016-17	2017-18
Non-grain crops (Metric Tonne)	42226	57075	67524
Grain crops (Metric Tonne)	364031	616122	631155
Sugarcane (Metric Tonne)	138201	173842	115007
Potato (Metric Tonne)	172269	178301	435224

Table 3 Livestock population in the district.

Livestock	2003	2007	2012
Cattle (Cow)	186437	188888	195697
Buffalos	278949	334284	374077
Sheep	9506	6959	9014
Goat	208210	242403	243810
Pigs	166253	186254	56824
Chicken	134511	105904	726042
Other Poultry	5522	453266	6182
Horses and Ponies	1869	450	1481

Table 4 Biogas potential from animal 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	195697	10	71,42,94,050	535720537.5	107144107.5	25	4285764.3

Buffalo	Manure	374077	15	2,04,80,71,575	1536053681	307210736.3	25	12288429.45
Sheep	Manure	9014	1	32,90,110	2467582.5	493516.5	25	19740.66
Goat	Manure	243810	1	8,89,90,650	66742987.5	13348597.5	25	533943.9
Pig	Manure	56824	2.5	5,18,51,900	38888925	7777785	25	311111.4
Poultry	manure	7,32,224	0.1	2,67,26,176	20044632	4008926.4	25	160357.056
Total		**16,11,646**						**17599346.77**

Table 5 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	78163	1.5	117244.5	82071.15	15	69760.4775	800	55808382
Wheat	straw	408721	1.5	613081.5	429157.05	30	300409.935	800	240327948
Sugarcane	Bagasse	115007	0.33	37952.31	26566.617	80	5313.3234	750	3984992.55
Total		**601891**							**300121322.6**

S.No	**Broad objectives / recommendations**	**Key activities / interventions to be planned**			**Monitoring & Evaluation**	**Impact**
		2022	**2023**	**2024**		
	Cleaning Ganga,Cleaning the city, integrating with National Mission for Clean Ganga,Ministry ofJalShakti(	Research to figure out the factors impacting the tourism in the district. Development of strategies to address the	Implementation of strategies. Development of policies based on EIA. Inspection of tanneries to check the poring of by-	Sampling for analysis. Evaluation of interventions. Redesigning of strategies based on Impact analysis	Intervention impact-RCTs, regression analysis, propensity scores, econometrics, structural equation modelling,	Trained youth to be a part of Tourism industry. Less polluted Ganga water Upgraded staff and

	Deptt.of Water Resources, River Development & Ganga Rejuvenation) Government of India Development of Ghats. Making ghats tourist friendly and scenic.	issue. Structural developments. Environment impact Assessment to check the impact on Ganga River because of leather tanneries. (Air and water pollution)	products directly in the river. Structural developments		Contribution analysis, process tracing, Bradford Hill criteria. Environment Impact Assessment	facilities associated with UP State Tourism Corporation. More number of tourist footfalls.