Analysis of Health Care Facilities in Narayanpur Block, Mirzapur District Uttar Pradesh

Shikha Singh* and M.B.Singh**

Abstract

This paper aims to attempt the study of availability, accessibility and infrastructure of public health care facilities in Narayanpur block. It also tries to find out the gap between existing public health care facilities and normative requirement of public health care facilities as set by the government of India. The Narayanpur block is situated in Mirzapur district of Uttar Pradesh. It has 2,12,560 persons as per 2011 census. With regards to allopathic health care facilities the study area possesses one Community Health Center, five Primary Health Centers, and twenty seven Sub-Centers. Among them some of the health centers are suffering from acute shortage of staffs and infrastructure.

Key words: Health care, Community health center, Primary health centers, Sub-centers and Facilities

Introduction

Healthy population is the boon for any society or country. The phrase 'health is wealth' proves it. Health is a basic aspect of human resource. Health is influenced by many factors such as nutrition, housing condition, sanitation, healthy lifestyle, protection against environmental hazards and communicable diseases etc. For better health every individual in a society tries to take care of such influencing factors, which come under health care. Health care determines the life expectancy at birth, which uses to calculate human development index. Medical care ('service provided by professionals for the purpose of promoting, maintaining, monitoring or restoring health') is subset of the health care. Health care facilities are the institutions that provide medical care. India acts as the welfare state; it is responsibility of the government to provide medical care to its people without any partiality.

Objectives

To find the detail account of the government owned health care facilities in Narayanpur block, Mirzapur district, following objectives have been undertaken:

- To study the availability and accessibility of health care facilities
- To analyze the infrastructure of health care facilities
- To assess the gap between existing public health care institutions and the normative requirement of health care institutions as set by the Government of India

Database and Methodology

The present study is based on both primary and secondary data. The primary data regarding infrastructure in CHC, PHC and Sub-Center have been gathered from January to May in 2012. The secondary data is collected from CMO Office, Mirzapur and District Statistical Handbook of Mirzapur district for 2012. An attempt is made to deal with availability of allopathic health care facilities (including institutions, sub-centers, doctors, beds, paramedical staffs and other staffs) as per 1,00,000 population.

The Study Area

Narayanpur block is situated in Mirzapur district of Uttar Pradesh. The longitudinal extent

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is 82° 48' E to 83° 5' E and latitudinal extent is 25° 0' N to 25° 14' N. There are 213 revenue villages (188 inhabited villages, 25 uninhabited villages) and 13 nyay panchayats. It's total area accounts for 230.53 sq.km. The total population of the study area is 2,12,560 among them 1,10,997 are males and 1,01,563 are females as per 2011 census.

Location of Narayanpur Block

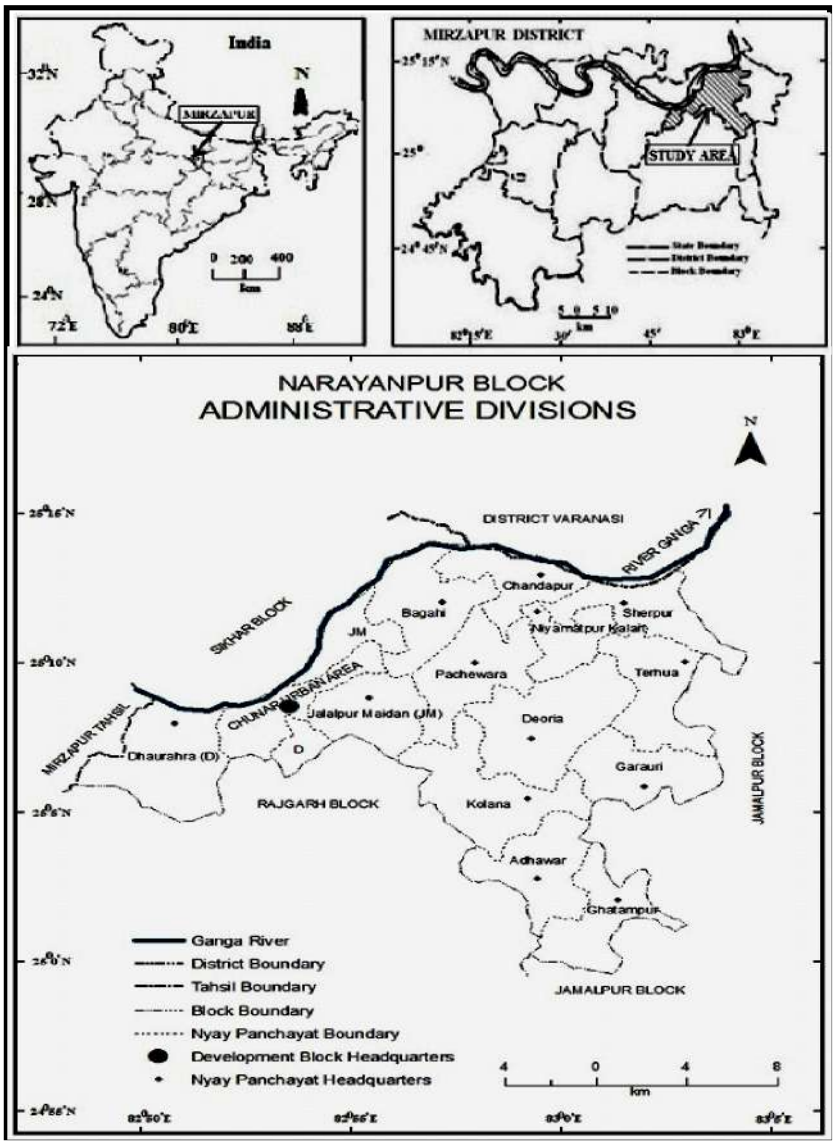
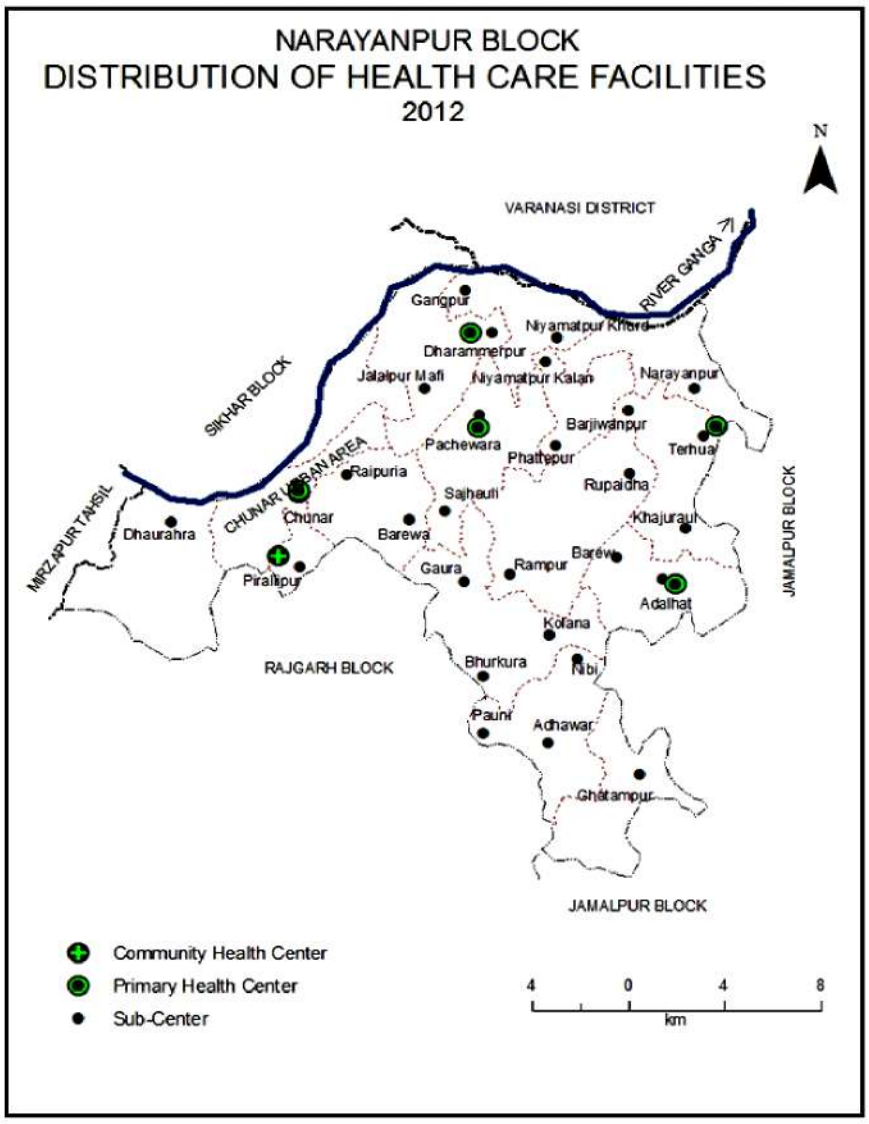


Fig.1

Availability and Accessibility of Health Care Facilities

The health care infrastructure in rural areas has been developed as a three tier system. The sub-centers (SCs) are the lower unit. A sub-center is serving on every 5,000 population in plain area (on every 30,000 population in hilly and tribal areas). The primary health centers (PHCs) are the



Source: CMO Office, Mirzapur, 2012.

Fig.2

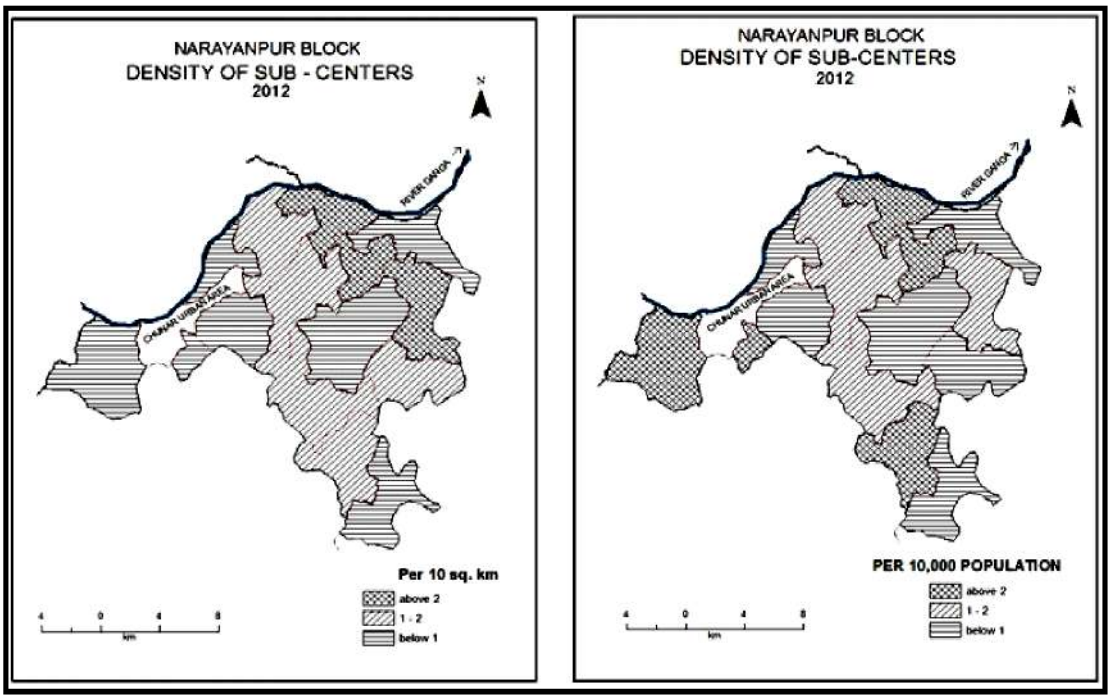
second lower unit. A primary health centre is serving on every 30,000 population in plain area (on every 20,000 population in hilly and tribal areas). The community health centers (CHCs) are higher unit, which also act as a referral unit for the PHCs. A community health center is serving on every 1, 20,000 population in plain area (on every 80,000 population in hilly and tribal areas).

In Narayanpur block there exists one CHC, five PHCs and twenty seven Sub-Centers. The community health centre is located at Chachery Mod (in Pirallipur village) while primary health centers are situated in Chunar town (it does not come under any nyay panchayat), Pachewara village, Dharammerpur village, Terhua village and Adalhat bazaar. This shows that out of 13 nyay

Table 1: Nyay Panchayat wise Density of Sub-Centers (2011)

Nyay panchayat	Area (km^2)	Total population	Sub-centers	Density per 10 km^2 Area	Density per 10,000 Population
Adhawar	19.81	14233	3	1.51	2.11
Ghatampur	14.13	13930	1	0.71	0.72
Garauri*	15.95	21615	2	1.25	0.93
Kolana	23.39	15827	3	1.28	1.90
Terhua	14.27	22197	3	2.10	1.35
Pachewara	19.42	17589	2	1.03	1.14
Deoria	24.49	22614	2	0.82	0.88
Niyamatpur Kalan	8.39	9182	2	2.38	2.18
Jalalpur Maidan	24.57	21662	2	0.81	0.92
Dhaurahara	22.05	8625	2	0.91	2.32
Bagahi	17.27	11430	2	1.16	1.75
Chandapur	9.92	7808	2	2.02	2.56
Sherpur	16.87	25848	1	0.59	0.39
Narayanpur block*	230.53	212560	27	1.17	1.27

Source: Self computed.
Note: *Including Garauri Census Town.



Source: Table 1.

Fig.3

panchayats, nine have no PHC in their nyay panchayat. The location of health centers is given in fig.2. For ascertaining the accessibility and efficiency, the availability of sub-centers per 10,000 population and 10 km^2 area has been calculated and presented in Table 1. The highest

density of sub-centers in context of area has been found in Niyamatpur Kalan (2.38) while the lowest density is found in Sherpur (0.59) followed by Ghatampur (0.71), Jalalpur Maidan (0.81), Devoria (0.82) and Dhaurahara (0.91) nyay-panchayats. In this regard 4 nyay panchayats showed low density, 5 nyay panchayats marked medium density and remaining 3 recorded high density. Highest density of sub-centers in terms of 10,000 population accounts for 2.56 in Chandapur and the lowest is recorded in Sherpur (0.39) followed by Ghatampur (0.72), Deoria (0.88), Jalalpur Maidan (0.92), Garauri (0.93). In this regard 5 nyay panchayats showed low density, 4 nyay panchayats marked medium density and remaining 4 recorded high density.

Infrastructure of Health Care Facilities

Government of India's bulletin on Rural Health Statistics, Ministry of Health and Family Welfare, New Delhi, 2012 highlights the health care facilities available at different levels namely CHC, PHC and SC levels in terms of health services, staffs and infrastructures. The analyses of personal survey in context of availability of staffs, health infrastructural facilities and equipments/stocks of 1 CHC, 5 PHCs and 27 sub-centers of the study area are discussed. In this survey availability of staffs and buildings, doctor's residence, supply of water and electricity, telephone and vehicles are included. The shortcomings of physical facilities with regards to recommended norms have been described under following sub heads at three levels of public health system.

Table 2: Staff Position at Primary Health Centres

PHCs	Medical Officers		Pharmacist	Lady Health Visitor / supervisor	Health worker		Laboratory Technician
	Male	Female			Male	Female (ANM)	
Chunar	2	1	-	6	10	5	1
Dharammerpur	2	-	1	-	-	1	-
Pachewara	2	-	-	-	1	1	-
Narayanpur	2	-	1	-	1	1	1
Adalhat	2	-	1	-	1	1	1

Source: Based on personal survey, 2012.

Availability of Staffs at Community Health Center

The CHC is recommended to serve 1, 20,000 population but as on 2011 census, it is serving 2, 12,560 population of the study area. The Indian Medical Health Standards (IMHS) guidelines for CHC, revised 2012 said about manpower that, CHC has essential five medical specialists i.e. general surgeon, physician, paediatrician, anaesthetist, obstetrician / gynecologist; four general duty officers i.e. one dental surgeon, one medical officers-AYUSH, two general duty medical officers supported by ten staff nurses, eleven paramedical and thirteen other staffs. IMHS also says that if patient load increases, then number of General Duty Doctors may be increased. The CHC acts as the referral hospital for the PHCs. The CHC of the study area is presently endowed with five medical specialists (one physician, one pediatrician, one anesthesiologist, two obstetrician / gynecologist), five staff nurses and twenty seven paramedical (twenty three RTI / STI specialist, one pharmacist, one laboratory technician, two female health worker / ANM), thirteen other staffs. The general surgeon and general duty doctor's posts were vacant on the day of survey. X-ray technician post is also vacant and there is shortage of staff nurses. These all hamper the performance of CHC.

Availability of Staffs at Primary Health Centers

The PHCs are the first contact point of medical persons with the community. The Indian Medical Health Standards (IMHS) guidelines for PHC, revised 2012 categorized the PHC into two.

These are Type A and Type B PHCs. Type A PHC with loaded less than 20 delivery in a month and Type B PHC with loaded 20 or more than 20 delivery in a month. Only Chunar PHC comes under Type B PHC. Rest PHCs come under Type A PHC. Type A PHC has essential manpower of one medical officer (MBBS Doctor), three staff nurses, five paramedical and four other staffs. Adalhat and Narayanpur PHCs have two male medical officers, four paramedical and four other staffs. Dharammerpur and Pachewara PHCs have two male medical officers, two paramedical and four other staffs. These all Type A PHCs are facing severe crunch of manpower. Type B PHC has essential manpower of one medical officer (MBBS Doctor), four staff nurses, five paramedical and four other staffs. The Chunar PHC has two male medical officers (MBBS Doctor); one female medical officer (AYUSH) on contractual basis; twenty two paramedical and seven other staffs (Table 2). The Chunar PHC is also the center for MCH (Mother and Child Health) programme.

Availability of Staffs at Sub-Centers

The sub-centers are the first contact point to the community. The Indian Medical Health Standards (IMHS) guidelines for sub-centers (SCs), revised 2012 categorised SCs into two. These are Type A and Type B SCs. Type A SCs provide all recommended services but do not have delivery facilities, while Type B SCs have all recommended services including delivery facilities and more staffs. Although the main focus is to promote institutional deliveries however the facilities for attending to home deliveries is remain available at both types of sub-centers. In Narayanpur block twenty seven sub-centers are under Type B SC and each sub-center is supposed to serve 5,000 population but among them six sub-centers (i.e. Raipuria, Pachewara, Jalalpur Mafi, Rupaidha, Rampur, Khajuraul) each is serving to 15,000 population. These six sub-centers are upgraded and a skilled birth attendance (SBA) trained health worker is appointed to observe the work of ANM. These are known as Lady Health Visitor / Supervisor (LHV). Six LHVs of Chunar PHC are working on these six sub-centers. The essential staffs of Type B SCs are two ANMs, one male health worker and the sanitation services are outsourced through full time basis. All Type B SCs have only one ANM accounting to 50 percent. Only Pirallipur, Gangpur, Adalhat, Nibi, Adhawar, Pauni, Rupaidha and Khajuraul sub-centers are having male multipurpose workers and their percentage is 29.63 %. Rest sub-centers do not have male multipurpose worker, which affects the counseling of men about RTI / STI and HIV. Shortage of male staffs also creates hindrance to popularize the male methods of family planning among the men. The Pirallipur, Gangpur, Narayanpur, Kolana, Bhurkura and Rupaidha sub-centers are having one female multipurpose worker and their percentage amounts to 22.22. The Terhua, Adalhat and Khajuraul sub-centers are having part time Dai and their percentage is 11.11. All these shortages of staffs are bound to hamper the performance of the sub-centers.

Accredited Social Health Activist (ASHA)

One ASHA is appointed on 1,000 population in plain area and on 600 population in hills, tribal and desert area (Annual Report, 2005-06, Ministry of Health and Family Welfare, Government of India). In the study area total required number of ASHA as per norm is 191 but only 178 ASHAs are appointed. There is 6.3 percent shortfall of ASHA position.

Availability of Health Infrastructural Facilities at Community Health Center

CHC is connected with all weathered metalled roads with district hospital and other PHCs. CHC is functioning in its own building, having electricity, one generator, one vehicle and water supply is done through bore well. But bore well water is not potable. It has no telephone facility. The staffs and patients are facing problem on account of this facility. It has 30 beds indoor service. The CHC is adequately equipped with laboratory (only for malaria and TB), separate aseptic labour room, delivery facilities, gynec OPD, RIT / STI OPD facilities, operation theatre and separate operation theater for gynecology. But there is no blood storage facility and it is still not connected with district blood bank, which

hampers its ability.

Availability of Health Infrastructural Facilities at Primary Health Centers

All five PHCs possess own building, doctor's residence and toilet facilities but only at Chunar PHC toilet is in working condition. Chunar PHC has got tap water because it comes under Chunar Urban Area. The Dharammerpur PHC has bore well but is not working because it has no electricity connection. Narayanpur PHC has water supply through hand pump. The rest two PHCs (Pachewara and Adalhat) do not have water facilities in their premises. Dharammerpur and Narayanpur PHCs do not have electricity connection. Only Chunar PHC has one telephone, two generators and one functional vehicle. Similarly only Chunar and Narayanpur PHCs are having delivery facilities. All PHCs have 4 beds. Pachewara PHC does not have labour room and only Chunar PHC is adequately equipped with laboratory.

Availability of Health Infrastructural Facilities at Sub-Centers

Pirallipur, Barew and Bhurkura sub-centers are functioning under rented building. Remaining sub-centers are having their own buildings but the building of Niyamatpur Kalan, Pauni and Raipuria sub-centers is in pitiable condition. On an average 88.9 percent sub-centers are running in their own building, while 11.1 percent are running under rented building. Gaura, Rupaidha and Khajuraul sub-centers do not have water supply in their premises. Dhaurahra sub-center has bore well but it is not working; other sub-centers have hand pump for water supply. The Niyamatpur Khurd and Adhawar sub-center's hand pumps are not in working condition and Raipuria hand pump's water is not suitable for drinking. The 85.9 percent sub-centers have hand pump, 3.7 percent sub-centers possess bore well and rest 11.2 percent sub-centers do not have water supply in their premises. Pirallipur, Dharammerpur, Gaura, Bhurkura and Rampur sub-centers have electricity connection. All sub-centers do not have telephone. Only 18.5 percent sub-centers has electricity connection.

Table 3: Availability of Health Care Facilities, 2012

Block	Health Care Facilities per Lakh Population					
	Institutions (CHC and PHCs)	Sub-centres	Beds	Doctors	Paramedical staffs	Other staffs
Narayanpur	2.82	12.70	23.52	7.06	134.08	18.35

Source: Self Computed.

Table 4: Gap between Required and Existing Health Care Facilities, 2012

Block	CHC			PHC			Sub-Centers		
	Required	Existing	Gap	Required	Existing	Gap	Required	Existing	Gap
Narayanpur	2	1	1	7	5	2	43	27	16

Source: Self Computed.

Availability of Selected Equipments at Community Health Center

At CHC one boyles apparatus, five oxygen cylinders, one shadow less lamp, one OT care / fumigation, one hydraulic table, one X-ray machine, one refrigerator are available. It also has four high pressure sterilizer equipments, but these are in damaged condition. The cardiac monitor, ventilator, ECG machine, ice lined freezer and deep freezer equipments are not available at alone Community Health Center.

For assured functioning of different programmes related to women health, some equipments are necessary. The CHC has two sets of standard surgical kits, five emergency obstetric care drug kits, six IUD insertion kits, five normal delivery / labour room kits and two equipments for neonatal resuscitation. The RTI / STI laboratory kit, side laboratory test kit and kit for donor blood transfusion were not available on the day of survey.

Availability of Selected Equipments at Primary Health Centers

All PHCs have adult weighing machine. The Chunar, Pachewara and Narayanpur PHCs also have infant weighing machine. Only Chunar PHC has deep freezer and vaccine carrier. All PHCs have blood pressure instrument except Pachewara PHC. Chunar and Narayanpur PHCs have autoclave. Chunar, Dharammerpur and Narayanpur PHCs have steam sterilizer. Only Chunar PHC has MTP suction aspiration but here is no availability of obstetrician & gynecologist, so these are useless; the patients are referred to Community Health Center. Chunar and Narayanpur PHCs have labour room table and equipment.

Gap between Required and Existing Health Care Facilities

In the study area the availability of health care facilities is given in table 3. The availability of health institutions (which include CHC and PHCs) is 2.82 on per lakh population. The number of sub-centers accounts for 12.70 on per lakh population. As per population norms there is requirement of two CHCs, seven PHCs and fourty-three Sub-Centers but in fact only one CHC, five PHCs and twenty-seven Sub-Centers are existing in the study area. There are huge gap between required and existing sub-centers i.e. sixteen (Table 4). The six sub-centers (i.e. Raipuria, Pachewara, Jalalpur Mafi, Rupaidha, Rampur, Khajuraul) are serving almost 15,000 population. Consequently, these health care facilities are facing huge population pressure. There are 23.52 beds, 7.06 doctors, 134.08 paramedical staffs and 18.35 other staffs on each per lakh population. The High Level Expert Group (HLEG) on Universal Health Coverage (UHC) was constituted by Planning Commission of India in October 2010. The HLEG submitted its report to the Planning Commission on November, 2011. It has recommended about minimum doctor-to-population ratio of 1:1,000 and bed-to-population ratio of 1:500. In the study area doctor-to-population ratio is 1:14,170 and bed-to-population ratio is 2:8,502. This indicates severe lack of doctors and beds as per suggested norm.

Conclusion and Suggestions

The highest density of sub-centers in context of 10 km^2 area has been found in Niyamatpur Kalan nyay panchayat (2.38) while the lowest density is recorded in Sherpur nyay panchayat (0.59). Highest density of sub-centers in terms of 10,000 population accounts for 2.56 in Chandapur nyay panchayat and the lowest is recorded in Sherpur nyay panchayat (0.39). The lone CHC of the study area is running without general surgeon, general duty doctor and X-ray technician. There is also shortage of staff nurses. Type A PHCs are facing severe manpower shortfall. Sub-Centers are having only 50 % ANM, 29.63 % male multipurpose workers, 22.22% female multipurpose workers and 11.11 % part time Dai. There is 6.3 % shortfall of ASHA. CHC has no blood storage facility and it is still not connected with district blood bank, which hampers its ability to deal with accidental emergency cases. Only Chunar PHC is adequately equipped with laboratory, telephone, generator and functional vehicle. Only Chunar and Narayanpur PHCs have delivery facility. About 89 per cent sub-centers are running in their own buildings, while 11.1 % are running in rented buildings. The 85.9 % sub-centers have hand pumps, 3.7 % sub-centers possess bore well and rest 11.2 % sub-centers do not have water supply in their premises. Only 18.5 % sub-centers has electricity connection. The sub-centers do not have telephone facility, while this facility is essential for communication. The PHCs and sub-centers are poorly equipped. There are 24 beds, 7 doctors, 134 paramedical staffs and 18 other staffs on each per lakh population. In the study area doctor-to-population ratio is 1:14,170 and bed-to-population ratio is 2:8,502; which is very high as per norm. As per population norm there is requirement of two CHCs, seven PHCs and forty-three Sub-Centers but only one CHC, five PHCs and twenty-seven Sub-Centers exist. There is huge gap between required and existing health care facilities. Thus there is need to improve the infrastructure of existing health care institutions as well as increase the number of institutions, beds and staffs (both doctors, paramedical and other staffs) to make them more viable & effective.

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Municipal Solid Waste Management in Varanasi: An Issue of Governance

Arun Kumar Singh*

Abstract

Municipal solid waste is generated by household, commercial and institutional activities. Its management includes the process from collection to disposal. With increasing urbanization and changing life styles, there has been continuous increase in municipal solid waste generation in Indian cities and its disposal has become the challenging task. Within this backdrop the paper intends to highlight the solid waste management scenario in Varanasi and examines the existing grass root level realities as a matter of governance. The study is based on primary data collected from field and secondary data including documents of ULB's, relevant government reports/ documents and study reports/research articles.

Key words: Municipal solid waste, Urbanization, Changing life styles, Governance matrix and FGD

Introduction

Municipal solid waste is 'any waste generated by household, commercial and/or institutional activities and is not hazardous' (Maria-2011). Municipal Solid Waste Rules (2000) defines municipal solid waste as 'unwanted and undesired material and includes commercial and residential wastes generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes' (MoEF-2000). Depending upon the source, it is broadly categorized into three types: Residential or household waste; commercial wastes and/or institutional wastes (DTIE-2011). Municipal solid waste management practice includes the entire process of dealing with municipal waste, starting from the collection at the primary source to ultimately disposing off it hygienically involving five types of activities but in most of the Indian cities, it involves only four activities, i.e., waste generation, collection, transportation, and disposal (Fig.-1). Processing and recovery is grossly missing in the system. Urban Local Bodies which is constitutionally accountable for managing municipal waste in the urban areas are spending around Rs.500/ to Rs.1500/- per ton on solid waste management of which, 60-70per cent is spent on collection alone and 20per cent - 30 per cent on transportation. Hardly any fund is spent on treatment/disposal of municipal waste and crude and open dumping is the most commonly used practice.

Due to population growth, industrialization, urbanization and changing life style there has been an increasing trend in municipal solid waste generation. Per capita daily MSW generation has shown a positive correlation with economic development (Sharholy et al.-2008). The average per capita waste generation in India is 370 grams/day as compared to 2,200 grams in Denmark, 2,000 grams in US and 700 grams in China (EEA-2011, USEPA-2009). In Indian context per capita waste generation rate is high in high (per capita) income states (Delhi) in comparison to medium (Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh) and low per capita income states (Uttar Pradesh, Madhya Pradesh, Bihar, Manipur) in India (Kaushal et al-2012).There has been more than eight times increase in municipal solid waste generation in Indian cities in the last sixty five years (1947-2012). Presently India is generating about 90

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Activities in Municipal Solid Waste Management System

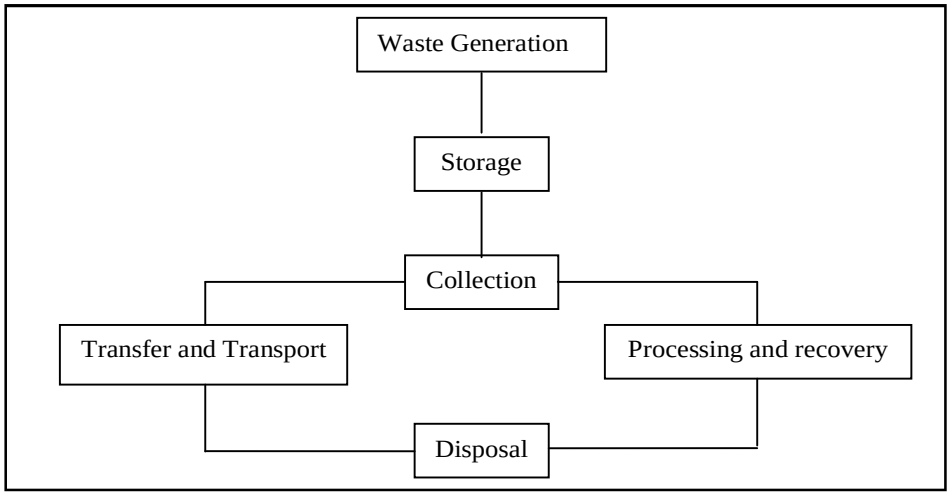


Fig. 1

million tons of solid waste annually (NIUA-2011). The Energy and Resources Institute (TERI) has estimated that by 2047, waste generation in Indian cities will increase five-fold to touch 260 million tonne per year (Singhal and Pandey-2001). In India a positive relationship is established between the size of the city and municipal solid waste generation rates (Table-1).

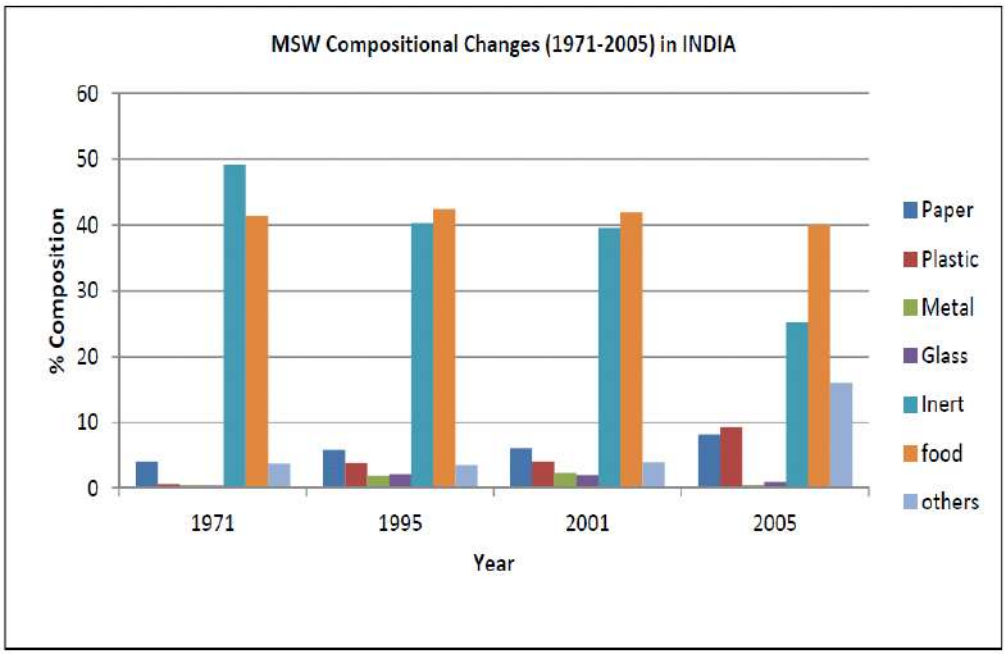
Table 1 : Per Capita Waste Generation in Indian Cities

Population Range (in million)	Average Daily Per Capita Waste Generation
0.1- 0.5	210
0.5-1.0	250
1.0-2.0	270
2.0-5.0	350
5.0 plus	500

Source: Based on Kaushal et al-2012

Kaushal et al (2012) opines that as countries develop economically and become more urbanized, the waste composition records an increase in the paper, paper packaging, plastics, multi material packing items and 'consumer products and decrease in the organic share. Compositional changes reported for India (1971-2005) suggests that the waste components like paper, plastic and glass have shown an increasing trend and inert materials and compostable matter have witnessed decreasing trend (Fig.2). As per the Constitution of India, subjects like water supply, sewerage, sanitation and solid waste management etc. are the state subjects. With the enactment of 74th Constitutional Amendment Act (1992) the urban local bodies have been given the responsibility of planning, designing, implementing and management of basic amenities and services like sewerage and solid waste management. Most of the ULBs are unable to cope with the challenging task of solid waste management because of multiple factors like rapid urbanization and rising incomes, lack of resources, inadequate infrastructure and non-availability of required open-spaces. The compliance of Municipal Solid Waste Rules (2000) has been poor (NIUA-2011).

Compositional Change in Municipal Solid Waste



Source: Kaushal et al.-2012

Fig. 2

Table 2: Growth Trend of Varanasi City

Year	Total Population (Persons)	Total Area (Ha)	Built-up Area (Ha)
1951	369799	2926.0	2015.4
1971	635175	4005.0	2343.0
1991	1027819	5665.9	4219.1
2001	1260517	14494.4	8956.46
2011	1638343	17927.4	14871.57

Source: Based on Singh and Singh, 2014, p 64

Objectives

Within this backdrop the paper intend to highlight the existing solid waste management system in Varanasi with focus on solid waste generation, its collection and disposal at the grass root level and the initiatives taken by the municipal authority to solve the problem and provide basic urban service as a matter of governance.

Database and Methodology

In totality 12 municipal wards have been selected randomly and from each ward 30 respondents were identified through convenient sampling making the sample size of 360. This paper is based on primary and secondary data. As the study restricts to the municipal solid waste practices household survey was conducted in the sample wards to collect primary data. Individual interview, informal discussion FGD, PRA and observation technique were applied as supportive techniques. Secondary Sources of data include documents of ULBs, relevant government reports/ documents and study reports/research articles. Finally a governance matrix has been developed to see the spatial variation at ward level.

The Study Area

Varanasi (25^0 20'N. Lat. and 83^0 00'E. Long.) is one of the metropolitan cities of India and is the biggest urban centre of Eastern Uttar Pradesh. It is considered as the oldest living city with more than 3000 years history. Varanasi Municipal Corporation (VMC) accounts for 70 per cent of the urban agglomeration divided into 90 municipal wards and fourteen sanitary wards. There is a constant increase in population with varying rate of increase. In the last six decades the population has grown almost five folds, total area increased by six times and the built up area increased by about seven times (Table-2).

Generation and Composition of Waste in Varanasi

Due to non-availability of reliable data on generation of municipal solid waste in Varanasi, the quantum of solid waste is ascertained on the basis of municipal records and number of trips made by vehicles/loaders for disposal purposes. So there is a variation in the data coming from different sources. However, the fact remains that it has increased from 410 MT/day in 1987 to 639 MT/day in 2008 , 650 MT/day in 2010,708 MT/day in 2012 and projected to be 1188 MT/day in 2021(Annepu-2012). Per capita waste generation is calculated as 549 gm (Kumra and Dwivedi-2009), 445 gms (Annepu-2012) and 545.08 gms (Agrawal et al-2012).

Varanasi being an important tourist place receives significant floating population which has bearing on the waste generation. Further it is observed that generation of solid waste also varies from one season to another. During festive season (October and November) and marriage seasons (May and June), when the city witnesses maximum influx of people, the quantum of solid wastes is reported higher as compared to rest of the year. It is also noted that a sizeable portion of the city remains water-logged during rainy season, causing interruption in the regular collection of garbage. Consequently, less amount of garbage is collected during these months. According to an estimate, residential waste (including waste from apartment houses) accounts more than two third of the total municipal solid waste generation and wastes coming from other sources account for around 30 per cent (Table-3).

Table 3: Sources and Quantity of Waste Generated in Varanasi

Source	Quantity in MT	Share in Percentage
Household	450	69.3
Shops/workshops	100	15.4
Offices/institutions	45	6.9
Industries	15	2.3
Others	40	6.1

Source: Based on VMC-2011

The physico-chemical characteristics of waste varies spatially, depending upon functional characteristics of the area, dietary habits of the inhabitants, consumption pattern of commodities, economic status of the people and religious composition of the community. In 1987, NEERI analysed the physico-chemical characteristics of municipal waste of Varanasi and revealed that it contains 28.89 per cent of organic matter and contents of N, P, and K are quite less. Kumra and Dwivedi (2009) found that characteristic of municipal waste has undergone significant change and presently it includes large quantities of plastics, metals, glasses, medical and chemical toxic wastes because of changing consumption pattern of the community. Srivastava et al (2014) have given the average physical composition of MSW of Varanasi (Table-4).

Table 4: Physical Composition of Municipal Solid Waste of Varanasi

Item	Quantity in Percentage
Food waste	32
Plastic	22
Cotton	10
Paper	9
Glass	7
Cardboard	6
Leather	6
Ash	5
Metals	3

Source: Based on Srivastava et al-2014

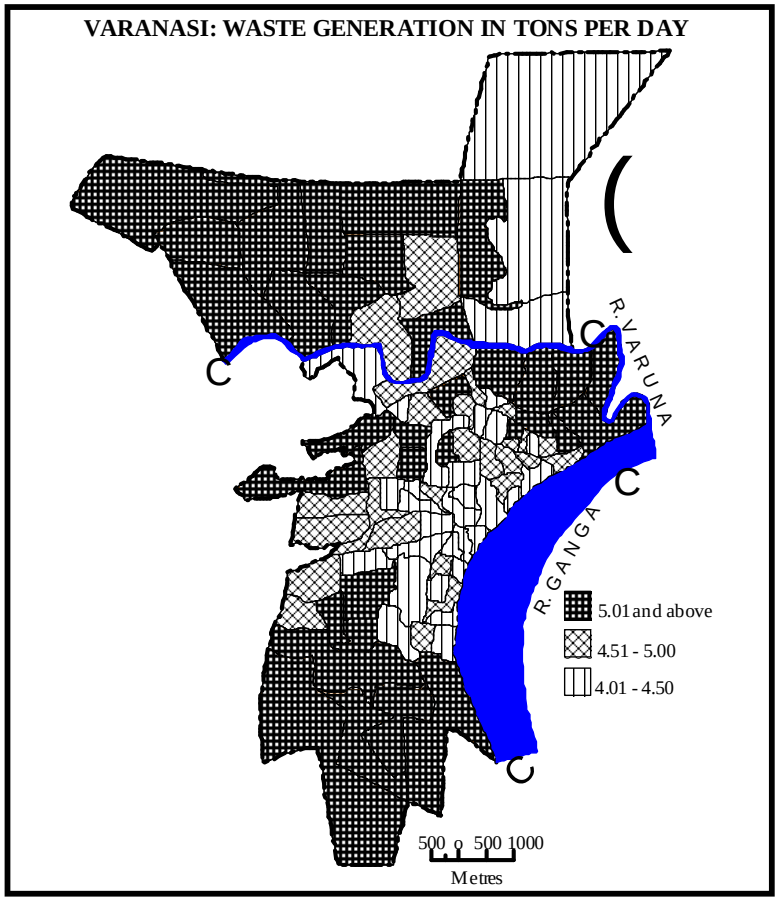


Fig. 3

Storage and Collection of Municipal waste

There is less practice of house-to house waste collection system in India and the wastes are usually thrown in the streets or public land or are disposed in the dustbins. There are very few bins for storage of domestic, trade and institutional wastes at source and they are never properly utilized. In Varanasi There are 112 storage depots include 27 open waste storage sites, 20 masonary bin and 65 metal containers(VMC-2012). There is marked shortage of employees particularly the sanitary workers for day to day waste management activities. In the absence of construction of an engineered landfill cell, the disposal of waste as per MSW (M&H) Rules-2000 is not being carried out and the percentage of compliance of the landfill component is zero.

Till 2010 there was no door-to-door collection system. A2Z Waste Management (Varanasi) Private Limited ("A2Z Varanasi") was incorporated on December 4, 2009 for the development of integrated solid waste management facilities in Varanasi on a Build, Own, Operate & Transfer (BOOT) basis with an aggregate MSW capacity of 600 tons per day (TPD) including the collection & transportation (C&T) of MSW and the processing and disposal (P&D) of MSW. However the contract could not continue and the agency stopped working since Aug.2012 and the city dwellers have become the worst victim.

Presently there is only one disposal site located along Ramnagar road near Mugal Sarai and dumping is the only method of disposal as of today. Under the JnURM scheme landfill sites and waste management plant is located at Karasara on the border of Varanasi and Mirzapur district which has not been operational and is not likely to function in near future.

Municipal Waste Management in Varanasi Field Level Observation

This section focuses on the field level observation and experiences during the survey for primary data collection. Dustbin is the most commonly used means (57.1 per cent) for waste collection followed by polythene bags (40.6 per cent). In seven wards (Vinayaka, Nadesar, Katuapura, Pan Dareeba, Ramapura, Pathani Tola and Dhup Chandi) dustbin is being used by majority while in four wards (Sunderpur, Shivpur, Naria and Benia) polythene bags are preferred. 22per cent of the waste generated in Varanasi consists of plastics. With the restriction on polythene bags by the Varanasi Municipal Corporation, it is likely that its use will come down.

Segregation of waste on the basis of its physical characteristics at the domestic level is one of the most eco-friendly ways to handle the problem at the grass root level. Unfortunately it is not practiced because of the lack of awareness and conspicuous insensitivity. In 92.5 per cent cases segregation of waste at source is not practiced by the people. All the waste generated at the household level is stored at one place without taking into account their physical/ chemical properties and handed over to the waste collector or dumped at nearby places.

Proper disposal of municipal waste is the responsibility of municipal authorities and since the enactment of 74th CAA (1994) many authorities are managing it either at their own or with the help of some other agencies. 82.1 per cent of the respondents consider affirmatively that the municipal authorities are handling the solid waste disposal at their own or by involving some other agencies. At the time of primary survey (Feb.- March 2012) in all the twelve sample wards more than 50 per cent of the respondents confirm that municipal corporation has provided door to door waste collection service (Plate-1). The response is 100 per cent in Katuapura and Pan Dareeba and relatively less in Sarnath (60.6 per cent), Nadesar (71.9 per cent) and Shivpur (72.7 per cent). The reason may be irregular visit which is perhaps one of the reasons for the failure of the contact.

Is there any fixed timing for the visit of the waste collectors? 53.4 per cent of the respondents said that there is no fixed timing. Whether do they visit the houses regularly i. e. daily? Majority of the respondents (70.1 per cent) said no. Whether the timing of waste collector to visit the ward is fixed and they stick to it? More than 50 per cent respondents in four wards i.e. Sunderpur, Sarnath,

Naria and Dhup Chandi confirmed it. Regular visit of waste collector on daily basis was reported only in two wards i.e. Benia and Dhup Chandi. Cross tabulation of the two variables i.e. fixed timing and regular visit reveals that maximum respondents (110/252) said no to both the queries while 82/ 252 said yes for both the variables. Test of independence for the two variables reject the hypothesis and statistically confirm that the two variables are dependent upon each other.

On the issue of payment of user charge @ Rs 30 per month in the case of pucca house and @ Rs 20 per month in the case of kachha house to the service providing agency i.e. A2Z , 70.7 per cent of the respondents said affirmatively and the ward level data states that in no ward there is hundred per cent recovery . There are wards like Sarnath, Shivpur and Nadesar where more than 40 per cent respondents were not paying user charge for the service. This happens to be one of the major reasons for withdrawal of the service by the A2Z agency (Plate-2). On the issue of level of satisfaction with the service 54.9 per cent of them said they are satisfied. In seven sample wards (Vinayaka, Shivpur, Katuapura, Pan Dareeba, Ramapura, Benia and Pathani Tola) more than 50 per cent respondents are not satisfied with the solid waste management system whereas in Dhup Chandi 54.8 per cent of the respondents said that they are satisfied with the service. Other wards where more than 40 per cent of respondents are satisfied are Sarnath (42.4 per cent) and Sunderpur (45.5 per cent)(Fig.-4).Whom do they approach for alternative measures? Majority of the respondents (56.6 per cent) said that they do not take any initiative and wait for the next day visit and 37 per cent of the respondents said they approach to municipal authority for alternative arrangement. Hardly do they go to local representative for the restoration of service and it was confirmed by the local representative also.

On the question of where do they dump the domestic waste 79.3 per cent respondents said that it is nearby the residence within the colony at less than 50 metres. The average distance of dump site is 66.6 mts..At ward level the distance of dumping ground from residence is reported as less than 50 metres by more than 50 per cent respondents in all the wards. In the wards like Pathani Tola and Sunderpur all the respondents dump the waste in this limit while in Vinayaka and Nadesar around one third of the respondents dump the domestic waste at the distance of more than 100 mts.

What are the means of alternative dumping if municipal waste collectors do not turn up? Maximum of the respondents (36.8 per cent) said they succumb to 'others' which include throwing the garbage near the house, along roadside, in the vacant land and in the nearby water bodies. This option is followed by dumping of waste in the locality (24.7 per cent) specified by the colony residents, wait for the next day (19.9 per cent) and dump it in the community dustbin (17.8 per cent). Majority of the respondents in nine sample wards of Varanasi said that they simply wait for the next day without complaining any one. In two wards i.e. in Naria and Dhup Chandi people approach municipal authority for timely waste collection. Obviously the people are throwing waste anywhere near his locality wherever he gets space/vacant land near his own residence. This attitude is likely to generate tension and conflict with the neighbours. DUDA Varanasi finds no dustbins placed in the sample wards and proposes 533 dustbins in the selected municipal wards (RCUES-2012). This is likely to bring positive impact but equally important is the change in behaviour, attitude and mind set of the people. It is a usual observation that wherever dustbin is placed, garbage is spread around and the dustbins are lying empty/partly filled.

The road conditions and overall city cleaning is claimed to be fairly good. The VMC has a road length of 1247 km (CSP-2011). The corporation has undertaken cleaning of 70 per cent of the streets on daily basis and 15 per cent on alternate day between 6 to 9am. However during primary survey 71.9 per cent respondents were of opinion that there is no regular street sweeping. On the issue of level of satisfaction with the street-sweeping aspect only 27.6 per cent respondents are of view that they are satisfied. Reason for not being satisfied is the timing of sweeping (6.00–10.00 AM) which happens to be the peak hour. It

is also likely to aggravate the symptoms of allergy, asthma and other respiratory inflammation. Majority of the respondents in eleven sample wards of Varanasi consider that there is no regular street sweeping and the percentage of respondents saying no varies from 57.6 per cent in Ramapura to 100 per cent in Sunderpur. The only ward where people are satisfied and admits that there is regular street sweeping is Dhup Chandi (58.1 per cent). The same is reflected in the response given to the question on level of satisfaction.

Is there any improvement in the last five year in the context of municipal waste management? Majority of the respondents (62.2 per cent) said no (Plate-3). The situation is grim as it is one of the 63 identified cities under JNURM scheme because of its religious and heritage importance; it is in the list of 100 smart cities and has the privilege of being the constituency of the Prime Minister of India.

Level of Satisfaction Solid Waste Managment System

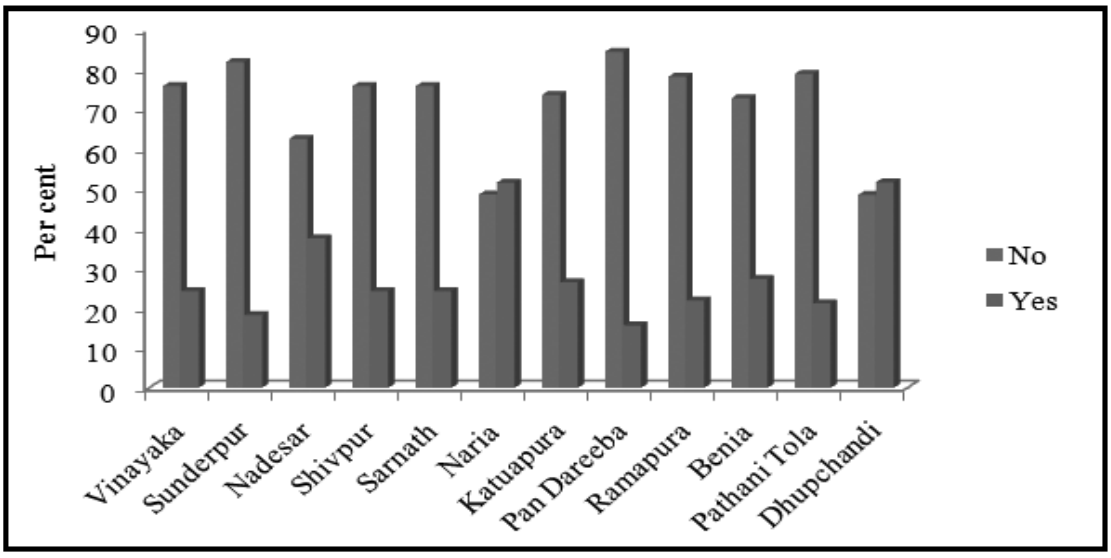


Fig. 4

Ward level analysis for Varanasi further stamps it. Only in three wards i.e Sunderpur, Nadesar and Naria more than 50 per cent respondents said yes to the question on improvement in last five years remaining nine wards responding negatively. Test of independence of the two variables i.e. any arrangement of solid waste disposal made by the municipal authorities and improvement in the last five years rejects the hypothesis and confirms that the two variables are dependent upon each other.

The Issue of Governance and Municipal Waste Management in Varanasi

The terms "governance" has different meanings in different contexts and varies from narrow structural definition to the processes that ensure deliveries, participation, and justice, respect of rights, innovation and networking. Since governance is the process of decision making and the process by which decisions are implemented, an analysis of governance focuses on the formal and informal actors involved in decision-making and implementing the decisions made and the formal and informal structures that have been set in place to arrive at and implement the decision.

" Governance, in general, has three distinct aspects: (a) the form of a political regime; (b) the processes by which authority is exercised in the management of a country's economic and social resources; (c) the capacity of governments to design, formulate and implement policies to discharge governmental functions" (World Bank-

2000). Urban Governance is the concept of governance in relation to urban areas to be reflective of how the various constituents of public service delivery are synchronised to increase the welfare of citizens (both current and future) and how effective the institutions are in terms of the principles of sustainability, decentralization, efficiency, equity, participation, transparency, accountability, civic engagement and citizenship, and security (UNESCAP-2002)(Fig.-5).

It can only be measured relatively and subjectively requiring a periodic monitoring in order to ensure effective and efficient service delivery, which is considered achievable through strategies of enabling, participation and capacity building. Crux of the urban governance lies in the fact that multitude of actors are involved with a network of system of governance and all the sectors (public, private and other social organizations) and geographies (cities, regional and national) interact in the decision making process in order to produce an efficient and effectively managed city as well as promoting city at a global level. However, financial constraints and fragmented responsibilities with multiple authorities have come in the way of functioning.

Municipal solid waste management essentially comes in the domain of urban local bodies. The difficulties in providing the desired level of public service in the urban centres are often attributed to the poor financial status of the managing municipal corporations (Sharholy et al -2008).

Characteristics of Good Governance

Source: www.unescap.org

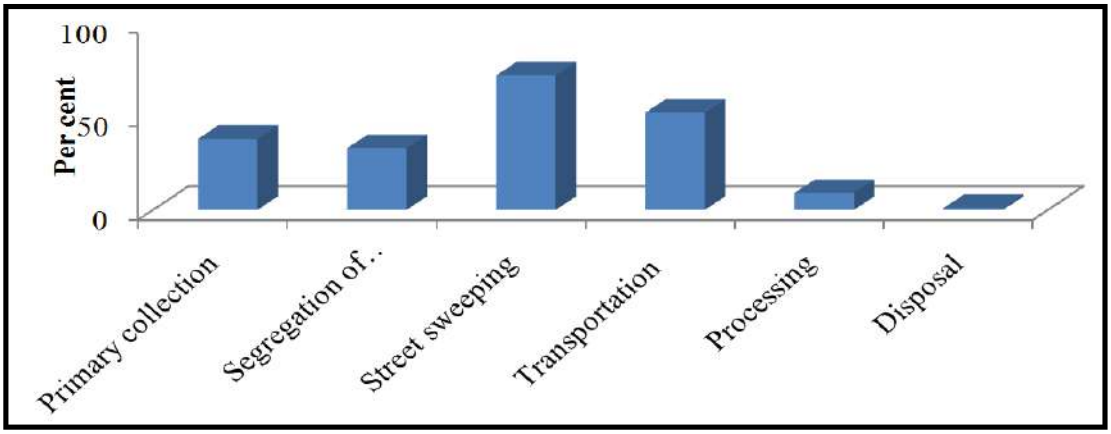
Fig. 5

Asnani (2006) has highlighted apathy of municipal authorities and the absence of community participation as the responsible factors for inadequacy and inefficiency in municipal waste management services.

Report of the study conducted on class I cities of India (2004) shows that there is insignificant progress. Survey conducted by Toxic Links (Delhi based NGO) in 2007 further reveals that solid waste management has a low priority because of unawareness and reluctance from the citizen side, poor budgetary provision at the government level and lack of role clarity and poor coordination at municipal level. Most of the towns/ cities have no action plan for implementation of the MSW Rules**.** Fig.-6 shows the percentage of compliance of the solid waste management rule in Varanasi.

Table 5 depicts the status of solid waste management as it exists in the different sample municipal wards of Varanasi with the help of

A Report Card Based on Municipal Solid Waste Rules 2000 in Varanasi



Sources: City Sanitation Plan, 2011

Fig.6

Table 5: Governance Matrix for Municipal Waste Management in Varanasi

Ward	1	2	3	4	5	6
Vinayaka	X	X	X	X	X	X
Sunderpur	✓	X	X	X	✓	✓
Nadesar	X	X	X	X	✓	X
Shivpur	X	X	X	X	X	✓
Sarnath	✓	X	X	✓	X	X
Naria	✓	X	X	✓	✓	✓
Katuapura	X	X	X	✓	X	✓
Pan Dareeba	X	X	X	✓	X	✓
Ramapura	X	X	X	✓	X	✓
Benia	X	✓	X	✓	X	✓
Pathani Tola	X	X	X	✓	X	X
Dhup Chandi	✓	✓	✓	✓	X	✓

- 50 per cent or more respondents saying Yes- ✓
- 50 per cent or more respondents saying No- X

governance matrix considering six variables

- Fixed timing for waste collection (1)
- Regular visit of waste collector (2)
- Regular street sweeping (3)
- Regular payment of user charge (4)
- Improvement in last five years (5)
- Complaints attended by the authorities(6)

Whether the timing of waste collector to visit the ward is fixed and they stick to it? More than 50 per cent respondents in four wards i.e. Sunderpur , Sarnath, Naria and Dhup Chandi confirmed it. Regular visit of waste collector on daily basis was reported only in two wards i.e. Benia and Dhup Chandi. Regular street sweeping is reported by majority of the respondents only in one ward i.e Dhup Chandi. Regular bill payment is done by more than half of the respondents in eight out of the twelve sample municipal wards. As far as improvement in the last five years are concerned only in three wards i.e. Nadesar, Naria and Sunderpur more than 50 percent of the responds said yes. Whether the complaints are attended properly by local authorities i.e. ward councillors and municipal functionaries in eight wards more

than 50 per cent of the respondents said affirmatively .On the whole Dhup Chandi is the only ward which fares well in the eyes of respondents fulfilling five out of six parameters at micro level whereas in Vinayaka majority of the respondents are dissatisfied on all the six parameters. As it has already been said that the issue of governance is subjective and relative hence it cannot be seen in a steel frame but with a positive sign that the situation is likely to improve because of two reasons firstly it is one of the cities under JNNURM as well as SMART city.

Conclusion and Suggestions

Due to anthropogenic transformation there has been an increasing trend in municipal solid waste generation in Indian cities with more than eight times increase in the last sixty five years. Most of the municipal authorities are unable to cope with the challenging task of solid waste management because of multiple factors. In Varanasi issues related to the poor management of municipal solid waste are rampant use of polythene bags causing environmental threat, non segregation of waste at domestic level and there dumping in nearby areas, provision of municipal service on ad hoc basis, lack of municipal bins and open dumping as a prevalent method of treatment. Consequently there is a non compliance of MSW (M&H) Rules-2000 in the city. However field level experience also reveals that wherever citizen has taken interest the situation is better. There is a need to create sensitivity and educate the mass for change in attitude through awareness programme. Community participation, civic engagement and involvement of NGO and CBO should be promoted. There should be budget allocation for essential urban services provision and effort should be made to implement the MSW(M&H) Rules -2000 in its word and spirit.

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Socio-Economic Status of Muslim Labour in Glassware Cluster of Firozabad City

Ateeque Ahmad* and Nikhat Bano **

Abstract

Employment plays an in important role for the sustenance of life of any individual. Employment is not only a means to have livelihood but also a key factor which determines socio-economic condition of any section of the society. Although muslims are the second largest community of the society their progression are hampered. Firozabad is known for the glass industry all over producing 70 percent of the total glass of India. Muslims are the most skilled labour because of being the torchbearer of glass and bangle making, but this section is the most deprived section of the society who's upliftment are the corner issue for the governing body. This discrimination of muslim laborers whose contribution is most in revenue generation are the worst suffers in terms of health due to absence of health provision. Employment insecurity and economic constraints are the biggest issues. This paper is based on primary as well secondary sources of data obtained thorough survey with the help of questionnaire and interviews and analyzed using statistical techniques. 57.83 per cent of Muslim labour force are involved indifferent categories of work associated with the glass and 90 percent have responded for various types of health issues.

Key words: Employment, Health problems, Glass industries, Muslim labour class and Socio economic condition

Introduction

A man has to perform many roles in his life, the most crucial of which is that of an earning member. It is crucial not because a man spends approximately one-third of his life time performing this role but because it determines both his livelihood and status. It also enables an individual to support his family and ful fill his social obligations to society (Ahuja, R. 1997). Employment is no guarantee of escaping poverty, the international Labour Organization (ILO) estimates that as many as 40 percent of workers as poor, not earning enough to keep their families above the $2 a day are at poverty line. In India most of the chronically poor are wage earners, their jobs are insecure and low paid and offer no chance to accumulate wealth to avoid risk (en.m.wikipedia.org/wiki/Employment). The Firozabad glassware cluster is a local economy and falls under the Micro, Small and Medium Enterprises (MSME) sector. In terms of value, the MSMEs sector accounts for about 45percent of the manufacturing output and 40percent of the total exports of the country. Formal employment in this sector is estimated to be almost 60 million (595 Lakhs) in over 261 lakh enterprises throughout the country. It produces over 6000 products ranging from traditional to high-tech items by the MSMEs in India (MSME, 2011-12). The contribution by MSMEs to the Gross National Product (GDP) reached 8.72percent in 2008-09, approximate-ly a 68% share in manufacturing and rest in services by MSMEs in India. The contribution to the production of different products by the Micro, Small and Medium enterprises are 94.94percent, 4.89 and 0.17percent, which clearly indicates the significant role of Micro enterprises in the MSMEs sector in India (Ministry of Small Medium and Micro

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Enterprises 2012). The Firozabad Glassware cluster is considered among one of the important local economies in the MSME sec-tor of India. Health is the important pertinent indicator of the social worth of an individual. A vast majority of india's labour force is in unorganized sector. In the absence of economic opportunities in their own states, many workers migrate across the other states of india to seek employment (Nadal, 2006).

Objectives

The objectives of the present study are, to identify the muslim labour in different glass units; To identify the major health problems in the labour force; and to enumerate some of the conditions that needs to be addressed urgently in order to tackle these problems.

The Study Area

The area of study is Firozabad city, situated in North-central India in Western Uttar Pradesh , at 230 09'N, 780 24'E. The focus of the study is health status of muslim labour force engaged in the bangle and glass industry of Firozabad. Firozabad city is popularly known as the 'Glass City or Suhag Nagri' of India (fig 1).

The Firozabad Glassware Cluster is a naturally emerged cluster throughout centauries which has been able to make its presence with in domestic as well as global market. This cluster, historically being a cottage industry, now a Micro, Small and Medium Enterprise is an important local economy which specialized in bangle making about since 40 years back it diversified and produces glass products of international marketing as well. The Glass-ware Industry of Firozabad contributes significantly to the local economy by providing livelihoods to over 0.5 million people (Indian Renewal Energy Efficiency Development Agency Limited 2005).

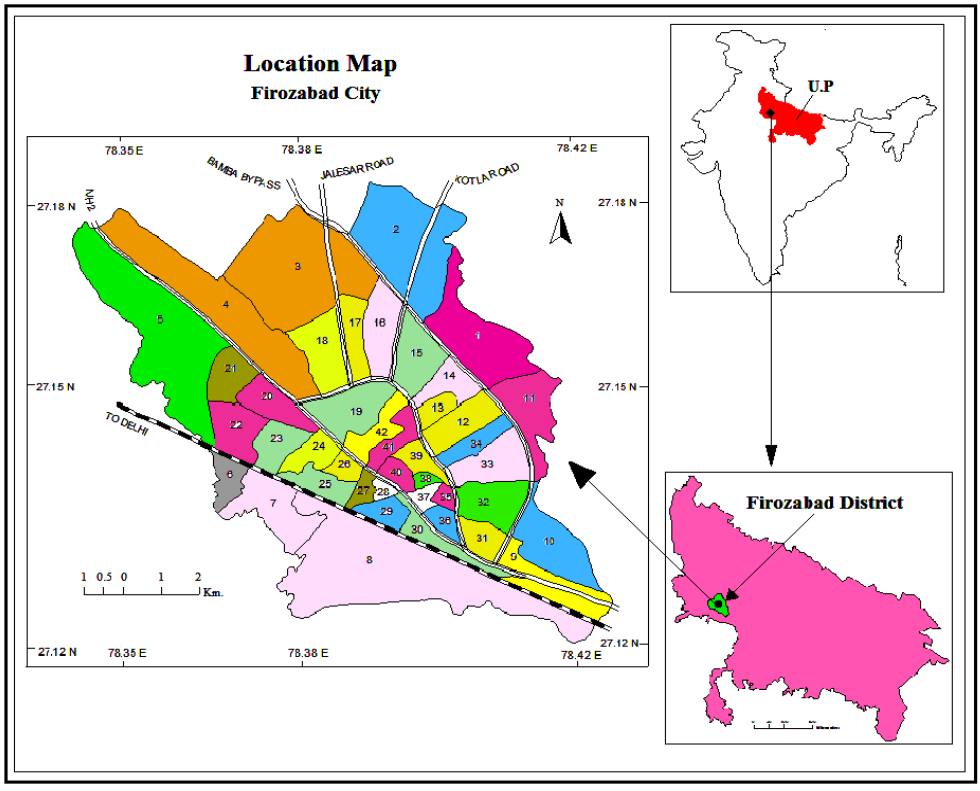

Fig.1

The local workers have perfected the art of the production process which is passed on for generations over the past 100 years.

Database and Methodology

For the study primary survey of industries and household (micro) bangle industries was carried out with the help of questionnaire including the socio-economic conditions of the muslim laborers and reported health problems. The total of 120 workers engaged in different units of the glass and bangle were interviewed randomly. The primary information collected has been analyzed by using descriptive statistics and depicted in the form of tables.

Secondary sources of data have been obtained from the District Information Center and MSME annual reports and various other agencies of the Firozabad City.

Result and Discussion

Out of the total 120 respondents 57.83 percent of the total sample belongs to minority(muslim) and among those 47.80 belongs to OBC (Fig 2).

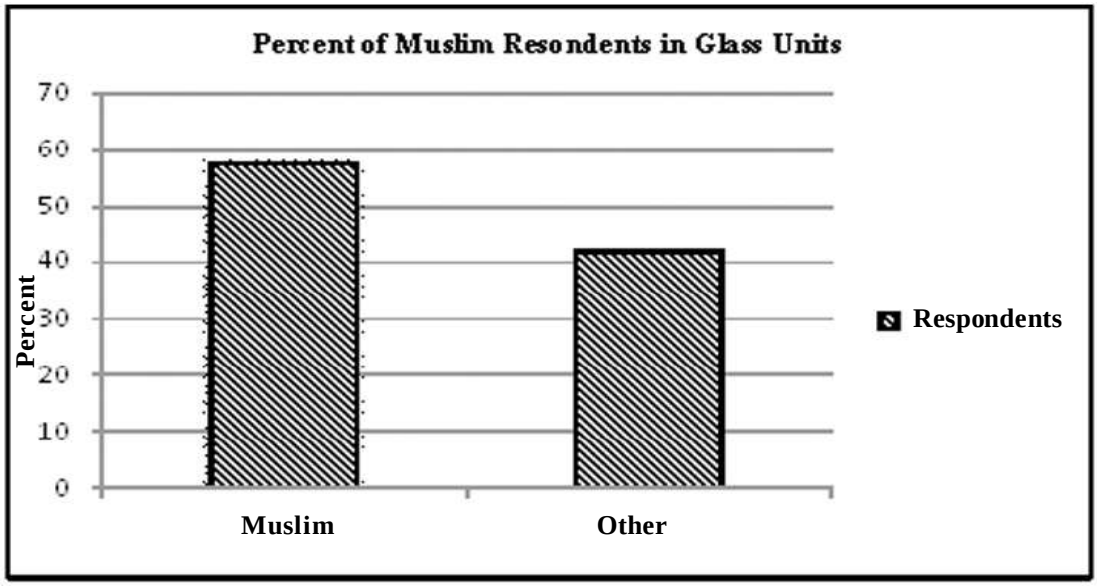

Fig.2

Labour force in Glassware Cluster

The laboure forces being employed in glassware are generally categorized as Skilled, Semi-skilled and unskilled laborers apart from managerial staffs. The labour force depends of types of furnace and number of furnaces operational in a factory. According to types of furnaces the labour intsitivity of glassware are shown in table 1.

Table 1: Types of Furnaces and Labour Intensiveness

S.No.	Types of Furnace	Type of Factories	Estimated laboure Force/day
1	Tank Furnace	Manufacturing	1000-2000
2.	Pot Furnace	Manufacturing	500-750
3.	Closed Furnace	Manufacturing	250-350
4.	Atomized	Manufacturing	200-300

Source: From Field Work 2012-2013

Table 2: Percent of Muslim Labour in Different Glassware Units

Particulars	Glass Melting units	Other Glass Units	Average % (A+B)
Muslim	47.26	23.48	35
Women	2.85	32.63	18
Others	50.01	44.01	47

Source: MSME, Annual Report(2011-12): Ministry of Medium,Small and Micro Enterprises Govt. of India

It is evident from the table 2 that the muslim labour force occupy a noticeable percentage in glass melting units than other glass units because most of the melting units are owned by the muslim, and they preferred to work with and feel comfortable working with same community and cast groups. This is also causing exclusion of certain social group especially the muslims to be in mainstream with glassware melting units.

Apart from above manufacturing units which come under medium and small factories, there are ancilliary(household based, micro) units that provide employment to maximum number of households of Firozabad and there would be more than 200,000 people working in such households units[1](Iqbal, Inter-view:23/07/2012).

Table 3: Labour Intensiveness and Labour Category in Firozabad City Micro Units of Bangle

Unit Types	Approximate No. of Units	Type of Labour	No.of Workers (ave.)	Negotiation	Wage Pattern	Age of Worker
Stock	200-250	Skilled, Semi-skilled and Unskilled	5-6	verbal Piece rate	Daily, fortnightly and Monthly	Adult male
Godam	10000-15000	Skilled, Semi-skilled and Unskilled	6-10	verbal Piece rate	Daily, fortnightly and Monthly	Children, adolescent male, adult male
Judai & Sadai	2000-3000	Skilled, Semi-skilled and Unskilled	4-6	verbal Piece rate	Daily, fortnightly and Monthly	Women, ado-lescent girls, children, adult male
Design Cutting	1500	Skilled, Semi-skilled and Unskilled	5-7	verbal Piece rate	Daily, fortnightly and Monthly	Male,Women, ado-lescent girls, children
Gold Polishing	50-100	Skilled, Semi-skilled and Unskilled	6-8	verbal Piece rate	Daily, fortnightly and Monthly	Adult male, children
Pakai & Sekai	250-300	Skilled, Semi-skilled and Unskilled	9-10	verbal Piece rate	Daily, fortnightly and Monthly	Adult male
Zari	2000-2500	Skilled, Semi-skilled and Unskilled	10-12	verbal Piece rate	Daily, fortnightly and Monthly	Adult male and children
Artificial Polish/ compressor work	1000-1500	Skilled, Semi-skilled and Unskilled	8-10	verbal Piece rate	Daily, fortnightly and Monthly	Children, adult male
Packet Making	1500-2500	Skilled, Semi-skilled and Unskilled	10-20	verbal Piece rate	Daily, fortnightly and Monthly	children, women, ado-lescent, male
Scrape/Glass Junk segre-gation	500-750	Unskilled	5-10	verbal	Daily, fortnightly and monthly	Women, ado-lescent girls, children

Source: From Field Survey, Mr. Tarique, Imran (Godam owner) Prakash Agarwal (stockist) - interview: 23-9-2013).

Table 4: Reported Health Problems of the Muslim Labour Engaged in Glass Industry of Firozabad City

Infirmities	Yes (in percent)	No (in percent)
Back	60	40
Neck	52	48
Shoulder	38	62
Lower limbs	52	48
Respiratory	60	40
Cardiovascular	40	60
Nervous system	38	62
Gastrointestinal	24	76
Eyes	68	32
Ears	54	46
Skin	70	30
Nose	53	47
Asthma	36	64
Sleep	58	42
Stress	38	62

Source: based on field survey 2012-2013

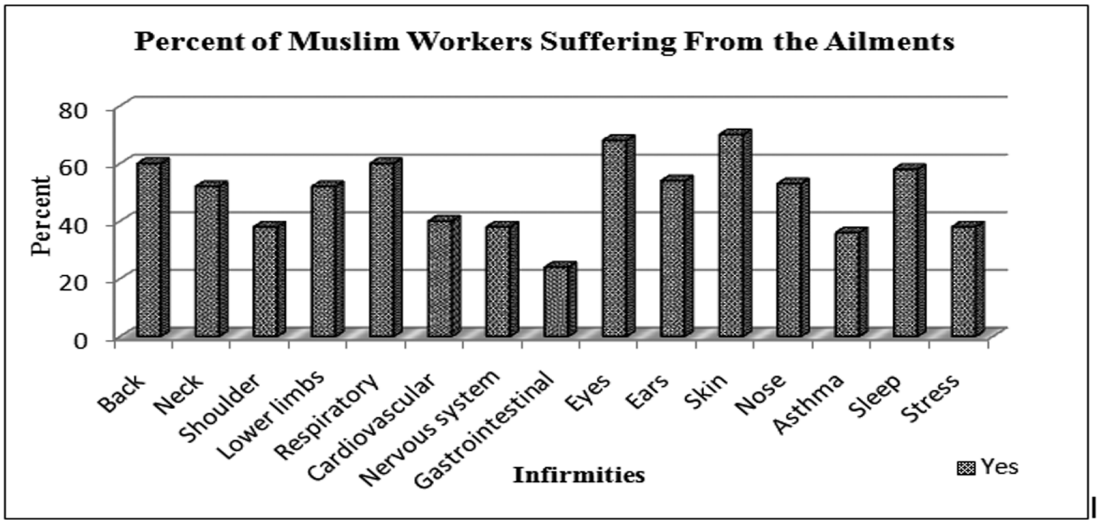

Fig. 3

There is no empirical data available on number of work-force and exact number of units because the units are household based and absolutely unorganized, However, based on primary sources table 3 is produced regarding micro at Firozabad cluster.

Health Status of Labour Force

The Firozabad glass cluster is a hazardous industry which deserve extra attention ,to minimize health risks and promote health security to workers, because of extremely harmful industrial heating, hazardous chemicals, risky operational or manufacturing processes of glassware production[2](Ahad,Interview:04/08/ 2012). The workers have to face various serious health issues; for instance; failure of kidney and

lung, Breath related problems, backache, headache, cuts, skin diseases , itching, irritation , Visual disorders , lack of apatite, Tuberculosis (T.B.) , dehydration etc.

The glass manufacturing process involves exposure to free floating silica dust and high temperature. It is evident from the table 4 that major health problem of muslim labour force of glass industry are related to eyes, sleep, nose, lower limbs, hands, as well as respiratory, cardiovascular and nervous systems. The free floating silica is responsible for nasal and ophthalmic problems and respiratory issues (fig 3).

Though the industry runs on the co-operation basis but still, some where muslim labour force is the most vulnerable one either in terms of job insecurity or availing the health facility. The resultant analysis reveals that awareness of the workers is very poor. Majority of the muslim labour belong to the poor socio-economic condition, therefore low income and poor educational levels are responsible for poor health conditions of the labour force.

Conclusion and Suggestions

- The analysis reflects there are practices of discrimination based on religion, caste and community which lead to economic exclusion of minorities. Most of the labours are hired from the labour market on a daily wage basis and only a limited number of workers, 7-8%, are provided with employment benefits and such workers belong to the family or friends of factory owners. The Firozabad cluster, despite the existing labour laws and policies is facing socio-cultural challenges which might be attributed to the lack of implementation of existing laws and policies therefore some suggestions are given as follows;
- Because most of the labour force belong to minority class, there is need to promote policy standards for social upgrading of muslim.
- Voluntary organization should be involved in creating awareness among labourers for their basic rights.
- it is worthwhile to incorporate the provision of a private-public partnership to enhance the working and labour conditions at the work-place in the policy framework.
- For socio-economic growth of muslim poor, policy intervention for integrating household-based units in one platform, their relocation and rehabilitation out of the community could be worthwhile.
- Furthermore, the alternative policy of corporations should include strategic measures to enhance education, health and entrepreneurship for excluded minorities and underprivileged communities.
- The local and regional government policymakers should establish separate health institutions and labour welfare institutions which could be helpful in dealing with discrimination, exclusion and exploitation issues.
- Last but not least, transparency of the government in allocating of funds and fellowships to muslim minorities for diversification of youths through entrepreneurship and promoting higher education to reduce the labour intensiveness.

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Socio-Economic Causes of Rural Out-Migration in Kanpur Nagar District of Uttar Pradesh

Tarique Hassan* and Jabir Hasan Khan**

Abstract

The prime aim of the present study is to find out the causesof rural out-migration in Kanpur Nagar district. The analysis of causes of migration has been based on age and sex composition, religion, caste, literacy, duration, distance and type of community of origin and destination of migrant population. The entire study is based on primary sources of data generated through the field survey that was carried out during 2012. The overall analysis of data reveals that the causes of out-migration become more social with increasing age of migrants, while, male are economically motivated and females are socially stimulated. Moreover, the proportion of out-migrants belong to the Hindu community have been migrated for economic reasons as compared to Muslim community. In addition, scheduled caste and scheduled tribe population was more migratory in nature for social reasons, whereas, the migrant community belong to the categories of general and other backward caste were economically motivated. Likewise, literate out-migrants migrated more for economic reasons as compared to the illiterate one. However, the majority of out-migrant population moved from rural to urban areas was for economic reasons. Notwithstanding, since 1992, the determinants of out-migration has became more economic in nature.

Key words: Migration, Rural, Commumity, Poputation and Economic

Introduction

The domain of internal migration covered a wide array of research on the issues related to the causes, distance, movement, pattern, decision-making processes of migration, etc (Hassan T, Khan J.H., 2012). The general questions which may be asked by the researchers in the sphere of internal migration are: Why migration does occur? Who migrates? What are the patterns of origins and destinations and of the flows between them? How the process of the decision to move is formed and it changes over time? However, the most important questions which are usually studied by the social scientist- why migration does occur and how the process of the decision to move is formed and it changes over time?Migration is primarily in response to deep-seated inequalities and rigidities (Lipton 1980) and a purposive move in response to perceived spatial diversity (White & Woods, 1980) and it started when migrants believed that they will be more satisfied in their needs and desires at the place where they moved to than at the place from where they came. Migrants may be rural origin or urban origin and when rural migrants getting information about the urban labour markets through various informal channels, and tend to move from low income and casual jobs to high income and regular jobs, and undergo an increase in their standards of living by migrating to urban areas (Gupta & Mitra, 2002) in order to attain sustainable livelihood, safety, peace and overall quality of life.

The contemporary studies on migration in developing countries often focus on rural out migration and are preoccupied with problems it may bring to cities (Yang, 1994). Migrants differ

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from the rest of the population in terms of their age, sex, life stage, housing tenure, socio-economic status and educational achievement (Boyle, Halfacree & Robinson, 1998; Buck, Gershuny, Rose & Scott, 1994; Champion et al., 1998) and hence, it should be made modifications in the structure of society both at the places of origin and destination. However, the structural forces in terms of spatial variations in socio-economic opportunity determine the scale and form of migration, and stresses that the significance of the various development related factors underlying of migration differs among the countries and over time (Shrestha, 1988; Bogue and Zachariah, 1962;Chapman, 1969; Davis, 1951; Mitra, 1968; Sen Gupta, 1968; Zachariah, 1960).Migration occurs when various factors operate together (Kosinski & Prothero, 1975; Bhagat & Mohanty, 2009), while, the importance of factors responsible for migration varies from place to place and time to time according to a locale's particular development milieu (Mabogunje, 1970; Zelinsky, 1971).

The specific aim of the present study is to find out reasons of rural out-migration particularly from the rural sectors of the district. Secondly, it has been also attempted toassess the variation in the causes of migration based on migration selectivity, for this, analysis of causes of out-migration has been made on the basis of age and sex composition, religion, caste, literacy, duration, distance and type of community of origin and destination of out-migrant population. Hence, the present study is very relevant and essential for understanding the variation in the causes of out-migration, particularly in case of India, where Indians are always been the representation of unity in diversity.

Hypothesis

- Causes of out-migration will vary with the differentials of migration.

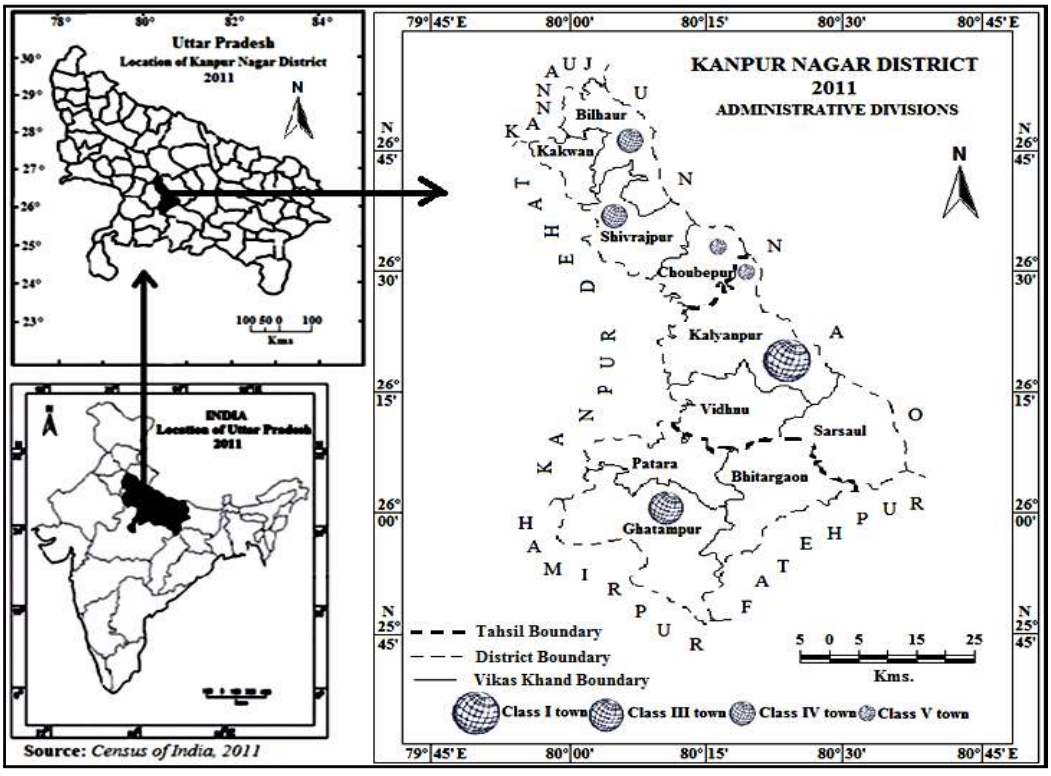

Fig. 1

- Economic reasons have always been dominated in rural migration.
- The proportion of rural-out migration has increased in the district.
- Long distance migration is mainly for economic reasons, while, short-and medium-distances migration for social reasons.

The Study Area

The district Kanpur Nagar belongs to the track known as lower Doab of Ganga and Yamuna. It is situated on the bank of river Ganga. It lies between the parallels of 25° 26' and 26° 58' north latitudes and meridians of 79° 31' and 80° 34' east longitudes. The total area of the district is 3,155 sq. Kms. as per revenue records, which is 1.23 per cent of the whole Uttar Pradesh and ranks 39th in respect of area in the state. It is surrounded by five districts of Uttar Pradesh and bounded on the north by Unnao district, on the east by Fatehpur district, on the west by Kanpur Dehat and Kannauj districts and on the south by Hamirpur district. According to the 2011 census, the total population of the district was 4,581,268, of which 65.83 per cent was classified as urban. The general density of population was 1452 persons per square kilometer. However, it was 553 persons per sq. km. in the rural sector and 9247 persons per sq. km. in the urban sector. During the four intercensal periods of 1971-1981, 1981-1991, 1991-2001 and 2001-2011, the growth rateof population in the district was 26.5 per cent, 22.5 per cent, 28.1 per cent and 9.9 per cent respectively.

The percentage of growth rate in the rural and urban population was 14.2 and 7.8 in the decade 2001-2011. The general sex ratio, that is the number of females per thousand males, was 862 while in rural areas it was 870 and in urban areas 859. The percentage of scheduled castes and scheduled tribes population in the district was 17.83 and 0.1 per cent respectively. The proportion of scheduled castes in rural population was 27.96 per cent as against 12.57 per cent in urban population. In the district 79.65 per cent population was literate, while the respective figures for the male and female literacy rate were 83.62 per cent and 75.05. The percentage of literacy in rural and urban population was 74.74 and 82.10 respectively.

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Database and Methodology

The present micro-level study is the part of my Ph.D. thesis work entitled "Patterns of Internal Migration in Kanpur Nagar District", which was exclusively based on primary sources of data generated through field survey and direct questionnaire to the respondents which was carried out during 2012 in Kanpur Nagar District. The villages have been selected on the basis of stratified random sampling based on the size of population. Out of the total 909 inhabited villages, 5 per cent (46) villages have been selected for rural survey. The rural survey consisted of 951 households in 46 villages. The study period selected for this study is twenty years (from 1992-2011), while for the data collection one year period has been taken as migration defining period, and the blocks (VikasKhand) administrative boundaries have been considered as migration defining boundaries, while, household is taken as the smallest unit of enquiry. On the basis of migration defining period and migration defining boundary, the respondents were categorized into in-migrants, out-migrants, return-migrants and non-migrants. For the convenience of survey, firstly, type of respondents has been identified and the separate individual slips have been used for the migrants and non-migrants population within

Table 1 : Percentage Distribution of Socio-Economic Causes of Out-Migration by Age-Composition of Migrant Population, Kanpur Nagar District, 1992-2011

Causes	Age-Group				
Economic	**Below 15**	**15-29**	**30-44**	**45-59**	**60 & Above**
Landless/Small Land Holding	18.09	14.29	15.63	17.54	33.33
Unemployment	13.83	19.78	21.09	19.3	27.78
Low Income	15.96	25.27	17.19	14.04	22.22
Shyness to work	7.45	4.4	4.69	-	-
Arduous work	15.96	17.03	14.84	12.28	-
Late Payment	17.02	16.48	18.75	14.04	-
Service/ To get job	-	1.1	5.47	8.77	-
Others	11.7	1.65	2.34	14.04	16.67
Total	100	100	100	100	100
	(58.39)*	**(43.96)**	**(46.21)**	**(55.88)**	**(37.50)**
Social					
Education	17.91	6.03	2.68	17.78	-
Social Conflict	-	1.72	0.67	13.33	-
Poverty	29.85	13.79	15.44	17.78	20
Marriage	17.91	53.02	47.65	22.22	-
Orphan	1.49	3.02	2.68	-	-
Large family	2.99	8.19	7.38	4.44	13.33
Household Migration	23.88	13.36	16.11	17.78	43.33
Others	5.97	0.86	7.38	6.67	23.33
Total	100	100	100	100	100
	(41.61)*	**(56.04)**	**(53.79)**	**(44.12)**	**(62.5)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

the households to make a survey more comprehensive, reliable and specified one. The number of in-migrants, out-migrants and return-migrants identified through the survey were 3417, 1298 and 315 persons respectively.

After the completion of survey, the obtained data have been coded and entered in the computer accurately for further calculation and analysis by the application of SPSS (version 16.0) and Microsoft Excel (2007). At each stage of analysis, maximum care has been taken into account to maintain the consistency and accuracy of the data. However, in the present paper only out-migrant populationof rural origin has been taken into account for the analysis and interpretation.The simple percentage method is employed and the percentage value of all the relevant variables is presented through tables.

Results and Discussion

Determinants of out-migration from the district by age and settlement status of out-migrants have been given in Table 1. An assessment of data regarding the economic reasons of out-migration from the rural areas of the district depicts that decreasing size of land holdings or landlessness and unemployment have motivated the highest proportion of senile age-group population aged 60 and over which amounted to 33.33 per cent and 27.78 per cent respectively, while, the maximum ratio of out-migration from the rural sector of the district due to low

Table 2 : Percental Distribution of Socio-Economic Causes of Out-migration by Sex-Composition of Rural Migrants, Kanpur Nagar District, 1992-2011

Causes	**Rural Out-Migrants**		
Economic	**Male**	**Female**	**Total**
Landless/Small Land Holding	16.84 (12.14)*	-	16.14 (8.39)
Unemployment	20.17 (14.54)	-	19.32 (10.05)
Low Income	19.75 (14.24)	14.29 (1.01)	19.52 (10.16)
Shyness to work	4.37 (3.15)	-	4.18 (2.18)
Arduous work	16.22 (11.69)	-	15.54 (8.08)
Late Payment	17.67 (12.74)	-	16.93 (8.81)
Service/To get job	2.70 (1.94)	23.81 (1.68)	3.59 (1.87)
Others	2.29 (1.65)	61.90 (4.36)	4.78 (2.49)
Total	**100.00 (72.11)**	**100.00 (7.05)**	**100.00 (52.02)**
Social			
Education	19.35 (5.40)	1.44 (1.34)	8.64 (4.15)
Social Conflict	4.84 (1.35)	-	1.94 (0.93)
Poverty	34.95 (9.75)	8.66 (8.05)	19.22 (9.22)
Marriage	6.99 (1.95)	73.29 (68.12)	46.65 (22.38)
Orphan	5.38 (1.50)	0.72 (0.67)	2.59 (1.24)
Large family	18.28 (5.10)	2.17 (2.01)	8.64 (4.15)
Household Migration	3.76 (1.05)	7.22 (6.71)	5.83 (2.80)
Others	6.45 (1.80)	6.50 (6.04)	6.48 (3.11)
Total	**100.00 (27.89)**	**100.00 (92.95)**	**100.00 (47.98)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

income(25.27 per cent) and shyness to work (7.45 per cent) has been found in the juvenile age-group (0-14) and 15-29 age-group respectively. However, in all the age-group, the reasons of arduous work and late payment for their work were the dominant factors which compelled the migrants to move from the rural areas in the age-group of 15-29 and 30-44 which shared about 17 per cent and 19 per cent of the total economically motivated out-migrants respectively. Besides, in order to get services or government jobs 8.77 per cent of out-migrants belonging to the age-group 45-59 have been moved out from the rural parts of the district.

Data regarding the social reasons of out-migration given in the Table 1 discloses the fact that education and poverty are played a dominant role in motivating the out-migrant population in the juvenile age-group 0-14 to migrate from the rural parts of the district. Moreover, the highest volume of out-migrants for the reason of social conflict from rural areas has been observed in the age-group 45-59. Marriage migration is recorded highest among the out-migrants of 15-29 age-group from rural sector of the district because this age-group population is biologically highly reproductive andmajority of population have been married during this age-group. The reasons of high rate of out-migration due to large family size has

been registered in the age-group 60 and above from rural areas of the district. Nevertheless, the reason of migration of household is recorded highest among the rural out-migrant population in the age-group 60 and over in the district.

Table 2 presents the percentage distribution of various reasons of out-migration based on the sex-composition of rural migrants. The data given in the Table 2 brings the fact into light that rural out-migration is more economic motivated and male migration outnumber female migration for economic reasons and vice versa. It will be also seen from the table that rural male out-migration (72.11 per cent) is proportionally higher for economic reasons. However, the reverse trend of

Table 3 : Percental Distribution of Socio-Economic Causes of Out-Migration by the Religion and Caste Category of Rural Migrants, Kanpur Nagar District, 1992-2011

Causes	Rural Out-migrants				
	Religion		Caste		
Economic	Hindu	Muslim	General	Other Backward Caste	Scheduled Caste & Scheduled Tribe
Landless/Small Land Holding	16.26	15.09	11.44	17.35	17.21
Unemployment	19.82	16.98	17.91	18.26	18.85
Low Income	19.82	13.21	18.91	19.18	16.39
Shyness to work	4.68	-	3.48	4.11	4.10
Arduous work	16.04	11.32	15.92	13.24	13.93
Late Payment	17.15	18.87	17.41	15.53	12.30
Service/To get job	4.01	3.77	8.46	5.94	7.38
Others	2.23	20.75	6.47	6.39	9.84
	100.00	100.00	100.00	100.00	100.00
Total	**(54.36)***	**(42.86)**	**(55.46)***	**(52.93)**	**(46.54)**
Social					
Education	10.08	2.90	6.92	9.33	7.91
Social Conflict	1.86	4.35	1.26	1.55	2.88
Poverty	20.42	17.39	19.50	19.69	14.39
Marriage	49.60	42.03	52.20	41.97	37.41
Orphan	3.18	-	2.52	3.63	0.72
Large family	7.96	11.59	4.40	10.36	2.88
Household Migration	4.77	14.49	7.55	9.33	21.58
Others	2.12	7.25	5.66	4.15	12.23
	100.00	100.00	100.00	100.00	100.00
Total	**(45.64)***	**(57.14)**	**(44.54)***	**(47.07)**	**(53.46)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

out-migration has been observed in case of social migration.

The further examination ofdata unfolds the facts that unemployment, low income, late payment, small land holdings or landlessness and arduous nature of work in rural areas are the main economic reasons which pushed the rural poor male population to migrate which combinely shared 87.45 of the total economic motivated migration and 90.65 per cent of total male migration, while, poverty, education, large family size, marriage and orphanage are alltogether contributed about 85 per cent to the total social migration and 23.70 per cent of the total male migration. On the other hand, female migration shares only about 7 per cent of economic migration and nearly 93 per cent of social migration. Among the economic reasons of female migration, to get service or job and their low income have been motivated 2.69 per cent of total females to migrate, while, marriage migration is the dominant factor of the total

Table 4 : Determinants of Out-Migration by Literacy Status of Rural Migrant Population, Kanpur Nagar District, 1992-2011

Causes	Rural Migrants	
Economic	**Literate**	**Illiterate**
Landless/Small Land Holding	15.95	18.64
Unemployment	20.80	16.96
Low Income	20.82	16.94
Shyness to work	4.86	2.54
Arduous work	15.95	16.10
Late Payment	17.57	16.95
Service/To get job	3.51	2.54
Others	0.54	9.32
Total	100.00	100.00
	(55.31)*	**(49.37)**
Social		
Education	9.36	9.92
Social Conflict	2.01	2.48
Poverty	21.40	22.31
Marriage	53.51	46.28
Orphan	3.34	1.65
Large family	8.36	10.74
Household Migration	1.34	2.48
Others	0.67	4.13
Total	100.00	100.00
	(44.69)*	**(50.63)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

migration (68.12 per cent) as well as the social migration (73.29 per cent) of female population, followed by poverty and household migration.
Table 3 provides information regarding the socio-economic causes of out-migration categorized on the basis of religion and caste compositions of the rural migrants of Kanpur Nagar District.

An examination of data given in the Table 3 reveals that in rural areas, among the economic motivated migration 39.64 per cent of Hindu and 30.19 per cent of Muslim migrantshave been pushed out due to their unemployment and low income. Landlessness or decreasing size of land holdings because of law of inheritance have compelled 16.26 per cent Hindus and 15.09 per cent Muslims to migrate. The proportions of Hindus and Muslim migrants for the reason of arduous nature of work are 16.04 per cent and 11.32 per cent, while, Muslims outnumbers Hindus for the cause of late payment. Of the economic reasons, various governmental services or better jobs amounted to 4.01 per cent of Hindus migration and 3.77 per cent of Muslims out-migration. However, of the economic motivation of migration, shyness to work is only recorded among the Hindu population. It may be attributed to prevalence of caste taboos among Hindus is considerable higher than the Muslims, as a corollary, poor Hindu population belonging to higher caste like Brahmans, Sharma, Pandey did not work at their native places for their means of livelihood and therefore, majority of them have migrated to somewhere else for menial or arduous work to get more income by concealed their caste identity.

As far as the social factors are concerned, marriage migration has been the dominant cause of migration among the Hindus and Muslims which shared about 49.60 per cent and 42.03 per cent respectively. Poverty is the second principal cause of out-migration for the both Hindus and Muslims that accounted to 20.42 per cent and 17.39 per cent. The potencies of migration for household migration, large family size and social conflict have been the highest percentages among Muslims than Hindus, while migration for education is remarkably higher among Hindus as compared to Muslims.

The percentage distribution of economic causes of out-migration categorized on the basis of caste composition of migrant population reveals that the main reasons of out-migration of general caste population from rural areas are low income, unemployment, late payment and arduous nature of work, while, among OBC population, low income, unemployment, small land holdings or landlessness and late payment. On the contrary, the unemployment, small land holdings or landlessness and low income have been played dominant role in pushing out the Scheduled Castes (SCs) and Scheduled Tribes (STs) rural population of the district. Likewise, the highest proportion of migration from rural areas due to marriage that shares 52.20 per cent among general caste population, 41.97 per cent and 37.41 per cent for OBC and SCs and STs population. Besides, abject poverty, household migration and education are the main social factors of out-migration among general caste population, while among OBC population poverty, large family size; education and migration of household have played a significant role in social motivated migration. On the other hand, household migration, poverty and education have contributed the remarkable proportion of SCs and STs which have been pushed out from rural parts of the district.

The socio-economic causes of out-migration by literacy status of rural migrant population have been set out in the Table 4. An analysis of data given in Table 4 shows that literate population of the district is highly economically prompted in out-migration than the illiterate one. The problems of unemployment, low income, arduous nature ofwork, shyness to work inlow status occupation, late payment, lack of governmental services and jobs have been the main driven forces of out-migration among the literate migrants as compared to illiterate population, while, landlessness or small size of land holding has played a remarkable role in pushing out the illiterate migrants than that of literate population. In consideration of social stimulates of migration it has been observed that migration due to marriage, education and orphanage is higher in proportion among literate than illiterate migrants,

but, poverty induced migration, large family size, household migration and social conflict have been more motivated the illiterate migrants to migrate as compared to literate one.

On the basis of settlement status of out-migrants of Kanpur Nagar district, it may be pointed out that proportion of illiterate out-migrants is higher than the literate migrants from rural parts of the district for the economic reasons of late payment shyness to work and service or jobs. Moreover, the percentage shares of literate out-migrants for unemployment and low income are considerably greater than the illiterate out-migrants in rural sector.

Among the social determinants of out-migration of literate and illiterate population, it has been observed that illiterate migrants from rural areas are more socially motivated. In rural areas, it is found that marriage and orphanage are the two driving forces of migration which shares highest among literate population than that of illiterate and their respective figures are 53.51 per cent and 3.34 per cent for the literate out-migrants and 46.28 per cent and 1.65 per cent for the illiterate out-migrants. Besides, the entire social stimulates including poverty, large family size, education, household migration and social conflicts have more pervasive influence over the illiterate migrants as compared to the literate one.

Table 5 provides information about the percentage distribution of causes of out-migration categorized on the basis of places of origin and destination of migrant community.

The close scrutiny of the data given in the Table 5 reveals that rural to urban migration from the district has been more economically motivated

Table 5: Percentage Distribution of Out-Migration by Causes and Type of Community of Origin and Destination of the Rural Migrants, Kanpur Nagar District, 1992, 2011

Causes	**Rural to Rural**	**Rural to Urban**
Economic		
Landless/Small Land Holding	16.53 (5.56)*	13.87 (9.06)
Unemployment	18.18 (6.11)	15.20 (9.93)
Low Income	21.49 (7.22)	19.47 (12.72)
Shyness to work	2.48 (0.83)	4.80 (3.14)
Arduous work	14.88 (5.00)	16.27 (10.63)
Late Payment	18.18 (6.11)	17.07 (11.15)
Service/To get job	1.65 (0.56)	9.07 (5.92)
Others	6.61 (2.22)	4.27 (2.79)
Total	100.00 (33.61)	100.00 (65.33)
Social		
Education	2.51 (1.67)	17.09 (5.92)
Social Conflict	1.67 (1.11)	2.51 (0.87)
Poverty	15.90 (10.56)	26.13 (9.06)
Marriage	64.44 (42.78)	31.16 (10.80)
Orphan	2.93 (1.94)	2.51 (0.87)
Large family	9.62 (6.39)	7.54 (2.61)
Household Migration	1.26 (0.83)	9.05 (3.14)
Others	1.67 (1.11)	4.02 (1.39)
Total	100.00 (66.39)	100.00 (34.67)

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

as compared to rural to rural migration. The economic motivations have been responsible for 65.33 of rural to urban migration and 33.61 per cent of rural to rural, while in case of social stimulates, district has witnessed the reverse pattern of it.

With respect to economic migration from the district that low income, unemployment, late payment, landlessness or small land holdings and arduous nature of work are the dominant causes of rural to rural migration, while, low income, late payment, arduous nature of work, unemployment, landlessness and for governmental services or to get better jobs are the main economic drivers of rural to urban migration.

The data regarding the social factors of out-migration unfolds the facts that rural to rural migration is more socially stimulated than that of the rural to urban migrations. Table 5 also reveals that marriages have been the dominant cause among the social factors of migration that contributed nearly three-fourth (66.39 per cent) of the rural to rural migration and 31.16 per cent of rural to urban migrations. Besides, poverty, large family size, education and orphanage have been the other significant determinants of rural to rural migration, while, poverty, education, household migration and large family size are the main social motivations of rural to urban migration.

Table 6 presents the information about the percentage distribution of causes of out-migration classified on the basis of period since migration. An analysis of the data given in the Table 6 shows

Table 6: Percent Distribution of Out-Migration by Causes Based on Years Since Migration of Rural Migrant Population, Kanpur Nagar District, 1992-2011

Causes	**Rural Migrants**			
Economic	**1992 to 1996**	**1997 to 2001**	**2002 to 2006**	**2007 to 2011**
Landless/Small Land Holding	20.45	15.38	12.70	14.15
Unemployment	13.64	19.23	19.84	17.30
Low Income	18.18	16.67	18.25	16.04
Shyness to work	-	1.28	2.38	5.35
Arduous work	11.36	11.54	13.49	14.78
Late Payment	15.91	14.10	15.87	15.41
Service/To get job	13.64	21.79	12.70	16.04
Others	6.82	-	4.76	0.94
Total	100.00	100.00	100.00	100.00
	(36.36)*	**(45.09)**	**(54.78)**	**(62.85)**
Social				
Education	6.49	4.21	8.65	11.70
Social Conflict	-	1.05	4.81	1.60
Poverty	7.79	17.89	15.38	27.13
Marriage	68.83	58.95	47.12	30.85
Orphan	3.90	-	5.77	1.60
Large family	2.60	11.58	12.50	6.38
Household Migration	6.49	1.05	1.92	6.91
Others	3.90	5.26	3.85	13.83
Total	100.00	100.00	100.00	100.00
	(63.64)*	**(54.91)**	**(45.22)**	**(37.15)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

that with the passage of time out-migration has become more economic than social in nature. The economically motivated out-migration accounted to 36.36 per cent during 1992 to 1996 which increased to 62.85 per cent in 2007-2011, while, the proportion of socially stimulated migration has been declined from 63.64 per cent to 37.15 per cent of the total out-migration of the district during 1992 to 2011.

The data about economic out-migration of the district given in the Table 6 reveals that during the span of twenty years since 1992 to 2011, the proportion of out-migrants have been declined who have migrated for the economic reasons due to their landlessness or small land holdings, low income and late payment, while, rate of out-migration have been increased for thecauses of unemployment, shyness to work, arduous nature of work and for governmental services or to get better jobs from rural parts of the district. With regards to social out-migration of the district, ithas been found that since 1992 to 2011, the rate of out-migration has increased from rural areas for the determinants of education, poverty, large family size and household migration and decreased for marriages and orphanage. The corresponding figures are 68.83 per cent and 30.85 per cent in 1992-1996 and 2007-2011 for marriage migration,

Table 7 : Percental Distribution of Out-Migration by Causes and Types of Administrative Boundaries Crossed at the Time of Migration, Kanpur Nagar District, 1992-2011

Causes	**Rural**		
Economic	**Within the District (Short-distance)**	**Other districts of Uttar Pradesh (Medium-distance)**	**States beyond Uttar Pradesh (Long-distance)**
Landless/Small Land Holding	16.06	16.67	15.59
Unemployment	18.98	22.22	18.82
Low Income	19.34	18.52	18.28
Shyness to work	2.92	5.56	5.38
Arduous work	15.69	7.41	17.20
Late Payment	17.15	20.37	15.05
Service/To get job	1.09	3.70	3.76
Others	8.76	5.56	5.91
Total	100.00	100.00	100.00
	(53.31)*	**(30.34)**	**(70.45)**
Social			
Education	8.75	5.65	15.38
Social Conflict	1.25	3.23	6.41
Poverty	22.50	9.68	30.77
Marriage	52.08	70.16	5.13
Orphan	0.83	2.42	8.97
Large family	9.58	3.23	14.10
Household Migration	4.17	1.61	11.54
Others	0.83	4.03	7.69
Total	100.00	100.00	100.00
	(46.69)*	**(69.66)**	**(29.55)**

* Figures in parenthesis indicate the percentages to the economic and social migrations combined together under the column.

Source: Calculation is Based on Sample Survey by Author, 2012.

while, 3.90 per cent in 1992-1996 and 1.60 per cent in 2007-2011 for the reason of orphanage.

Percental distribution of the reasons of out-migration categorized on the basis of migration defining boundaries has been set out in Table 7. It would be seen from the data that out-migration from the district under economic motivations has been more to the states beyond Uttar Pradesh than either within the district or that to other districts of Uttar Pradesh. The ratio of economic motivated migration within the district boundaries has been registered 53.31 per cent and between the districts of State 30.34 per cent, whereas to the other states of India 70.45 per cent from the rural parts of the district. On the other hand, the reverse trend has been observed for the social reasons of out-migration.

Table 7 also reveals that among the different migration defining boundaries, economic reasons namely, low income (19.34 per cent) has recorded the highest proportions of out-migration in the category of intra-district migration, unemployment, late payment, landlessness and shyness to work in inter-district migration and arduous nature of work and governmental services or better job opportunities in inter-state migration from the rural areas of the district. The further analysis of data regarding social reasons of out-migration classified on the basis of migration defining boundaries given in Table 7 depicts that marriages have the highest share in motivation of medium-distance migration, followed by short-distance and long-distance and the corresponding figures of it was 70.16 per cent, 52.08 per cent and 5.13 per cent respectively. Besides, poverty, education, large family size, household migration, orphanage and social conflicts are the main social stimulates of rural out-migration from the district to different states of India beyond Uttar Pradesh.

Conclusion

It may be summarized from the above analysis that the causes of out-migration become more social with increasing age of migrants, while, male are economically motivated and females are socially stimulated. Moreover, the proportion of out-migrants belong to the Hindu community have been migrated from rural areas for economic reasons as compared to Muslim community. In addition, scheduled caste and scheduled tribe population of rural parts of the district was more migratory in nature for social reasons, whereas, the migrant community belong to the categories of general and other backward caste were highly economically motivated. Likewise, literate out-migrants migrated more for economic reasons as compared to illiterate one. However, the majority of out-migrant population who moved from rural to urban areas was for economic reasons, on the contrary, the reverse condition has been observed in case of rural to rural migration that is for social factors. Notwithstanding, since 1992 to 2011, the determinants of out-migration from rural areas has became more economic in nature, while, the long distance out-migration was economically stimulated that has been followed by short-distance and medium-distance migration.

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Urban Land Use Pattern and its Dynamics: A Study of Jhansi City

Janki Prasad* and R.S. Yadava**

Abstract

The urban land use and its pattern are the result of the main municipal functions that hold central importance to planning, research and action. The spatio-temporal analysis of land use within the city reveals variations in functions and its dynamics. The internal structure of urban area consists of a variety of functions and land use patterns. These differences are based on the geographical controls on one hand and human efforts to utilize the urban lands in various ways on the other. The land use pattern of any urban area is a reflection not only of the immediate and current space requirements of the community but rather of the cumulative needs over a period of year. Jhansi city is experiencing rapid changes in its land use pattern through uncontrolled and haphazard development in various parts of the city due to lack of proper implementation of master plan. The urban functions and employment opportunities especially in tertiary sector of Jhansi city have attracted people from surrounding region. It creates pressure on urban infrastructure as well as on urban land. In this emerging situation, there is a need to identify the changes in urban land use and concerned issues to prepare a plan for sustainable development. This paper is an attempt to study of urban land use and its dynamics during different four points of time that is very useful to urban geographers, land economists, city planners and administrative officers.

Key words: Urban land use, Dynamics of land use, Urban functions, Settlement and Development

Introduction

Urban geography puts emphasis on the method that how people are spaced in cities in which it is found as a complex intermingling of different land use types, i.e., a base for the development of modern society. Impressions of growth of any settlement are revealed in the pattern of land use, internal structure and morphology. The study of urban land use is very significant for geographers because availability of land and its value play a seminal role in the determination of man's economic, social and cultural activities. 'Land use pattern of a city is a reflection of anthropogenic transformation of land and dynamicity of the city which is conditioned, controlled and shaped by various phases of histogenetic evolution and are guided by location, topography and accessibility'(Singh, 2010, p.75). 'Land use in a city has a unique structure because of its interactions between spatial configurations and functions. Urban land uses differ with each other not only in their areal coverage but also in their different morphological structures. Its study becomes essential as a part of analysis of different functions' (Sharma and Mishra, 2011, p.11). Human occupancy of the land changes dynamically in space and time. This requires a scientific study of the land use related to their types, incentives and concentrations (Tiwari, et al., 2010, p.17). The influence which the city exerts on the social and economic structure of the areas helps in the formation of land use pattern (Richarch, 1949, p.396). The process of urbanisation is transforming the urban land use and functions of Jhansi as internal restructuring and peripheral geographical expansion. 'Urbanisation is an inevitable result of social-economic development, the development and promotion of

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the socio-economic development and prosperity' (LI Cheng-fan et al. 2011, p.45). Geometric progression of urban population and the transforming urban economy leads to an ever increasing demand on the urban environment in terms of urban capture in the fringe areas and change in the internal structures of the cities (Pathan, et al. 1992, p.73).

The Study Area

The city is located between 25^0 21' 19.9" N to 25^0 31' 54.12" N latitude and 78^0 30' 9.47" E to 78^0 39' 20.33" E longitude. The area comes under the gneissic region of Bundelkhand upland and its surface configuration consists of plateau platform. The average elevation of the city is 284m above mean sea level and its general slope tends towards north and eastward. It receives an average amount of 87.5cm annual rainfall and falls under semi-arid type of climatic conditions. In summer season city experiences temperatures up to 47ºC while it falls as low as 4^0 C in winter season.

Jhansi municipal corporation covers an area of 16,950 ha and it consists of 60 municipal wards. The city has a population of 5, 47,638 in which cantonment and railway settlement notified area are included while the population of municipal corporation is 505,693. The sex ratio of the city comes to 905. The total literacy rate of the city is 83.65 per cent. Male literacy goes to 89.25 per

Table 1: Jhansi City: Variations in the Rate of Growth of Urban Land Use (A Area in ha)

Sl. No.	Land Use	Municipal Board				Municipal Corporation					
		1976	1990	Variati-on 1990-1976	Percent Change	2000	Variati-on 2000-1990	Percent Change	2013	Variati-on 2013-2000	Percent
1.	Commercial	19.45	72.63	53.18	273.42	83.22	10.59	14.58	121.61	38.39	46.13
2.	Residential	386.80	600.41	213.61	55.22	2,088.86	1,488.45	247.90	2,490.95	402.10	19.50
3.	Industrial	9.91	9.61	-0.3	-3.03	247.33	237.72	2,473.67	373.42	126.09	50.98
4.	Governmental	51.92	96.63	44.71	86.11	254.64	158.01	163.52	254.91	0.27	0.10
5.	Defence (Army Cant)	1,969.00	1,969.00	00.00	00.00	1,969.00	00.00	00.00	2,178.35	209.35	10.63
6.	Recreational	54.19	18.06	-36.13	-66.67	115.05	96.99	537.04	77.05	-38.00	-33.03
7.	Public and Semi- Public	105.22	149.69	44.47	42.26	600.15	450.46	300.93	1,104.48	504.33	84.03
8.	Transportation	127.73	147.95	20.22	15.83	270.52	122.57	82.84	436.18	165.66	61.23
Developed Land		**2,724.22**	**3,063.98**	**339.76**	**12.47**	**5,628.77**	**2,564.79**	**73.75**	**7,036.95**	**1,408.18**	**25.01**
9.	Water Body	43.40	41.07	-2.33	-5.37	49.39	8.32	20.25	48.32	-1.07	-2.17
10.	Hills	62.54	62.54	00.00	00.00	159.56	97.02	155.13	159.56	00.00	00.00
11.	Open Space and Cultivated area	2,121.66	1,784.23	-337.43	-15.90	11,112.28	9,328.05	522.80	9,705.17	-1,407.11	-12.66
Undeveloped Land		**2,227.60**	**1,887.84**	**-339.82**	**-15.25**	**11,321.23**	**9,433.39**	**499.69**	**9,913.05**	**-1,408.18**	**-12.43**
Total Area		**4,951.82**	**4,951.82**	**00.00**	**00.00**	**16,950.00**	**11,998.18**	**242.30**	**16,950.00**	**00.00**	**00.00**

Source: Based on (●) Jhansi Master Plan, 2001, Town and Country Planning Department, UP, 1979; (●) Jhansi Master Plan, 2021, Town and Country Planning Department, UP and Jhansi Development Authority, 2003;(●) Land Use Map of Jhansi Urban Area, Town Directory Uttar Pradesh, Census of India, 1991;(●) Land Use Map of Jhansi city, Town and Country Planning Department, Uttar Pradesh, 2000 and (●) Google Image updated 2012 and field check, 2013.

cent and female literacy slightly low, 77.2 per cent (Census, 2011).

Objectives

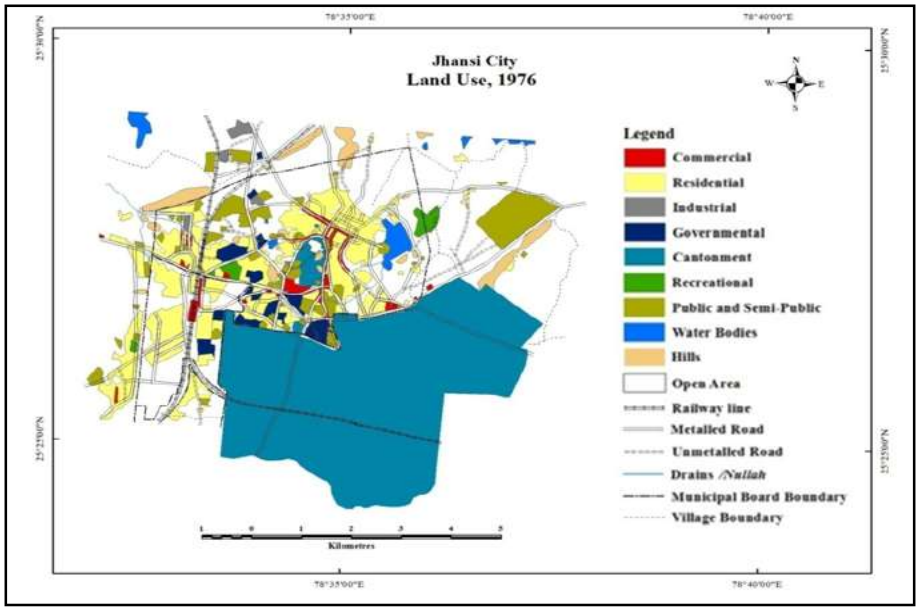
. To find out the area under different land uses of Jhansi city in terms of spatial pattern.

. To study the temporal change (dynamics) in land use of entire urban space.

. To describe and explain that processes are underlying to change.

Database and Methodology

The data on urban land uses are collected from different primary and secondary sources. The secondary sources of data are land use maps and master plans from Town and Country Planning Department and Jhansi Development Authority and Town Directory, U.P., municipal publications, census reports, and other published and unpublished literature. The primary work is mainly related to field check and enquiry of urban land use for the preparation and interpretation of current land use map which is based on Google image updated in 2012.



Source: Based on Town and Country Planning Department, Uttar Pradesh, 1979

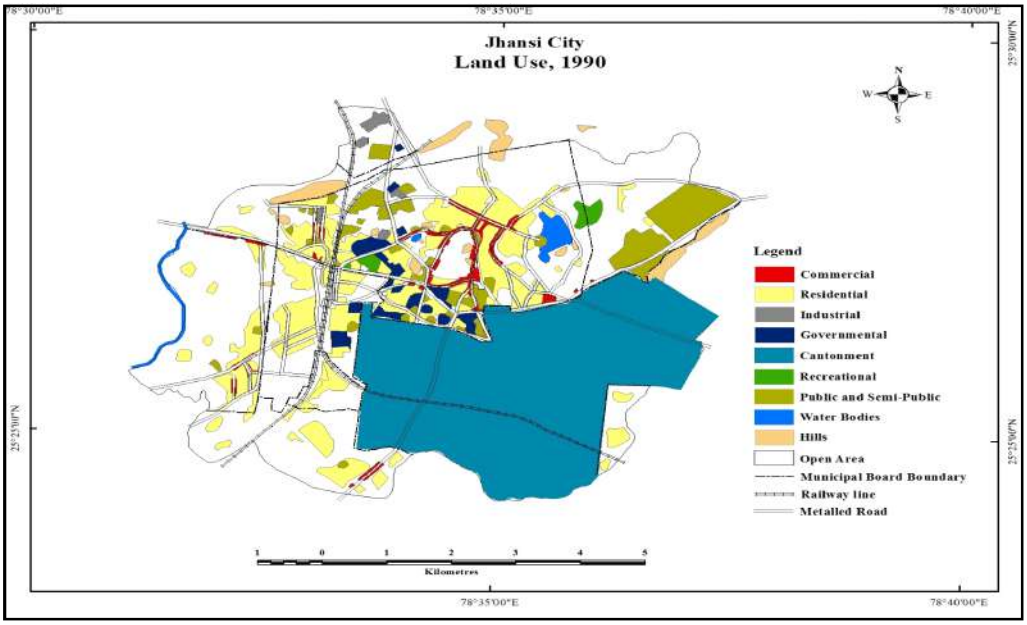
Fig. 1

The demarcation of various urban land uses on Google earth image has been done carefully with the field check. The geo-referencing of land use maps of Jhansi city made by GIS technique with the help of topographical maps 54 K/10 and 54K/11. Digitization and area calculation of various uses of land made by the drawing of polygons on geo-referenced maps of the years 1976, 1990, 2000 and Google earth image 2012 is completed by the Arc GIS 10.1, an improved version of software. Tabulation of data and drafting of the paper are completed on MS office 2007.

Land Use Pattern

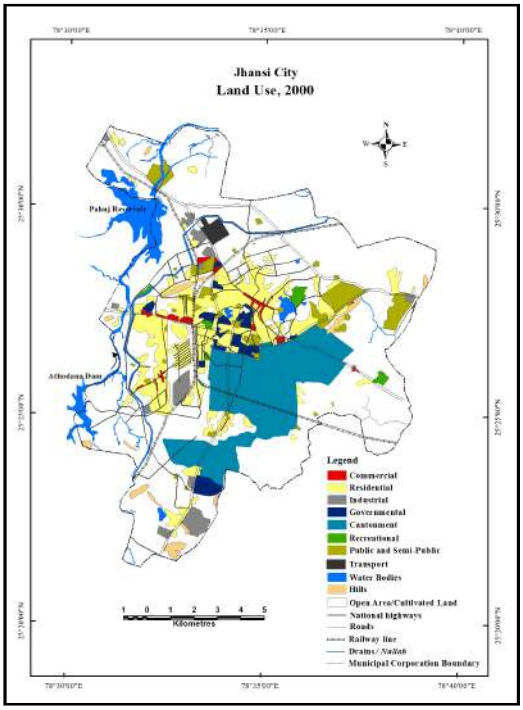
Table1shows the of urban land use of Jhansi city and its rate of growth between four point of time, i.e., 1976, 1990, 2000 and 2013. The land use of Jhansi is the product of interaction of socio-cultural and economic attributes with physical environment which are classified, analysed and described as follows.

The land use pattern of the city reflects that 41.52 per cent of land is developed, i.e., 7,036.95 ha. The highest proportion of land is occupied by



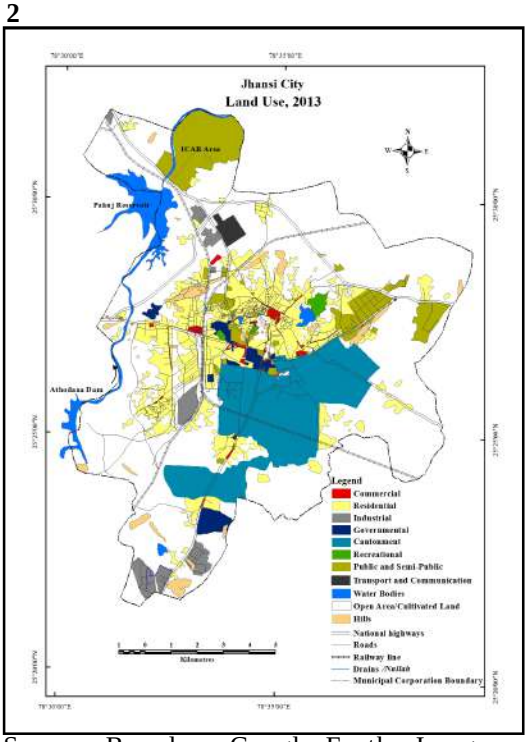
Source: Based on Town Directory of Uttar Pradesh, Census of India, 1991

Fig. 2



Source: Based on Town and Country Planning Department, Uttar Pradesh, 2000

Fig. 3



Source: Based on Google Earth Image as Updated 2012 and Field Checks 2013

Fig. 4

the residential area that is 14.69 per cent to the total area and 35.40 per cent to the developed land. 'Residential areas play most important part both quantitatively and qualitatively in the morphology and sustenance of the city. They provide shelter and living accommodation to its inhabitants' (Taneja, 1968, p.185). 'The residential area of Jhansi city consisted of developed, semi-developed and rural areas. The developed areas are known as constructed areas which include entire walled city, Civil line, Pulia No.9, Nagra, Khusipura, Talpura and encompass more than 80 per cent infrastructural facilities' (Master Plan 2021, p.39). The residential areas of Jhansi are classified as residential areas inside the city wall, residential areas outside the city wall, planned residential areas, rural localities and slums. It is followed by Army cant which is 12.85 per cent to the total area and 30.95 per cent to the developed land. The cantonment of Jhansi is located in south of the main city but presently it comes under the limit of municipal corporation with the addition of surrounding fifteen villages while civil line is located between main city and the cantonment. Both of which have became part of the city that bear the legacy of British rule. Establishments of cantonment, civil line and railway station attract the development to southward. The 1,104.48 ha of land lies under the public and semi-public use which has also a good proportion of land that is 6.52 per cent to the total area and 15.70 per cent to the developed land. The land developed under this category has third largest proportion of area after residential and defence. This use refers to the use of land under education, health, electricity, water supply, religious, cultural institutions as well as other public uses such as funeral ghats, graveyards, kabristan, etc. The public institutions are developed in entire urban area but most of them are developed in civil line because of the offices of district and division and local body governance are located here that attract various developments of public land uses. The transportation occupies 436.18 ha which contributes 2.57 per cent to the total area while 6.20 per cent to the developed land. Transportation is an important function of the city because it is located at the centre of north-south and east-west corridors and it is also a junction of railways, all the trains joining to the north and south of the country pass from Jhansi and a line joins to Manikpur-Allahabad and another line joins to Kanpur-Lucknow. The city's traffic structure is made of four national highways (NH-25, 26, 75 and 76), some regional roads and the local circulatory system that connect all parts and places of the city. Industries occupied 373.42 ha that is 2.20 per cent and 5.31 per cent to the total and developed area, respectively that lie in outskirts of the city, especially in the south and north-west parts. The existing industrial landscape of Jhansi is characterised by varieties of small scale industries and a few of them are medium and large scale industries. There is lack of any specialisation of industrial structure in Jhansi. The industries of the city belong to ayurvedic medicine, electric transformers AC and DC, furniture, agricultural implements, plastic goods, utensils, dye, soap and bidi. Apart from above, an important industrial function and workshop is located in form of rail wagon overhaul and repairing unit. Governmental land covers an area of 254.91ha which is 1.5 per cent of the total area and 3.62 per cent of the developed land. The city serves as headquarters of district and divisional administration. Some of the offices assume status of regional and national importance. The administrative set-up of Jhansi city has long been in practice since the rulers of Bundelas and Marathas while present administrative status of Jhansi is the legacy of British rule. Jhansi became Superintendency in1854 after the death of Raja Gangadhar Rao, 1953. The commercial function occupies 121.61 ha which contributed 0.72 per cent to the total and 1.73 per cent to the developed area. The major concentration of retail commercial use of land lies in the walled city due to historical base of its development that includes Manik chowk, Bada bazar, Hardy ganj, Taksal, Sarafa bazar, Sweet bazar, Gandhi Tapra, Bisati bazar, Hingan katra, Khatrayana, Purani bazariya, Rai ke Tazia and Tilyani bazariya that constitute central commercial area (CCA) of the city. The two other retail markets are developed outside the wall at considerable distance, i.e., Sipri bazar and

Sadar bazar. The wholesale markets (mandis) are developed along the NH25 due to the requirement of larger space and transportation facility while other neighbourhood shopping centres developed in residential areas to fulfil daily needs of the local people. The recreational (parks and playgrounds) land comes under marginal area that covered only 77.05 ha and constituted 0.45 per cent to the total area and 1.09 per cent to the developed area. Rapid growth of construction activities, lack of planning and maintenance led to shrinkage of recreational land use. Some of the parks were developed in different neighbourhood under the urban planning policy and the suggestions of master plan.

Town and Country Planning Department, Uttar Pradesh conducted the land use survey of Jhansi city in 1975-76 and recorded the total area of municipal board as 4,951.82 ha (including army cantonment 1,969 ha) that is grown up to 16,950 ha in 2002 with the addition of fifteen surrounding villages in municipal corporation.

The data of urban land uses of the city (1976) show that the highest percentage of developed land comes under residential area (7.81%). It is followed by 2.58 per cent area under transportation, 2.12 per cent under public and semi-public uses, 1.09 per cent for recreational, 1.05 per cent governmental, 0.4 per cent commercial and 0.20 per cent industrial uses. Above calculation of developed land includes the area of army cantonment, i.e., 72.27 per cent to the total developed land of the city. The most of the area of cantonment is covered by residential units which is due to the fact that urban centre is the base for a variety of functions which provide employment in service sector and facilities to people. Area under industrial use has very low proportion of urban land because most of the industries were established beyond the former municipal limit. The land under transportation (127.73 ha) shows better base of transport facility as roads and highways connect Jhansi city with various important cities of the country. The railway junction and its tracks also cover a significant proportion of city's land under transport system. The public and semi-public land cover an area of 105.22 ha as city has developed as an important centre of academic and medical institutions in the area. The 51.92 ha land was developed under the governmental use as the city is the headquarters of the Jhansi district and the Jhansi division including local body governance and some the national level offices. The undeveloped land included 44.99 per cent to the total area wherein vegetables and flowers, and fruits are grown in small pockets especially in outer area of the city. Hills and water bodies are topographical features of the city that cover an area of 105.94 ha and play a vital role in the spatial expansion and development of urban functions and shaping the internal structure and layout of the city.

Urban Land Use Dynamics

The geographic understanding of land use change in urban areas is an important aspect for planning. Analyzing a temporal database for spatial patterns, rates of change, and trends that can provide better insight into the fact how cities have developed under varying social, economic, and environmental conditions. 'Urban land use change, as a comprehensive reflection of the space distribution and structure adjustment in the process of urban development is closely related, directly or indirectly with the change of the urban population, environment and the development of social economy' (Jing, et al. 2004). 'Urban land use is dynamic; its continuous state of flux is the result, chiefly, of alterations in socio-economic conditions and their accommodation. Cities also react to changes in their hinterlands, especially changes in emphasis within agriculture and primary resource exploitation' (Mannion, 2002 pp.1-2). The urban land use of Jhansi slightly changed with further development under various categories of land uses and its percentage of developed land which has increased 339.76 ha from 1976 to 1990 that shows the rate of growth as 12.47%. Each category of land use show different rates of growth such as the highest growth rate (273.42%) was marked in the commercial land use that was followed by 86 per cent in governmental, 55.22 per cent in residential, 42.26 per cent in public and semi public, 15.83 per cent in transportation while

recreational land has been considerably reduced, i.e., -66.67 per cent. The business and commercial activities have rapidly increased as the city emerged as a better market in the region with the enhancement of wholesale and retail business, and other related institutions like hotels, guest houses, banks, petrol filling/ service stations, warehouses, etc. The area under governmental use also increased with the establishment of new administrative departments and construction of buildings for official purpose. The growth rate of residential area follows the commercial and governmental that is having higher proportion of land (12.13%) of the city. The city is marked as an important nodal point of transport network. The construction of roads and growth of other transport facilities also took place. The invasions of recreational land by other urban functions against the proposal have been marked in this period of time. The area under water body got reduced more than 5 per cent due to the encroachment as constructions. The open area of the city was reduced 15.9 per cent with the development of land under other urban uses.

The scenario of land use change from 1990 to 2000 was quite different as area of municipal corporation has been included to the calculation of urban land use in 2000. The highest (2,473.67%) rate of growth was marked under industrial land during the period because majority of industrial units were developed in Bijauli and Naya gaon, beyond the former limit of municipality. It is followed by residential area with the growth rate of 237.72 per cent as many residential areas defined as outgrowths beyond the limit of municipal board such as Lahar gird, Naya gaon, MRLB medical college and Bundelkhand university, Hansari gird and Bhatta gaon. The outgrowths are characterised as urban residential units with the establishment of industries, education and medical institutions. Apart from outgrowths fifteen peripheral villages also came within the limits of municipal corporation. The expanse of recreational land increased as the Narayan bagh (33 ha) came under the municipal corporation. The area under government land has also increased due to the fact of PAC at Rajgarh came within the limits of municipal corporation. The public and semi-public area increased (300.93%) because of the development of public institutions such as MRLB medical college (117.4 ha), Bundelkhand university (75.34 ha), ITI and Polytechnic (41.3 ha). Besides, Bundelkhand Institute of Engineering and Technology and the Indian Grassland and Fodder Research Institute also came within the municipal limit. The area under transportation has also increased 82.84 per cent with the addition of length of highways and other roads of municipal corporation and area of workshop of UPSRTC. Thus, overall the developed land has increased by 73.75 per cent and the open area also increased to 9,328.05 ha that shows high rate of growth 522.80 per cent which may be attributed to addition of more land expanding in surrounding 15 villages. The area under hills and the area of water bodies also increased substantially due to Pahuj dam.

The growth of developed land in the municipal corporation was unexpected, i.e., 1,408.18 ha (25.01%) during the last 13 year from 2000 to 2013. This phenomena may be due to increase of land under the public and semi public use especially the addition of farm lands to IGFRI (450.42 ha) and NRCAF (106.46 ha), respectively. This was in addition to earlier built-up area of 38 ha only. The construction of paramedical institute also occupied a significant space in the north of medical college. The area under residential use has increased to 402.10 ha with the boom of planned colonies and unplanned urban sprawl. The 126.09 ha of land was added to industrial area, especially for proper development of growth centre in Bijauli. The 165.66 ha of land has been added under transportation network due to widening of national highways and construction of bypasses, roads and other approach roads. The 209.35 ha of land has been increased in army cantonment but it reported area is 1,969 ha. This difference may be due to the calculation of area by Arc GIS 10.1 on the basis of geo- referenced map. The area of recreational land has reduced by 38 ha within the 13 years due to the constructions and encroachments. During the above short span of time, 38.39 ha of land got increased under commercial functions with the addition of

neighbourhood shopping centres of different localities and other commercial establishments such as commercial buildings by local body. The continuous reduction of open area reflects fast construction process of development in urban area.

Conclusion and Suggestions

The development in the built-up area is quit uneven due to historical process of development and the establishment of administrative set-up and other institutions and industrial units. The four points of time, i.e., 1976, 1990, 2000 and 2013 have been selected for the study of changing scenario of land use of Jhansi city. The rapid changes took place in the outer zone with the expansion and sprawl of residential areas and other urban functions, especially along the highways and other roads. It happens due to accelerating population growth and their increasing demand. The land use pattern of Jhansi city reflects that 7,036.95 ha land is developed, i.e. 41.52 per cent to the total area. The growth rate in municipal area from 1976-2013 is 242.29 per cent while the growth rate in developed area during the period is 158.31 per cent. The highest rate of growth is marked as 3,668.11 per cent under the industrial land use due to the industries were established outside the former municipal limit. Most of the industrial units of UPSIDC are closed and it followed by cotton spinning mill that is the cause of poor industrial base of the city. The area under public and semi-public use has considerably grown, i.e., 999.26 ha with the establishment of various academic, medical, research and training institutions. The area under administrative use has also increased from 51.92 ha to 254.91 ha with the inclusion of PAC area in the municipal limit.

It is important to plan and control the rapid urbanisation process in a systematic manner that would maintain the environment within the city and surrounding region. The proper implementation of master plan 2021 is required for sustainable development of the city and check improper development of land uses under various urban functions. It is essential to discourage the growth of mix land use and encroachment process.

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Regional Variations in the Application of Modern Farm Implements in Devi Patan Plain, Uttar Pradesh

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Abstract

Agriculture includes cultivation of the soil, growing and harvesting crops, breeding and raising livestock, dairying and forestry. Agriculture in India is backward with low level of productivity. Compared with the developed nations of the world, there is a huge difference in the level of our agricultural productivity. The reason for this lies in the farm mechanisation and the choice of technology. Farm Mechanization provides the technology to facilitate agricultural growth through efficient utilization of inputs. Adoption of mechanization ensures timeliness of agricultural operations, reduces cost of production as well as reduces drudgery in carrying out various agricultural operations. At the time of independence in 1947, Indian agriculture used mostly bullock drawn ploughs, wooden peg tooth harrows, wooden planks for pulverisation compaction and smoothening, bullock carts, and hand tools. Food security eluded India for two decades, food imports at times being the largest import bill of the country. India witnessed Green Revolution in 1967-68 and subsequently White Revolution, Blue Revolution and Yellow Revolution, achieving quantum jumps in production and productivity in food grains, milk, fishery, and oilseeds, respectively. In India, though, there has been a considerable progress of mechanization in agriculture; its spread has, however, been most uneven.

The result shows that there are huge variations in the application of modern farm implements in all the blocks of Devi Patan plain. The plain of Devi Patan includes the districts of Bahraich, Gonda, Balrampur, And Shrawasti districts.

Key words: Agriculture, Productivity, Farm mechanization, Green revolution and Implements.

Introduction

The term mechanisation refers to the introduction of tools, implements and machines which substitute human and non human labour. In short, the term mechanisation covers a wide range of machines and appliances which can be used from ploughing to harvesting (Mukherjee & Chakrabarti, 2000) Modern agriculture depends heavily on engineering and technology and on the biological and physical sciences. Mechanisation – the outstanding characteristic of late 19th and 20th century has eased much of the backbreaking toil of the farmer. More significantly, mechanisation has enormously increased farm efficiency and productivity. (Kumar, 2001)

Agricultural Mechanization directly affects the production of food crops which in turn affect the food security and sustainability of a nation. (Tabrez, Z. 2015). Agricultural mechanization helps in increasing production, productivity and profitability in agriculture by achieving timeliness in farm operations, bringing precision in metering and placement of inputs, reducing available input losses, increasing utilization efficiency of costly inputs (seed, chemical, fertilizer, irrigation, water etc.), reducing unit cost of produce, enhancing profitability and competitiveness in the cost of operation. It also helps in the conservation of the

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produce and by products from qualitative and quantitative damages; enables value addition and establishment of agro processing enterprises for additional income and employment generation from farm produce. It is one of the important inputs to usher in all round development in the rural India. With the advent of agricultural mechanization and use of modern machineries viz. advance harrow and cultivator, advance thresher machine, sprayers, advance sowing instrument, tractor and application of agricultural inputs like high yielding varieties of seeds, chemical fertilizers, better irrigation facilities, insecticides and pesticides have increased the agricultural production to a great extent. (Tabrez, Z., and Khan, N. 2014).

Farm mechanization is regarded as *sine-qua-non* to reduce the human drudgery and enhance the agricultural productivity. During the post-green revolution period, the impact of farm mechanization on agricultural production and productivity has been well recognised in India. Depending upon the use of other inputs such as irrigation, high yielding seed varieties, chemical fertilizers, herbicides and pesticides, different States in India have attained different levels of mechanization. Consequently the agricultural production & productivity has witnessed three to four fold increases. (Verma, 2000). Studies have been conducted by various organisations & individuals which have highlighted the impact of agricultural mechanization on farm production and productivity. It is generally believed that the benefits of modern farm technology have been availed of only by large farmers. The fact, however, is that even small farmers utilize selected farm equipment for efficient farm operations through custom hiring. (Sharma, 2000) Mechanization of agriculture should not only be guided by the goal of higher returns to the farmers and to the Industry, but also by its contribution to the balanced agricultural development of the different regions / areas having diverse socio-economic and agro-climatic conditions. Farm mechanization has been helpful to bring about a significant improvement in agricultural productivity. Thus, there is strong need for mechanization of agricultural operations. The factors that justify the strengthening of farm mechanization in the country can be numerous. The timeliness of operations has assumed greater significant in obtaining optimal yields from different crops, which has been possible by way of mechanization. (Joginder Singh, 2000). But with the commercialisation of farming switching over from biological to mechanical energy was realised as an imperative requirement. (Jain, Ohri & Majhi, 2010)

Agricultural Mechanization is not well developed in Western Trans-Ghaghara (Devi Patan) plain, Uttar Pradesh. The result obtained with the application of statistical technique shows that in all the 44 blocks of Devi Patan plain, there is a huge spatial variation in the use of Agricultural Machines in the field in different blocks of the Study Area.

Objectives

- To observe the level of mechanization of agriculture in different parts of the study area.
- To find out the Spatial Variations in Agricultural Mechanization in different Blocks of the Study Area.
- To investigate and understand the temporal change among the different blocks of study area.

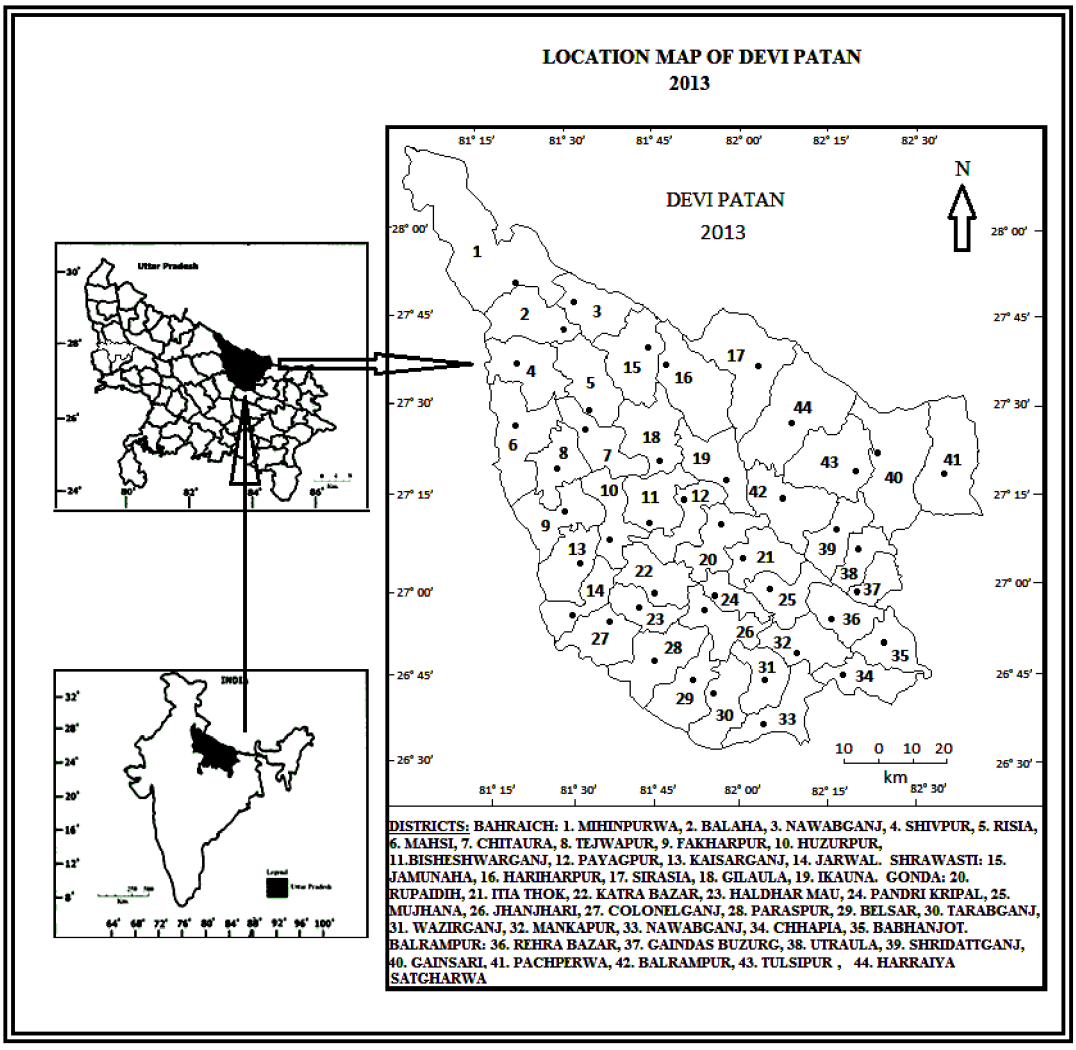
Database and Methodology

The Study is based on the Secondary Sources of data. Broadly, the machineries which were used to find out the Spatial Variations in the Level of Mechanization in the different blocks of the Study Area are Wooden plough, Iron plough, Sowing instrument, Thresher machine, Sprayer, Tractor, Harrows & Cultivators, and Tube Wells. The data of total Agricultural implements, block wise machineries in the study area to calculate the total block wise distribution of total Agricultural implements, and decadal growth have been obtained from the Statistical bulletin and Statistical offices of the districts (Study Area) Bahraich, Balrampur, Gonda and Shrawasti. To find out the number of different agricultural implements, per hundred hectares of Net Sown Area (NSA), and to show the spatial variations among the blocks in Devi-Patan plain, the researcher has used different statistical

techniques as well as GIS Arc view 3.2 to depict it in different maps.

The Study Area

In 2011 India has 121, 01, 93,422 people, out of which Uttar Pradesh has 19, 95, 81,477 people living in 71 districts. The sex-ratio of Devi Patan plain is about 902. The average literacy rate of Devi Patan plain is 53.28 percent, which is much below than the average literacy rate of Uttar Pradesh which is 67.68 percent. In terms of male and female literacy rates of Devi Patan Plain it is 63.41percent and 41.97 percent respectively. In terms of district wise sex-ratio of Devi Patan plain, it is 922 in both Gonda and Balrampur,



Source: District Gazetteer Handbook of Uttar Pradesh: 1991

Fig. 1

891 in Bahraich, and 875 in Shrawasti. The district wise literacy rate of Devi Patan plain is 61.16 percent in Gonda, 51.76 percent in Balrampur, 51.10 percent in Bahraich, and 49.13 percent in Shrawasti. Shrawasti is the most backward district of Devi Patan plain in terms of sex-ratio, literacy, male-female literacy differentials, and so on. The total geographical area of Devi Patan is 14,229 Sq.km.

Results and Discussions

The result obtained with the help of analyzing the data and mathematical calculations reveals that there are variations among the blocks in terms of application of various agricultural implements. In terms of wooden plough per hundred hectare of Net Sown Area (NSA) in 1997, there is a great variation among the blocks. Table. 1 shows that there are nine (9) blocks which comes under the category of very high group namely Bisheshwarganj, Hariharpur, Sirasia, Pandri Kripal, Rehra Bazar, Utraula, Shridattganj, Balrampur and Harraiya Satgharwa, where Rehra Bazar is highest at 103.41. The range of the blocks which comes under the category of high is 45-55, where 10 blocks comes under this category and their shares are 54.83 in Tejwapur block, 46.42 in Payagpur, 54.15 in Gilaula, 54.57 in Itia Thok, 47.63 in Haldhar Mau, 46.50 in Mujhana, 45.79 in Jhanjhari, 51.24 in Wazirganj, 49.0 in Nawabganj, and 49.59 in Pachperwa blocks. The blocks of medium group are comparatively less in numbers than the very high and high group. There are eight (8) blocks which comes under the medium group namely Mihinpurwa 44.54, Chitaura 40.82, Jamunaha 44.49, Katra Bazar 36.61, Tarabganj 40.23, Chhapia 38.97, Gainsari 38.49 and Tulsipur 40.53. The range of wooden plough per hundred hectare of Net Sown Area (NSA) is 25-35 in the low category in which ten (10) blocks lies namely Balaha, Mahsi, Fakharpur, Rupaidih, Colonelganj, Paraspur, Belsar, Mankapur, Babhanjot and Gaindas Buzurg blocks. In comparison to all the categories, the very low category of blocks constitutes only seven (7) blocks, namely Nawabganj, Shivpur, Risia, Huzurpur, Kaisarganj, Jarwal and Ikauna blocks, where Huzurpur is lowest at 3.95.

Table 1: Wooden Plough/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	9	> 55	Bisheshwarganj, Hariharpur, Sirasia, Pandri Kripal, Rehra Bazar, Utraula, Shridattganj, Balrampur, Harraiya Satgharwa
High	10	45-55	Tejwapur, Payagpur, Gilaula, Itia Thok, Haldhar Mau, Mujhana, Jhanjhari, Wazirganj, Nawabganj, Pachperwa
Medium	8	35-45	Mihinpurwa, Chitaura, Jamunaha, Katra Bazar, Tarabganj, Chhapia, Gainsari, Tulsipur
Low	10	25-35	Balaha, Mahsi, Fakharpur, Rupaidih, Colonelganj, Paraspur, Belsar, Mankapur, Babhanjot, Gaindas Buzurg,
Very Low	7	< 25	Nawabganj, Shivpur, Risia, Huzurpur, Kaisarganj, Jarwal, Ikauna

In terms of wooden plough per hundred hectare of Net Sown Area (NSA) in the year 2007. Table. 2 shows that there are nine (9) blocks which comes under the category of very high are Jamunaha 77.44, Hariharpur 40.97, Gilaula 53.62, Ikauna 51.55, Jhanjhari 37.58, Mankapur 36.76, Chhapia 43.37, Rehra Bazar 45.61 and Harraiya Satgharwa 39.26. The category of high group ranges between 30-35 in six (6) blocks of the study area. The blocks in this category incorporates Kaisarganj, Itia Thok, Pandri Kripal, Wazirganj, Babhanjot and Balrampur block. The medium category includes the blocks which ranges between 25-30, and like the high group it also incorporates

six (6) blocks i.e. Nawabganj 28.83, Sirasia 28.19, Rupaidih 29.14, Utraula 28.05, Shridattganj 27.95 and Pachperwa 28.88. Unlike the other category the low category has the largest number of 12 blocks of the study area. The blocks under this group are Balaha 23.08, Risia 20.98, Mahsi 23.71, Chitaura 22.13, Tejwapur 23.32, Bisheshwarganj 20.91, Jarwal 24.44, Haldhar Mau 20.66, Colonelganj 22.71, Nawabganj 22.50, Gainsari 20.99 and Tulsipur 22.13. Except low category group, the very low category has more number of blocks than the other groups. The lowest value of this group is found at Huzurpur block where it is only 12.52. The other blocks of this group are Mihinpurwa 15.90, Shivpur 15.44, Fakharpur 17.56, Payagpur 18.13, Katra Bazar 18.88, Mujhana 19.36, Paraspur 17.06, Belsar 18.78, Tarabganj 17.30, and Gaindas Buzurg 13.90.

Table 2: Wooden Plough/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	9	> 35	Jamunaha, Hariharpur, Gilaula, Ikauna, Jhanjhari, Mankapur, Chhapia, Rehra Bazar, Harraiya Satgharwa
High	6	30-35	Kaisarganj, Itia Thok, Pandri Kripal, Wazirganj, Babhanjot, Balrampur
Medium	6	25-30	Nawabganj, Sirasia, Rupaidih, Utraula, Shridattganj, Pachperwa
Low	12	20-25	Balaha, Risia, Mahsi, Chitaura, Tejwapur, Bisheshwarganj, Jarwal, Haldhar Mau, Colonelganj, Nawabganj, Gainsari, Tulsipur
Very Low	11	< 20	Mihinpurwa, Shivpur, Fakharpur, Huzurpur, Payagpur, Katra Bazar, Mujhana, Paraspur, Belsar, Tarabganj, Gaindas Buzurg,

In terms of use of iron plough per hundred hectare of Net Sown Area (NSA) in the year 1997, there are variations among the different blocks in the study area. Table. 3 explains that there are five (5) blocks which comes under very high category such as Mihinpurwa 44.22, Balaha 34.21, Shivpur 39.04, Tejwapur 31.46 and Hariharpur 41.98. The blocks of high category ranges between 25 and 30, Payagpur block is highest at 29.42. The other blocks of this category are Huzurpur 26.79, Kaisarganj 27.72, Jarwal 26.83, Jamunaha 26.84, Gilaula 26.36, Pandri Kripal 28.06 and Babhanjot 28.04. There are six (6) blocks which comes under the medium category and their range varies between 20-25. Nawabganj contributes the highest at 24.80. The remaining five (5) blocks of this category are Sirasia 22.30, Haldhar Mau 21.68, Mankapur 20.20, Chhapia 22.65 and Utraula 24.59. Except very low category, the low category has more number of blocks than the other categories. Their range varies between 15 and 20, 12 blocks lies in this group namely Mahsi, Chitaura, Fakharpur, Jhanjhari, Colonelganj, Wazirganj, Rehra Bazar, Gaindas Buzurg, Shridattganj, Gainsari, Balrampur and Harraiya Satgharwa. The very low category has the maximum number of 13 blocks in the study area. Ikauna block is the lowest in this category and stands at 4.12. The other blocks are Risia 12.05, Bisheshwarganj 12.93, Rupaidih 11.94, Itia Thok 14.28, Katra Bazar 12.45, Mujhana 13.97, Paraspur 11.0, Belsar 11.0, Tarabganj 10.88, Nawabganj 12.23, Pachperwa 14.95 and Tulsipur 11.48.

Table 3: Iron Plough/100 Hectare NSA1997

Category	Number of Blocks	Value	Name of Blocks
Very High	5	> 30	Mihinpurwa, Balaha, Shivpur, Tejwapur, Hariharpur
High	8	25-30	Huzurpur, Payagpur, Kaisarganj, Jarwal, Jamunaha, Gilaula, Pandri Kripal, Babhanjot
Medium	6	20-25	Nawabganj, Sirasia, Haldhar Mau, Mankapur, Chhapia, Utraula
Low	12	15-20	Mahsi, Chitaura, Fakharpur, Jhanjhari, Colonelganj, Wazirganj, Rehra Bazar, Gaindas Buzurg, Shridattganj, Gainsari, Balrampur, Harraiya Satgharwa
Very Low	13	< 15	Risia, Bisheshwarganj, Ikauna, Rupaidih, Itia thok, Katra Bazar, Mujhana, Paraspur, Belsar, Tarabganj, Nawabganj, Pachperwa, Tulsipur

There are huge variations among the blocks in the study area in terms of iron plough per hundred hectares of Net Sown Area (NSA) in the year 2007. Table. 4 shows that 12 blocks are included under the category of very high group in which Jamunaha block is highest at 54.40. The other blocks are Balaha 31.97, Nawabganj 44.42, Risia 30.67, Mahsi 35.82, Chitaura 31.42, Tejwapur 35.11, Bisheshwarganj 27.98, Kaisarganj 47.43, Jarwal 34.80, Hariharpur 42.30 and Gilaula 40.86. The blocks under high category ranges between 20 and 25. There are only four (4) blocks which comes under this category namely Shivpur, Fakharpur, Payagpur and Sirasia. Mihinpurwa and Huzurpur are the only blocks which come under the medium category group. The share of Mihinpurwa is 18.68 and that of Huzurpur is 19.79. The range of blocks of low category is 10-15, which is lowest in Pandri Kripal at 10.04. Apart from that the other blocks under this category are Jhanjhari 11.80, Wazirganj 10.78, Mankapur 11.55, Chhapia 13.66 and Babhanjot 10.49. The very low category accounts for 20 blocks in the study area, which is highest among all the groups. Ikauna block is the lowest in this group which contributes only 4.62 iron plough per hundred hectare of Net Sown Area (NSA). The other blocks of this group are Rupaidih which is 9.12, Itia Thok

Table 4: Iron Plough/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	12	> 25	Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Bisheshwarganj, Kaisarganj, Jarwal, Jamunaha, Hariharpur, Gilaula,
High	4	20-25	Shivpur, Fakharpur, Payagpur, Sirasia
Medium	2	15-20	Mihinpurwa, Huzurpur
Low	6	10-15	Pandri Kripal, Jhanjhari, Wazirganj, Mankapur, Chhapia, Babhanjot
Very Low	20	< 10	Ikauna, Rupaidih, Itia thok, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Paraspur, Belsar, Tarabganj, Nawabganj, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj, Gainsari, Pachperwa, Balrampur, Tulsipur, Harraiya Satgharwa

9.43, Katra Bazar 5.93, Haldhar Mau 6.49, Mujhana 6.07, Colonelganj 7.13, Paraspur 5.36, Belsar 5.97, Tarabganj 5.42, Nawabganj 7.07, Rehra Bazar 5.81, Gaindas Buzurg 7.15, Utraula 9.77, Shridattganj 7.62, Gainsari 8.74, Pachperwa 7.25, Balrampur 7.27, Tulsipur 5.22 and Harraiya Satgharwa 7.96.

Table 5: Harrow & Cultivator/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	6	> 16	Mihinpurwa, Balaha, Fakharpur, Pandri Kripal, Balrampur, Tulsipur
High	6	12-16	Shivpur, Risia, Tejwapur, Huzurpur, Kaisarganj, Jarwal
Medium	6	8-12	Payagpur, Jamunaha, Gilaula, Itia thok, Mujhana, Jhanjhari,
Low	18	4-8	Nawabganj, Mahsi, Chitaura, Bisheshwarganj, Hariharpur, Rupaidih, Belsar, Tarabganj, Wazirganj, Mankapur, Nawabganj, Chhapia, Babhanjot, Gaindas Buzurg, Utraula, Shridattganj, Pachperwa, Harraiya Satgharwa
Very Low	8	< 4	Sirasia, Ikauna, Katra Bazar, Haldhar Mau, Colonelganj, Paraspur, Rehra Bazar, Gainsari,

In terms of harrows and cultivators per hundred hectare of Net Sown Area (NSA), there are more variations among the blocks. Table. 5 clearly shows that in 1997 there are six (6) blocks which comes under the very high category namely Mihinpurwa, Balaha, Fakharpur, Pandri Kripal, Balrampur and Tulsipur, and their shares in the study area are 23.55, 24.17, 17.07, 17.31, 17.09 and 18.56. The range of the blocks which comes under the high category ranges between 12 and 16. This category also incorporates six (6) blocks. Shivpur block contributes the highest share in this range which is 14.61. The other blocks under this are Risia, Tejwapur, Huzurpur, Kaisarganj and Jarwal. In terms of total number of blocks in a range or group, the medium category is like the very high and high category which also contributes six (6) blocks under this category which ranges between 8 and 12 in which Payagpur block is highest at 11.21. There are variations among all the remaining five (5) blocks i.e. Jamunaha 9.74, Gilaula 9.50, Itia Thok 10.19, Mujhana 10.34 and Jhanjhari 8.98. The range of blocks under the low category ranges between 4 and 8. This category contributes the maximum number of 18 blocks in the study area. Bisheshwarganj block contributes the highest of 7.99, the other remaining blocks in the study area are Nawabganj 5.17, Mahsi 6.73, Chitaura 6.78, Hariharpur 7.67, Rupaidih 7.97, Belsar 4.09, Tarabganj 4.82, Wazirganj 6.06, Mankapur 5.84, Nawabganj 5.77, Chhapia 7.32, Babhanjot 6.17, Gaindas Buzurg 4.43, Utraula 4.99, Shridattganj 4.24, Pachperwa 7.32 and Harraiya Satgharwa 6.02. The range of blocks which comes under the very low group is below four (4). There are eight (8) blocks which comes under this namely Sirasia, Ikauna, Katra Bazar, Haldhar Mau, Colonelganj, Paraspur, Rehra Bazar and Gainsari.

In terms of harrows and cultivators per hundred hectare of Net Sown Area (NSA), it increased from 9.35 in 1997 to 15.82 in 2007. Table. 6 shows that Jamunaha block is highest at 80.08. The other remaining blocks in the study area which comes under the very high category are Nawabganj 26.17, Kaisarganj 31.14, Hariharpur 31.38 and Gilaula 59.72. The range under this group is more than 25. The range of blocks which comes under the high category ranges between 20 and 25, and in which five (5) blocks lies namely Risia, Mahsi, Chaitaura, Tejwapur and Jarwal block in which Mahsi is highest at 24.71. The concentration of harrow and cultivator per hundred

hectare of Net Sown Area (NSA) which ranges between 15 and 20 is found in nine (9) blocks in the study area. Balaha block is highest at 19.80. The other blocks of this range which are included in the medium category are Shivpur, Fakharpur, Bisheshwarganj, Payagpur, Jhanjhari, Chhapia, Balrampur and Tulsipur. The range of low category ranges between 10 and 15, and it also includes nine (9) blocks namely Mihinpurwa, Huzurpur, Sirasia, Rupaidih, Itia Thok, Pandri Kripal, Wazirganj, Mankapur and Babhanjot. The range of the blocks which comes under the very low category is below 10. There are total 16 blocks which comes under this category. Colonelganj is the highest at 9.30 and lowest is 2.64 which are found in Rehra Bazar.

Table 6: Harrow & Cultivator/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	5	> 25	Nawabganj, Kaisarganj, Jamunaha, Hariharpur, Gilaula
High	5	20-25	Risia, Mahsi, Chitaura, Tejwapur, Jarwal
Medium	9	15-20	Balaha, Shivpur, Fakharpur, Bisheshwarganj, Payagpur, Jhanjhari, Chhapia, Balrampur, Tulsipur
Low	9	10-15	Mihinpurwa, Huzurpur, Sirasia, Rupaidih, Itia thok, Pandri Kripal, Wazirganj, Mankapur, Babhanjot,
Very Low	16	< 10	Ikauna, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Paraspur, Belsar, Tarabganj, Nawabganj, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj, Gainsari, Pachperwa, Harraiya Satgharwa

In terms of number of thresher machine per hundred hectare of Net Sown Area (NSA) in the year 1997 was 5.15 in Devi Patan Plain. Table. 7 shows that there are 12 blocks which comes under the very high category and their range is more than nine (9). The blocks concentrated in this category are Huzurpur, Jarwal, Itia Thok, Pandri Kripal, Mujhana, Jhanjhari, Mankapur, Chhapia, Babhanjot, Rehra Bazar, Utraula and Shridattganj. There are only two (2) blocks namely Kaisarganj and Rupaidih which are concentrated in the high category and their range lies between 7 and 9. In terms of the thresher machine per hundred hectare of Net Sown Area (NSA) they are at 8.87 and 8.15 respectively. The category of medium group also incorporates two (2) blocks and they are at 5.77 and 5.40 in Wazirganj and Gaindas Buzurg blocks. Like the very high category the low category also includes twelve (12) blocks and their range ranges between 3 and 5 per hundred hectare of Net Sown Area (NSA). Pachperwa block is highest at 4.77 in this group of low category. The other blocks in this category are Mihinpurwa 3.38, Fakharpur 3.72, Bisheshwarganj 4.57, Katra Bazar 3.11, Haldhar Mau 4.27, colonelganj 3.75, Belsar 3.30, Tarabganj 3.99, Nawabganj 4.36, Gainsari 3.11 and Balrampur 3.38. The group of very low category includes maximum number of 16 blocks whose range is less than 3. The blocks in this category are Balaha, Nawabganj, Shivpur, Risia, Mahsi, Chitaura, Tejwapur, Payagpur, Jamunaha, Hariharpur, Sirasia, Gilaula, Ikauna, Paraspur, Tulsipur and Harraiya Satgharwa.

In terms of concentration of thresher machine in the study area, there are variations among the blocks. In the year 2007, the concentration of thresher machine was maximum in Chhapia block which is 807, followed by Mankapur and Rupaidih which is 756 and 719 respectively. On the contrary, the lowest concentration was found at Tulsipur which is 118, followed by Gaindas Buzurg 139 and 170 in Ikauna. In terms of number of thresher machine per hundred hectare of Net sown Area (NSA) in the year 2007. Table. 8 shows that

there are only four (4) blocks which are grouped in the category of very high, in which the range is more than 4. Chhapia block is highest at 4.75, followed by Utraula 4.47, Jhanjhari 4.12 and Mankapur 4.03. The category of high group varies between 3-4 thresher machines per hundred hectare of Net sown Area (NSA) in the study area. Six (6) blocks are concentrated in this group namely Kaisarganj, Rupaidih, Itia Thok, Pandri Kripal, Wazirganj and Babhanjot block. In terms of total blocks in a group, the medium category incorporates the maximum of 15 blocks in that group which ranges between 2 and 3. The blocks concentrated in this group are Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Jarwal, Jamunaha, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Belsar, Nawabganj and Shridattganj. The low category blocks ranges between 1 and 2, and there are 13 blocks in the study area which are concentrated in this category. Tarabganj block is highest at 1.94 in the study area. The other blocks under this category are Mihinpurwa 1.20, Shivpur 1.54, Fakharpur 1.74, Huzurpur 1.49, Bisheshwarganj 1.92, Payagpur 1.79, Hariharpur 1.33, Gilaula 1.61, Paraspur 1.87, Rehra Bazar 1.77, Gaindas Buzurg 1.10 and Pachperwa 1.23. The range of the blocks in the very low category is less than 1. Like the high group this group of very low category also includes 6 blocks in the study area. The highest concentration of thresher machine per hundred hectare of Net Sown Area (NSA) in this category is found in Ikauna block which is 0.80. It is followed by Gainsari 0.75, Balrampur 0.74, Harraiya Satgharwa 0.60, Sirasia 0.59 and 0.39 in Tulsipur which is the lowest in this category of very low group.

Table 7: Thresher Machine/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	12	> 9	Huzurpur, Jarwal, Itia thok, Pandri Kripal, Mujhana, Jhanjhari, Mankapur, Chhapia, Babhanjot, Rehra Bazar, Utraula, Shridattganj
High	2	7-9	Kaisarganj, Rupaidih
Medium	2	5-7	Wazirganj, Gaindas Buzurg
Low	12	3-5	Mihinpurwa, Fakharpur, Bisheshwarganj, Katra Bazar, Haldhar Mau, Colonelganj, Belsar, Tarabganj, Nawabganj, Gainsari, Pachperwa, Balrampur
Very Low	16	< 3	Balaha, Nawabganj, Shivpur, Risia, Mahsi, Chitaura, Tejwapur, Payagpur, Jamunaha, Hariharpur, Sirasia, Gilaula, Ikauna, Paraspur, Tulsipur, Harraiya Satgharwa

Table 8: Thresher Machine/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	4	> 4	Jhanjhari, Mankapur, Chhapia, Utraula
High	6	3-4	Kaisarganj, Rupaidih, Itia thok, Pandri Kripal, Wazirganj, Babhanjot,
Medium	15	2-3	Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Jarwal, Jamunaha, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Belsar, Nawabganj, Shridattganj
Low	13	1-2	Mihinpurwa, Shivpur, Fakharpur, Huzurpur, Bisheshwarganj, Payagpur, Hariharpur, Gilaula, Paraspur, Tarabganj, Rehra Bazar, Gaindas Buzurg, Pachperwa
Very Low	6	< 1	Sirasia, Ikauna, Gainsari, Balrampur, Tulsipur, Harraiya Satgharwa

The variations found in the number of sprayers in 1997 was hefty in the study area, where the highest concentration is found in Tejwapur block where it is 2530 sprayers, followed by Chhapia 1392 and Mankapur 1391 sprayers. There is a huge gap between the highest and lowest concentration of sprayers in the study area where the lowest concentration is found in Sirasia where it is only 10, followed by Jamunaha 12 and Ikauna 40. Table. 9 reveals that the range of 9 blocks which comes under the category of very high is more than 4 sprayers per hundred hectare of Net Sown Area (NSA) in the study area, where the concentration of sprayer was found to be highest in Tejwapur block where it is 12.28 followed by Chhapia 9.27, Babhanjot 7.79, Mankapur 7.54, Pandri Kripal 5.95, Nawabganj 5.14, Wazirganj 4.95, Mahsi 4.68 and Tarabganj 4.48. Like the category of very high group, the high group also includes 9 blocks in which the range varies between 3 and 4. The highest number of sprayers per hundred hectares of Net Sown Area (NSA) in the study area is found in Jhanjhari where it is 3.80 and lowest in Shivpur where it is 3.10. The other remaining blocks are Balaha, Fakharpur, Jarwal, Itia Thok, Haldhar Mau, Mujhana and Colonelganj. Four blocks namely Rupaidih, Katra Bazar, Paraspur and Belsar ranges between 2 and 3 sprayers per hundred hectares of Net Sown Area (NSA) is found in the study area where Rupaidih is highest at 2.75 and Paraspur is lowest at 2.35 in the medium category group. The value of the low category is found to be maximum at 1.28 in Utraula followed by 1.21 in Shridattganj, 1.20 in Gaindas Buzurg and 1.01 in Rehra Bazar. The range of this category varies between 1 and 2. The rest of the remaining eighteen (18) blocks was found in very low category, where the range is less than 1. The blocks concentrated in the study area in this category are Mihinpurwa, Nawabganj, Risia, Chitaura, Huzurpur, Bisheshwarganj, Payagpur, Kaisarganj, Jamunaha, Hariharpur, Sirasia, Gilaula, Ikauna, Gainsari, Pachperwa, Balrampur, Tulsipur and Harraiya Satgharwa.

Table 9: Sprayer/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	9	> 4	Mahsi, Tejwapur, Pandri Kripal, Tarabganj, Wazirganj, Mankapur, Nawabganj, Chhapia, Babhanjot
High	9	3-4	Balaha, Shivpur, Fakharpur, Jarwal, Itia thok, Haldhar Mau, Mujhana, Jhanjhari, Colonelganj,
Medium	4	2-3	Rupaidih, Katra Bazar, Paraspur, Belsar
Low	4	1-2	Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj
Very Low	18	< 1	Mihinpurwa, Nawabganj, Risia, Chitaura, Huzurpur, Bisheshwarganj, Payagpur, Kaisarganj, Jamunaha, Hariharpur, Sirasia, Gilaula, Ikauna, Gainsari, Pachperwa, Balrampur, Tulsipur, Harraiya Satgharwa

The number of sprayers in Devi Patan Plain reduced from 21674 in 1997 to 5886 in the year 2007. Table. 10 shows that in the year 2007 the concentration of sprayer was found to be maximum in Fakharpur block, where it is 355 sprayers in that block. It is followed by Mihinpurwa 340 and 325 in Chitaura block. On the contrary the concentration of sprayer is minimum in Sirasia where it is only 6, followed by Jamunaha and Ikauna where it is 8 and 20 sprayers respectively.

Fig. 5 shows that in the year 2007 the range of the very high category is more than 1, 11 blocks lies in this category namely Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Fakharpur, Bisheshwarganj, Payagpur, Kaisarganj and Jarwal. The range of the blocks which are concentrated in

the high category ranges between 0.80 – 1.00. Only 2 blocks namely Mihinpurwa and Shivpur falls under this category which varies from 0.87 Sprayer per hundred hectare of Net Sown Area (NSA) in Mihinpurwa block to 0.92 in Shivpur block. In terms of minimum number of blocks in a group, there is only 1 block i.e. Huzurpur which falls in the medium category. The range of the low category varies between 0.40 – 0.60 in the study area. The block of Chhapia contributes the highest of 0.55 sprayers per hundred hectares of Net Sown Area (NSA), it is followed by Jhanjhari 0.48, 0.46 each in Mankapur, Utraula and Shridattganj, 0.44 in Gilaula, 0.43 in Wazirganj and 0.42 in each blocks of Pandri Kripal, Babhanjot and Gaindas Buzurg. The range of group of very low category is less than 0.40, and in terms of block wise total numbers it is maximum of 20 blocks which are concentrated in this category namely Jamunaha, Hariharpur, Sirasia, Ikauna, Rupaidih, Itia Thok, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Paraspur, Belsar, Tarabganj, Nawabganj, Rehra Bazar, Gainsari, Pachperwa, Balrampur, Tulsipur and Harraiya Satgharwa.

Table 10: Sprayer/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	11	> 1	Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Fakharpur, Bisheshwarganj, Payagpur, Kaisarganj, Jarwal,
High	2	0.80-1.00	Mihinpurwa, Shivpur
Medium	1	0.60-0.80	Huzurpur
Low	10	0.40-0.60	Gilaula, Pandri Kripal, Jhanjhari, Wazirganj, Mankapur, Chhapia, Babhanjot, Gaindas Buzurg, Utraula, Shridattganj
Very Low	20	< 0.40	Jamunaha, Hariharpur, Sirasia, Ikauna, Rupaidih, Itia thok, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Paraspur, Belsar,Tarabganj, Nawabganj, Rehra Bazar, Gainsari, Pachperwa, Balrampur, Tulsipur, Harraiya Satgharwa

Table 11: Sowing Instruments/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	3	> 0.45	Risia, Jamunaha, Nawabganj
High	6	0.35-0.45	Balaha, Nawabganj, Payagpur, Pandri Kripal, Belsar, Babhanjot
Medium	6	0.25-0.35	Bisheshwarganj, Gilaula, Itia thok, Wazirganj, Rehra Bazar, Utraula
Low	10	0.15-0.25	Shivpur, Rupaidih, Haldhar Mau, Mujhana, Jhanjhari, Colonelganj, Tarabganj, Chhapia, Gaindas Buzurg, Shridattganj
Very Low	19	< 0.15	Mihinpurwa, Mahsi, Chitaura, Tejwapur, Fakharpur, Huzurpur, Kaisarganj, Jarwal, Hariharpur, Sirasia, Ikauna, Katra Bazar, Paraspur, Mankapur, Gainsari, Pachperwa, Balrampur, Tulsipur, Harraiya Satgharwa

The concentration of sowing instrument in Devi Patan Plain is highly uneven. The range of the blocks concentrated in the very high category is above 0.45. Only 3 blocks are concentrated in the very high category. Jamunaha block comes at 4.43 is the highest in this group followed by 0.99 in Risia and 0.76 in Nawabganj block. There are 6 blocks which comes under the category of high

group. The range varies between 0.35 – 0.45 per hundred hectare of Net Sown Area (NSA). The blocks concentrated in this category are Balaha, Nawabganj, Payagpur, Pandri Kripal, Belsar, and Babhanjot in which Balaha and Belsar block is highest at 0.44 per hundred hectare of Net sown Area (NSA). Like the blocks of high category the medium category also incorporates 6 blocks. The range of the blocks varies between 0.25-0.35 per hundred hectare of Net Sown Area (NSA). The per hundred hectare of NSA of sowing instrument is 0.34 each in Bisheshwarganj, Gilaula and Itia Thok followed by 0.31 in Utraula, 0.29 in Wazirganj and 0.25 in Rehra Bazar. The category of the low group includes 10 blocks in which range varies between 0.15-0.25 per hundred hectares of NSA. The blocks which are comprised in this group are Shivpur, Rupaidih, Haldhar Mau, Mujhana, Jhanjhari, Colonelganj, Tarabganj, Chhapia, Gaindas Buzurg and Shridattganj. The remaining 19 blocks are concentrated in the very low category and in which the range is less than 0.15 per hundred hectare of Net Sown Area (NSA).

Table. 12 shows that the sowing instrument increased from 3033 in 1997 to 8556 in 2007. The highest concentration in the year 2007 is 541 in Chhapia block followed by Mankapur and Rupaidih which accounts for 507 and 482 instruments.

In terms of number of sowing instruments per hundred hectare of NSA in Devi Patan Plain there are 10 blocks which comes under the very high category and the range is more than 1.60 per hundred hectare of NSA. In terms of block wise distribution it is 2.14 in Rupaidih block, 2.21 in Itia Thok, 2.33 in Pandri Kripal, 2.76 in Jhanjhari, 1.67 in Colonelganj, 2.52 in Wazirganj, 2.70 in Mankapur, 1.65 in Nawabganj, 3.19 in Chhapia and 2.45 in Babhanjot. There are 7 blocks which lies in high category and their range is 1.20-1.60 per hundred hectare of Net sown Area (NSA). Haldhar Mau is highest at 1.52, followed by Mujhana 1.43, Belsar 1.40, Katra Bazar 1.39, Kaisarganj 1.34, Tarabganj 1.32 and 1.26 in Paraspur. The range of the blocks in medium category ranges between 0.80-1.20 per hundred hectare of Net Sown Area (NSA). The highest value of 1.07 is found in Jarwal block followed by 1.02 in Nawabganj, 0.98 in Chitaura, 0.96 in Mahsi, 0.95 in Tejwapur, 0.93 in Bisheshwarganj, 0.86 in Balaha and 0.83 in Risia. In terms of total number of blocks in a group, the category of low group contributes only 6 blocks namely Mihinpurwa, Shivpur, Fakharpur, Huzurpur, Payagpur and Jamunaha, the range of which varies between 0.40-0.80. The group of very low category has a maximum of 13 blocks in that group. The blocks under this group are Hariharpur, Sirasia, Gilaula, Ikauna, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj, Gainsari, Pachperwa, Balrampur, Tulsipur and Harraiya Satgharwa.

Table 12: Sowing Instruments/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	10	> 1.60	Rupaidih, Itia thok, Pandri Kripal, Jhanjhari, Colonelganj, Wazirganj, Mankapur, Nawabganj, Chhapia, Babhanjot
High	7	1.20-1.60	Kaisarganj, Katra Bazar, Haldhar Mau, Mujhana, Paraspur, Belsar, Tarabganj
Medium	8	0.80-1.20	Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Bisheshwarganj, Jarwal,
Low	6	0.40-0.80	Mihinpurwa, Shivpur, Fakharpur, Huzurpur, Payagpur, Jamunaha
Very Low	13	< 0.40	Hariharpur, Sirasia, Gilaula, Ikauna, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj, Gainsari, Pachperwa, Balrampur, Tulsipur, Harraiya Satgharwa

There are hefty variations in the use of tractors among the different blocks in the study area. The total concentration of tractor in the year 1997 was 11065, which increased to 23299 tractors in the year 2007.

In the year 1997 there were 10 blocks in the very high category and their range is more than 2.00. In terms of block wise number of tractor per hundred hectare of Net Sown Area (NSA), it was highest in Rehra Bazar which was 3.43, it was followed by 2.29 in Utraula, 2.94 in Gaindas Buzurg, 2.88 in Wazirganj, 2.72 in Pandri Kripal, 2.60 in Nawabganj, 2.38 in Mankapur, 2.34 in Shridattganj, 2.29 in Tarabganj and 2.26 in Chhapia. There are only 3 blocks which comes under the high category. The blocks which come under the range 1.50-2.00 in this category are 1.52 per hundred hectare of Net Sown Area (NSA) in Mihinpurwa block, 1.91 in Itia Thok and 1.88 in Babhanjot. There are maximum of 13 blocks in the medium category namely Bisheshwarganj, Payagpur, Kaisarganj, Jarwal, Gilaula, Rupaidih, Haldhar Mau, Mujhana, Jhanjhari, Colonelganj, Pachperwa, Tulsipur and Harraiya Satgharwa. The range of the blocks which are concentrated in the low category varies between 0.50-1.00. 12 blocks which are concentrated in this category are Balaha, Nawabganj, Shivpur, Risia, Fakharpur, Huzurpur, Sirasia, Katra Bazar, Paraspur, Belsar, Gainsari and Balrampur. In terms of number of tractor per hundred hectare of NSA in the study area, it is highest in Huzurpur which is 0.98 per hundred hectare of NSA. The range of the very low category is less than 0.50. The lowest value in this group is as low as 0.02 in Mahsi block, 0.45 in Chitaura block, 0.14 in Tejwapur, 0.18 in Jamunaha, 0.19 in Hariharpur and 0.22 in Ikauna block.

Table 13: Tractor/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	10	> 2.00	Pandri Kripal, Tarabganj, Wazirganj, Mankapur, Nawabganj, Chhapia, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj
High	3	1.50-2.00	Mihinpurwa, Itia thok, Babhanjot
Medium	13	1.00-1.50	Bisheshwarganj, Payagpur, Kaisarganj, Jarwal, Gilaula, Rupaidih, Haldhar Mau, Mujhana, Jhanjhari, Colonelganj, Pachperwa, Tulsipur, Harraiya Satgharwa
Low	12	0.50-1.00	Balaha, Nawabganj, Shivpur, Risia, Fakharpur, Huzurpur, Sirasia, Katra Bazar, Paraspur, Belsar, Gainsari, Balrampur
Very Low	6	< 0.50	Mahsi, Chitaura, Tejwapur, Jamunaha, Hariharpur, Ikauna

Table 14: Tractor/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	13	> 3.00	Gilaula, Rapaidih, Itia thok, Pandri Kripal, Jhanjhari, Wazirganj, Mankapur, Chhapia, Babhanjot, Rehra Bazar, Gaindas Buzurg, Utraula, Shridattganj
High	8	2.50-3.00	Jamunaha, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Nawabganj, Pachperwa, Harraiya Satgharwa
Medium	5	2.00-2.50	Kaisarganj, Paraspur, Belsar, Tarabganj, Tulsipur
Low	11	1.50-2.00	Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Jarwal, Hariharpur, Ikauna, Gainsari, Balrampur
Very Low	7	< 1.50	Mihinpurwa, Shivpur, Fakharpur, Huzurpur, Bisheshwarganj, Payagpur, Sirasia

Table. 14 shows that in terms of number of tractor per hundred hectare of NSA in the year 2007 in the study area, there are 13 blocks which are concentrated in the very high category and the range is more than 3. Rehra Bazar block is highest at 5.97 tractors per hundred hectare of NSA, and 3.34 in Itia Thok which is the lowest in this category. The other blocks of this category are Gilaula 3.74, Rupaidih 3.42, Pandri Kripal 4.39, Jhanjhari 4.75, Wazirganj 4.19, Mankapur 4.30, Chhapia 4.58, Babhanjot 3.76, Gaindas Buzurg 5.30, Utraula 5.61 and Shridattganj 4.62. The range of the 8 blocks which are concentrated in the high category group is 2.50-3.00. The main blocks under this group are Jamunaha, Katra Bazar, Haldhar Mau, Mujhana, Colonelganj, Nawabganj, Pachperwa and Harraiya Satgharwa. The category of medium group accounts for only 5 blocks under the group. In terms of total number of blocks in a category, this category is lowest in terms of total number of blocks. The range of these blocks varies between 2.00-2.50. In terms of block wise number of tractor per hundred hectare of NSA, it is highest of 2.39 in Belsar. It was followed by 2.36 in Kaisarganj, 2.31 in Paraspur, 2.19 in Tulsipur and 2.16 in Tarabganj block. Excluding the very high category, the low category includes a maximum of 11 blocks in the study area, whose range is 1.50-2.00. The blocks under this category are Balaha, Nawabganj, Risia, Mahsi, Chitaura, Tejwapur, Jarwal, Hariharpur, Ikauna, Gainsari and Balrampur blocks. In the group of very low category, the Sirasia block accounts for highest of 1.46 tractor per hundred hectare of NSA. It is followed by 1.44 in Bisheshwarganj, 1.33 in Payagpur, 1.27 in Fakharpur, 1.19 in Shivpur, 1.04 in Huzurpur and 0.74 in Mihinpurwa blocks.

Table 15: Tube Wells/100 Hectare NSA 1997

Category	Number of Blocks	Value	Name of Blocks
Very High	10	> 50	Bisheshwarganj, Rupaidih, Itia thok, Pandri Kripal, Mujhana, Jhanjhari, Wazirganj, Mankapur, Chhapia, Babhanjot
High	6	40-50	Payagpur, Gilaula, Ikauna, Gaindas Buzurg, Utraula, Balrampur
Medium	11	30-40	Nawabganj, Risia, Chitaura, Jamunaha, Hariharpur, Paraspur, Tarabganj, Nawabganj, Rehra Bazar, Shridattganj, Tulsipur
Low	7	20-30	Mihinpurwa, Balaha, Tejwapur, Haldhar Mau, Belsar, Gainsari, Pachperwa,
Very Low	10	< 20	Shivpur, Mahsi, Fakharpur, Huzurpur, Kaisarganj, Jarwal, Sirasia, Katra Bazar, Colonelganj, Harraiya Satgharwa

The concentration of tube wells in Devi Patan Plain in the year 1997 was 323873, which increased to 458693 in the year 2007. Table. 15 shows that there are 10 blocks which comes under the very high category and their range is more than 50 tube wells per hundred hectare of NSA. The value of the block in this category is 50.24 in Bisheshwarganj, 62.03 in Rupaidih, 75.28 in Itia Thok, 67.00 in Pandri Kripal, 64.03 in Mujhana, 60.60 in Jhanjhari, 60.27 in Wazirganj, 83.00 in Mankapur, 82.00 in Chhapia and 80.67 in Babhanjot block. The range of the 6 blocks which comes under the high category is 40-50, and the block which lies in this group are Payagpur, Gilaula, Ikauna, Gaindas Buzurg, Utraula and Balrampur. The category of medium group

contributes a maximum of 11 blocks which ranges between 30-40 tube wells per hundred hectare of NSA in the study area. The value of these blocks are 31.07 in Nawabganj, 37.97 in Risia, 36.91 in Chitaura, 33.24 in Jamunaha, 35.20 in Hariharpur, 31.08 in Paraspur, 32.55 in Tarabganj, 31.86 in Nawabganj, 34.84 in Rehra Bazar, 39.86 in Shridattganj and 30.76 in Tulsipur. The range which lies in the low category is 20-30 is found in the blocks of Mihinpurwa, Balaha, Tejwapur, Haldhar Mau, Belsar, Gainsari and Pachperwa. Like the very high category the very low category also includes 10 blocks in which the range is less than 20 tube wells per hundred hectare of NSA. The blocks along with the values in this category is 18.06 in Shivpur, 11.19 in Mahsi, 17.61 in Fakharpur, 13.85 in Huzurpur, 16.43 in Kaisarganj, 10.58 in Jarwal, 9.99 in Sirasia, 4.70 in Katra Bazar, 17.60 in Colonelganj and 17.52 in Harraiya Satgharwa. The range of these blocks is less than 20.

In terms of number of tube wells per hundred hectare of NSA in the year 2007, there are 21 blocks which comes under the very high category namely Risia, Mahsi, Chitaura, Jamunaha, Gilaula, Rupaidih, Itia Thok, Katra Bazar, Haldhar Mau, Pandri Kripal, Mujhana, Jhanjhari, Colonelganj, Paraspur, Belsar, Tarabganj, Mankapur, Nawabganj, Chhapia, Babhanjot and Utraula. The range of the blocks under this category is more than 60 per hundred hectares of NSA. There are 4 blocks which comes under the high category and their range is 50-60. Wazirganj block is highest at 56.87 in this group. It is followed by 56.22 in Balrampur, 54.00 in Tejwapur and 53.91 in Shridattganj. The range of the blocks in the medium category is 40-50. 8 blocks lies in this category and their values are 45.83 in Balaha, 44.20 in Nawabganj, 42.40 in Shivpur, 48.41 in Bisheshwarganj, 44.19 in Payagpur, 44.04 in Ikauna, 44.82 in Rehra Bazar and 41.14 in Gaindas Buzurg. There are only 2 blocks namely Mihinpurwa and Hariharpur which falls in the low category and they are at 38.90 and 37.94 per hundred hectare of NSA. The range of the 9 blocks which comes under the very low category is below 30. The blocks in this group includes Fakharpur, Huzurpur, Kaisarganj, Jarwal, Sirasia, Gainsari, Pachperwa, Tulsipur and Harraiya Satgharwa.

Table 16: Tube Wells/100 Hectare NSA 2007

Category	Number of Blocks	Value	Name of Blocks
Very High	21	> 60	Risia, Mahsi, Chitaura, Jamunaha, Gilaula, Rupaidih, Itia thok, Katra Bazar, Haldhar Mau, Pandri Kripal, Mujhana, Jhanjhari, Colonelganj, Paraspur, Belsar, Tarabganj, Mankapur, Nawabganj, Chhapia, Babhanjot, Utraula
High	4	50-60	Tejwapur, Wazirganj, Shridattganj, Balrampur
Medium	8	40-50	Balaha, Nawabganj,Shivpur, Bisheshwarganj, Payagpur, Ikauna, Rehra Bazar, Gaindas Buzurg
Low	2	30-40	Mihinpurwa,Hariharpur
Very Low	9	< 30	Fakharpur, Huzurpur, Kaisarganj, Jarwal, Sirasia, Gainsari, Pachperwa, Tulsipur,Harraiya Satgharwa

Conclusion

The result obtained with the help of simple percentage method and the outcomes of various agricultural implements per hundred hectare of Net Sown Area (NSA) in the different blocks of the study area have shown that there are more variations among the different blocks in terms of use of different agricultural implements like wooden plough, iron plough, harrows & cultivators, thresher machine, sprayer, sowing instrument, tractor and tube wells. There are more regional variations in the agricultural infrastructure, the economic

condition of farmers, the agricultural inputs, fertility of the land, availability of other inputs like high yielding varieties of seeds, chemical fertilisers, insecticides and pesticides which determines the overall agricultural production and prosperity for the farmers. In terms of use of absolute number of agricultural implements in the study area, there are variations in the total change in number and percentage between two points of time i.e. 1997 and 2007.

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Cultural-Heritage Tourism in Ayodhya-Faizabad: Scenario and Prospects

Sarvesh Kumar* and Rana P.B. Singh**

Abstract

Sustainable tourism is influenced by the dimension of heritage (cultural/natural), including community, basic infrastructure, visitor, administration, and enterprises, and other related issues. In a way, tourism and cultural heritage are interrelated to each other. The Indian twin city of Ayodhya-Faizabad consists of the places of cultural heritage. Ayodhya is famous for pilgrimage, salvific quality, and holy tradition of Hindus. Of course, it is scared and religious place for Hindus, where also exists religious sites of Muslims, Jains, Buddhists, and Sikhs. Like other holy cities, Ayodhya too enumerates unique and variety of cultural heritagescapes, like tradition, faith, festivities, pilgrimages, folklore, custom, artefacts, historical building monuments, and other tangible and intangible cultural heritage that attract the tourists. Since 1992 Ayodhya has been suffered from the religious contestation, as exemplified by Babari mosque and Ramajanmabhumi temple; such type of contradiction obstacles the tourism development, however pilgrimage-tourism has been the main force in the city.

Key words: Pilgrimage, Heritagescapes, Festivities, Tangible and Intangible heritage

Introduction

International Council on Monuments and Sites (ICOMOS) defined "heritage" as a broad concept that include tangible assets such natural and cultural environment, encompassing landscape, historic places, and build environment as well as intangible assets such as collection, past and continuing cultural practices, knowledge and living experiences (see ICOMOS Charter 2002). All kind of things that acknowledge about the past are under the premises of heritage. It always shows and maintains the relationship between the memories of our past for better consequences to purview present and envisioning future. The concept of heritage appeared with respect to cultural tourism, and tourism involves the movement of people through time and space, either between their living place and destination, or within destination area (Lew et al. 2004: 36). Heritage is what we inherit from the past and use in the present day. History is the past, whereas heritage is the modern day use of the past for tourism and other purposes. Heritage itself is not a thing and does not exist by itself nor does it imply a movement or a project, rather, heritage is about the process by which people use the past a discursive construction with material consequences (see, Smith 2006: 13). There is an implicit relationship between heritage and history (in which heritage might be seen as a means of consumption of different readings of the past that history provides), the wide ring rage of environment or contexts in which heritage identify certainly (see, Poria et al. 2003: 249). Tangible immovable heritage, tangible movable heritage, and tangible heritage are the consequently cultural and natural form of heritage and history (see, Timothy and Boyd 2003). In the context of heritage tourism includes two main kinds of heritages, viz. natural heritage and cultural heritage. Natural heritage includes naturally occurring phenomena, such as forest, lakes, rivers, mountains, deserts, and coastlines. Cultural

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heritage, on the other is the past created by humankind and its various manifestations, while natural heritage is an important part of tourism, particularly in the growing realm of nature-based tourism (Timothy 2011: 3). Cultural heritage and tourism closely connected with the various forms of urban tourism, rural tourism, and ecotourism, which are the core of heritage tourism. Present study identifies the varying components of cultural heritage and analyzes the scenario and prospects of tourism development in the study area. The study is based on the primary field survey, questionnaire method and analysis of information collected from regional tourist office, and reports of the Archaeological Survey of India.

The Study Area

Ayodhya counted among one of the seven most scared and salvationary cities of the India (i.e. Ayodhya, Mathura, Maya-Haridvar, Kashi, Kanchi, Avantika-Ujjain, Puri, Dwarka), is situated on the right bank of the river Sarayu (Ghaghara) at a distance of 7km east from Faizabad. Ayodhya is the part of Faizabad city and both are known together as Ayodhya-Faizabad twin city (26-$^{0-}$ 47' North and 26^{0} 80' North Latitude and 82^{0} 12' East and 82^{0} 20' East Longitude). These two twin cities are divided by a pilgrimage route of Panchakroshi Yatra, and the entire sacred territory is demarcated by the Chaudahkroshi Yatra. (Fig. 1)

Location of Ayodhya-Faizabad

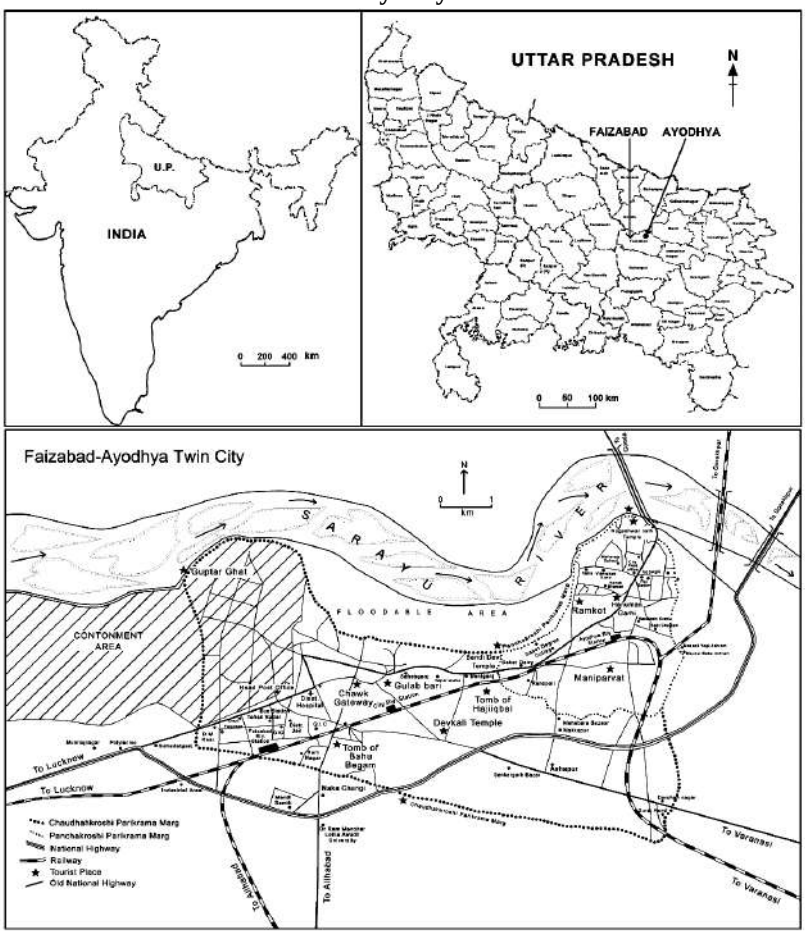

Fig. 1

The state's capital Lucknow lies at distance of 130km west and another holy city Varanasi at 208 km in south-east, Gorakhpur at 145km in east and Allahabad lies at distance of 167km in the south. Ayodhya-Faizabad has a common Development Authority but separate Municipal Boards. According to Hindu mythology, Ayodhya was settled by King Manu (Hindu progenitor of mankind), and narrated as the birth place of Lord Rama, the seventh incarnation of Vishnu. Ayodhya was one of the famous cities and the first capital of the powerful Koshala among the sixteen Mahajanapadas of ancient India (Law 1944: 424, Chakrabarti 2000: 378 and 387). Ayodhya for a period of over two thousand years has borne witnessed to the presence of Jainism, Buddhism, Shaivism, Vaishnavism, and Islam too, therefore Ayodhya consists of the sacred and religious places for Hindus together with Muslims, Jains, Buddhists, and Sikhs too (Shaw 2000: 698). In the 12th century under the sultanate rule at Delhi and Mughal rulers, Ayodhya was invaded and destroyed many times by the order of the Mughal invader Mir Baqi Tashkandi who demolished the famous Rama temple Ramajanmabhumi of Pratihara from the Gahadavala period at the birth place of Rama, and in the following period of fifteen months he built a Muslim monument (Babari mosque) using the debris of the temple. Since its inception this has been controversial and sensitive place for centuries and even today. Muslims have never performed prayer (*namaz)* there. As it has been centre of Hindu-Muslim riots, the main site was opened for devout Hindus till 23rd of February 1857 when the East India Company (Britain) made a separating wall and stop the entry of Hindus through the mosque since 5th of January 1950 under the law, and only restricted entry was permitted (Singh and Rana 2002: 301).

Faizabad originally known as Fyzabad, was founded by Ali Vardi Khan, Nawab of Bengal. In CE 1722 when state of Awadh was established and Faizabad became its first capital Saadat Ali Khan was the first Nawab and progenitor of Nawabs of Awadh (Upadhaya and Mishra 2012: 17). In the period of third Nawab Shuja-ud-Daula, Faizabad was a full-fledged capital city with gardens, palaces, markets, roads, and other infrastructure. In CE 1775, the period of fourth Nawab Asaf-ud-Daula, the capital of Awadh moved from Faizabad to Lucknow and thus Faizabad lost its prosperity. The historical and pilgrimage twin city Ayodhya-

Table 1. Annual Pilgrims/ Tourist Arrival in Ayodhya-Faizabad

Year	Ayodhya			Faizabad		
	Domestic	International	Total	Domestic	International	Total
2003	503,855	199	504,054	5,295	32	5,327
2004	505,000	163	505,163	5,661	35	5,696
2005	509,899	367	510,266	7,796	39	7,835
2006	-	-	-	-	-	-
2007	583,472	424	583,896	7,845	57	7,902
2008	519,926	662	520,588	7,714	129	7,843
2009	895,518	755	896,273	7,908	136	8,044
2010	1,095,147	822	1,095,969	8,489	225	8,714
2011	1,274,136	1,325	1,275,461	8,689	252	8,941
2012	1,394,360	1,486	1,395,846	9,544	305	9,849
2013	1,437,532	1,562	1,439,094	10,623	385	11,008
2014	1,569,763	1,628	1,571,391	10,958	411	11,369

Source: Records of the Regional Tourism Office, Faizabad; from Various Sources the Data is Adjusted

Note: The annual pilgrims/ tourist data as recorded in the Regional Tourists Office is at least ten times fabricated because of lack of primary survey and rational methodology. The data for 2006 was not recorded due to turmoil situation faced at Ayodhya.

Faizabad possesses rich cultural heritage that attracts more than 1.5 million people on various religious occasions (Table 1).

According to personal experiences and understanding it is estimated that presently around 1.5 million pilgrims pay visit to Ayodhya every year. Of course international tourists and devout Hindus also visit the city, but mostly stay for one, or two nights.

Cultural Heritage (Tangible): Tourist Pilgrims' Sites

Ghat and Kunda

The right-side banks of the Sarayu River at Ayodhya consists of number of bathing places (*ghats*), and are known as sacred spots for Hindu adherents. Svaragadvara Ghat is the most famous ghat, where the pilgrims come for pilgrimage and take holy dip and perform other rituals. Other important ghats are Basudev Ghat, Sahastradhara Ghat, Papamochana Ghat, Rinamochana Ghat, Chakratirtha Ghat and Guptar Ghat. Every ghat possesses individual historical, mythological, religious folktales and associated spiritual importance. From the ancient time *kundas* (water pools) have played an important role of Hindu's purification rituals and also the essential source of sacred water. Ayodhya-Faizabad has numbers of *kundas*, like Dantadhavan Kunda, Vidya Kunda, Sita Kunda, Brihaspati Kunda, Laxmi Kunda, and Girja Kunda.

Riverfront Ghats and Temples of Ayodhya-Faizabad

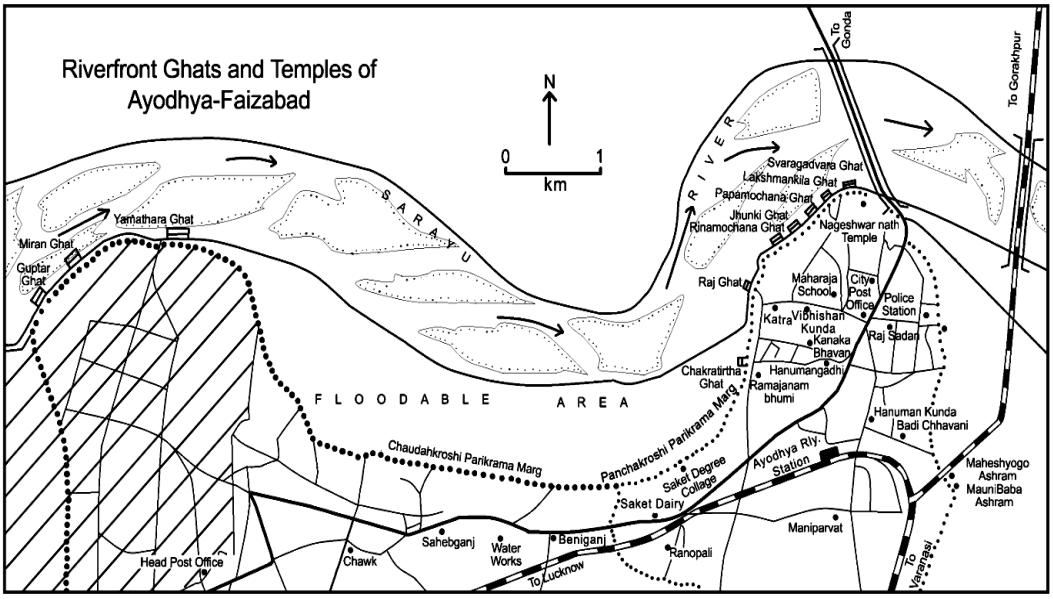

Fig. 2.

Hindu Shrines

Hanumangarhi

It is one of the most important temples of Ayodhya, situated in the heart of the city (Fig. 2).This is the 10th century temple, built in the four-side fort with circular bastions at each corner, and is believed to be the place where monkey god Hanuman used to live in a cave-guard of the city. The temple has golden idol of Hanuman in view of Rajatilak.

Ramajanmabhumi

It is the place where Lord Rama was said to have taken birth. There is a small Rama temple here. During the Gupta period (CE 4th - 6th century) many Vaishnavite temples were built, including the famous one at this site that was reshaped and expanded in the CE 11th-12th centuries. The Mughal king Babur demolished the temple in 1528, and using the debris made here a mosque like monument called Baburi Masjid. On 6th of December 1992

the fundamentalist Hindus razed the mosque in order to build a temple to Rama.

Kanaka Bhawan

This temple was built by the Queen of Tekamahgarh (M.P.) in 1891. The main temple is built around an open inner court in which stand a small shrine of Ramapada. The main idols installed inside the *garbhagriha* (inner sanctum) are the goddess Sita and Lord Rama with his three brothers (Bakker 1986: 141).

Nageshvarnatha Temple

Situated on the Svaragadvara Ghat, the present temple of Nageshvarnatha was built during the period of Nawab Safdar Jung by his Hindu minister Naval Ray in the fifth decade of the 18th Century. The temple contains a Shiva Linga, in front of which stand three images of Nandin Ox (vehicle of Shiva). According to mythology temple was founded by King Kusha, the son of Lord Rama (Veer 1988: 17).

Islamic Monuments

Gulab Bari

Is one of the most accomplished monument of Avadh Nawabi architecture. It is laid out by second Nawab of Avadh Nawab Safdar Jung, surrounding the garden of verities of roses. Tomb of third Nawab of Avadh Nawab Shuja-ud-daula is situated in inner part of Gulab Bari. The construction of this tomb was themselves started by Shuja-ud-daula in his Nawabi period (Führer 1891) and after death in CE 1775 he was buried in this tomb. The full construction of tomb with dome and tower accomplished by Bahu Begum by the wife of Nawab Suja-ud-daula in CE 1789. In CE 1860 it was occupied by British government.

Tomb of Bane Khanam (by Kumar)

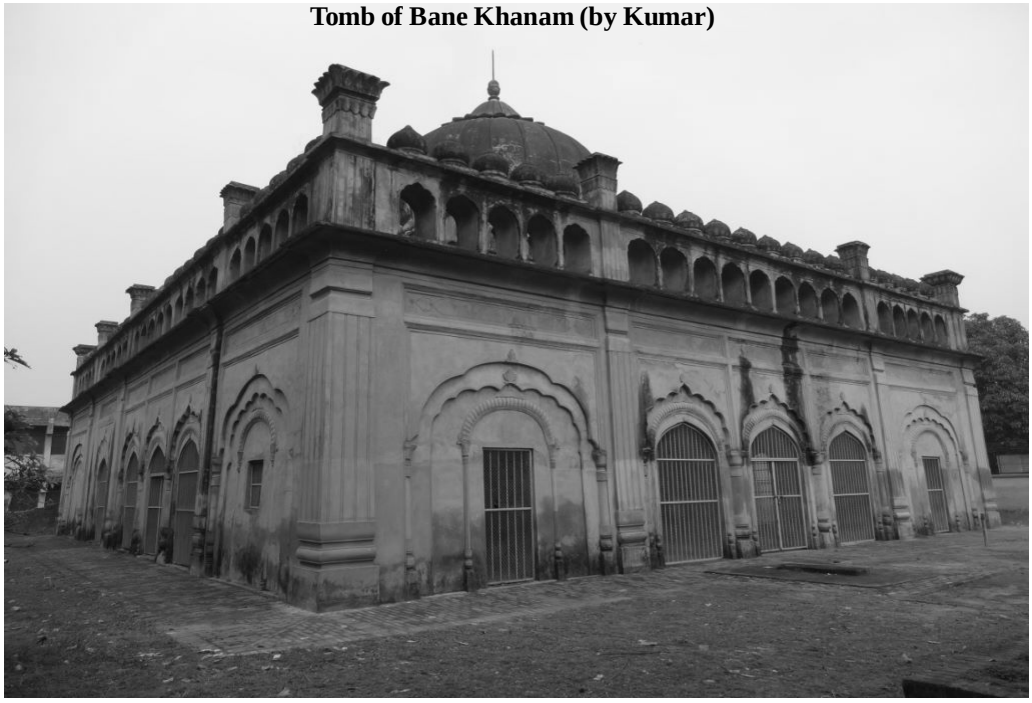

Fig. 3

Now it is the heritage monument of Archaeological survey of India.

Tomb of Bahu Begum

Is the other most important monument of Nawabi architecture. After death of Bahu begum in CE 1815 the tomb contraction accomplished by the help of collected money in her trust and in the observation of two courtiers Darab Ali and Vakeel Panah Ali. Bahu Begum Tomb is based on

Iranian architecture and the dome style represents a rare triple-dome style.

Tomb of Bane Khanam

Is a memorial honouring the wife of Nawab Najam-ud-daula (see Fig. 3). This was built by the Almas Ali Khan, originally one of her slaves. The building may, however, be dated to the last quarter of the 18th century. The dome is clearly modelled following the style of Gulab Bari.

Jain Shrines

Ayodhya is sacred and religious place even for Janis. There are five Jain temples located near birth place of the five Jain Tirthankaras, viz. Adinatha or Rishabhadev temple in Muraitola Swargadvara, Ajeetnatha temple near Saptsagar, Abhinandananatha temple near to Saraya, Sumanthnatha temple near to the Ramkot and last one Anantnatha temple near to Golaghat. In CE 1193, Muhammad Ghori invaded north India including Ayodhya, and his army officer Makhdum Shah come to Ayodhya and destroyed the famous Jain temple of Adinatha in CE 1194.

Tourist Places of Ayodhya-Faizabad

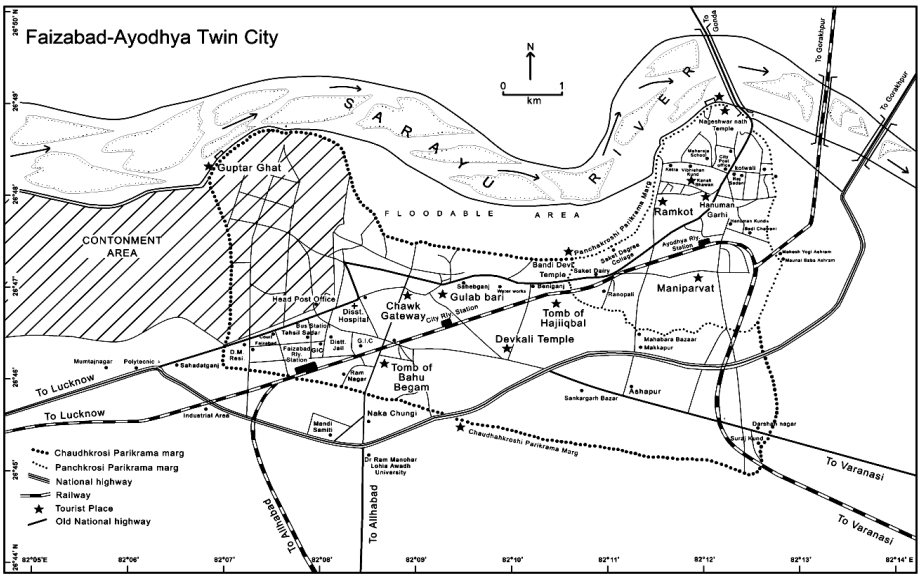

Fig.4

Special Celebration:Examples of Intangible Heritage

Ramanavami

Ramanavami is an important and big festival of Ayodhya, celebrated as the birth anniversary of Lord Rama. It is usually celebrated in the month of Chaitra according to the Hindu calendar which generally corresponds to the March-April of Georgian calendar. Ramnavami *mela* (fair) at Ayodhya is the testimonial of love, faith and devotion of the people for their great god-like hero Rama. Kanak Bhavan is the main centre of attraction for the birth celebration because it is oldest temple and assumed to be the representative of the remnant of Ramakot (fort of Rama).

Parikrama (CircumAmbulation Path)

Ramkot ke Parikrama

Ramkot (Fort of Lord Rama) is the most important and ancient worship place in Ayodhya. This area is occupied mostly by important temples and number of shrines. Kanak Bhavan, Hanuman Garhi, Ramajanmabhumi and other important temples are situated in this locality. It is also a sacred place, where pilgrims perform the circumambulation around it. Of course, this Parikrama is performed every day, however most commonly a huge mass of pilgrims perform it on the Ekadashi Tithi (the 11th day of dark/light fortnight of Moon's cycle).

Panchakroshi Parikrama

This Parikrama is the oldest tradition of sacred journey in Ayodhya-Faizabad that covers 15km route alomng the periphery of Ayodhya and linked with thirty-six sacred places and water pools. Pilgrims first take cleansing holy dip in the Sarayu (Ghaghara) River, followed with the sacred journey. On the way the pilgrims offer oblation and offerings of ritual items to deities in the shrines along the route. Panchakroshi Parikrama is organised on the Hindu auspicious day of Ekadashi Tithi of Karttika month (Lunar month of October-November).

Chaudahkroshi Parikrama

The Chaudahkroshi Parikrama starts with *sankalpa* (initiation vow), followed with pilgrimage on the peripheral route of about 45km surrounding Ayodhya-Faizabad, and connected with thirty-six sacred places and water pools. Every year more than half a million pilgrims gather in Ayodhya-Faizabad to take part in the Chaudahkroshi Parikrama after taking holy dip in the Sarayu River. Chaudahkroshi Parikrama organised on the Hindu auspicious day of Navami Tithi of Karttika month (October-November).

Chaurasikroshi Parikrama

Chaurasikroshi is one of the oldest and biggest pilgrimage routes, which interconnects 108 sacred places, but presently exists only 100, and performed in a period of twenty one days. Mythologically the route symbolises journey to 8.4 million of organic species where the soul has to move, as perceived in the frame of transmigration of soul in Hindu mythology. Chaurasikroshi is the ancient religious territory of Ayodhya, and presently passes through five districts, viz. Faizabad, Gonda, Basti, Akbarpur, and Barabanki. The Parikrama starts from Makhbhumi (Makhauda) situated on bank of the beautiful small river tributary Manorama. Chaurasikroshi Parikrama is initiated every year on the Chaturdashi Tithi of Chaitra (March-April lunar month) according to Hindu calendar.

Contemporary Critical Issues

- Most of the heritage sites and monuments are dilapidating and are in abounding condition in lack of proper strategy for the conservation and preservation, as illustrated with a case of Gulab Bari (Fig. 5).

Entrance Gateway in Front of Gulab Bari in Damage Condition.

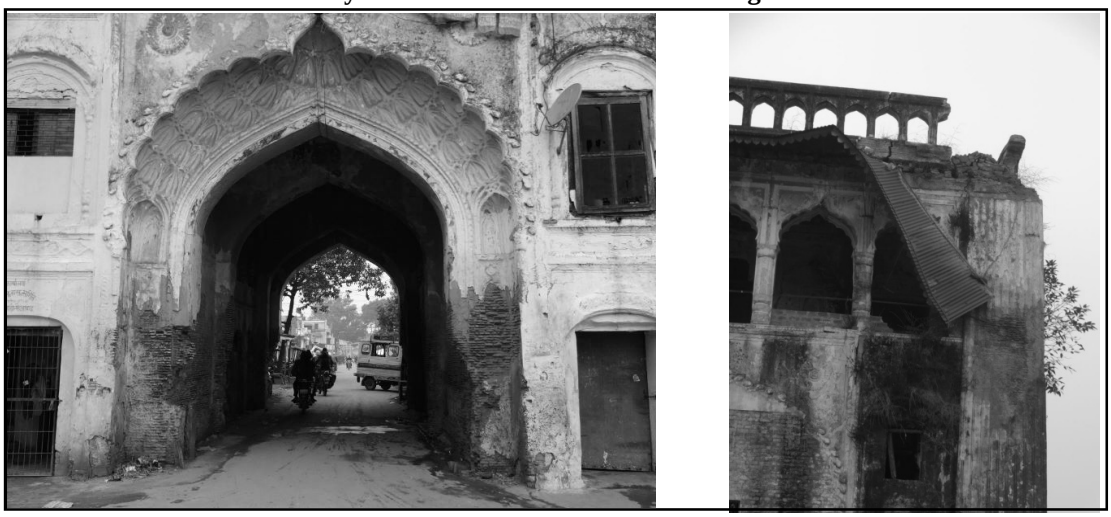

Fig. 5.

- Ayodhya Act - 1993, related to acquisition of land (buildings, shops, residential houses) near to Ramkot (*Ramajanmabhumi*) by provenance and rule under the Central Government of India, prohibits any type of new construction near Ramkot, which has interrupting the security of Ramajanmabhumi. Of course there exist examples of illegal encroachments.

- Of course, government has built embankment along the Sarayu river, however but some historical and mythological ghats are still neglected, like Raj Ghat, Kaushalya Ghat, Kaikeyi Ghat, Sumitra Ghat, Brahma Kunda, Prahalad Ghat, and Chakratirtha Ghat. These ghats are in abandoned condition because river bed has already shifted far from these ghats.
- During several years in the past Ayodhya suffered from the issues of religious contestation those obstacles the tourism development, in spite of several attractive heritage sites that represent harmonious interfaces among several faiths.
- Inadequate integration of cultural heritage protection and management laws and practices in promoting issues of social, economic, political, legislative, and cultural development that may be use as base for making sustainable policies and strategies for protection and conservation of cultural heritage over time.
- Lack of optimal and rationally required basic facilities for tourists and pilgrims.

Prospects & Potentials

- Ayodhya needs to be developed as pilgrimage-tourist place taking in view its cultural importance and mass of pilgrim-tourists (recording on 1.5 million annually).
- Panchakroshi Parikrama, Chaudahkroshi Parikrama, and Anvarat Ramalila should be exposed on national and international level in the frame of universal value of intangible heritage. The active support of Ayodhya Research Institute will promote this in a much better way.
- Similarly Faizabad is the first capital of Awadh Nawab region, the universal values of intangible heritage to be projected on the line of Muslim and Sufi cultures represented with sacred buildings, tombs, and Imambara (prayer sites), and other representatives of Nawabi culture.
- As Ayodhya and South Korea having cultural bondage, with the support of Korean government, an international site of inter-cultural repositories for pilgrimage-tourism should easily be developed.

Conclusion

Ayodhya-Faizabad represents an aesthetic and unique type of cultural landscape and heritagescape that include historical monuments, artefacts, *ghats*, water pools, traditional performances, mythology and faiths, custom, folklore, festivities, pilgrimages, and other tangible and intangible cultural heritages. These are attractions for pilgrims and tourists but lacking adequate or appropriate presentation and communication in respect to their significance of heritage values to both visitors and members of the local host community. Lack of awareness can hinder and prevent the development of public, political and governmental support and funding to protect and conserve the heritage places. Government should plan sustainable strategy and guiding visions for conservation and protection of heritage monuments and sites for future generation while taking care of people's involvement and provision for required infrastructure.

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Problem of Banning of Plastic Carry-Bags : A Case Study of Krishnagar Municipality, West Bengal

Balai Chandra Das *

Abstract

Krishnagar Municipality is suffering from the excessive use of plastic carry bags and its associated problems. Although most of the people know the problems of after-use-plastic-carry bags, customers do not carry the marketing bags to reduce the use of former. For the reason, sellers have been forced to supply the plastic carry bags for selling their goods. After marketing, customers bring the goods in the plastic bags in their house with him and then throw it or burn it here and there. As a result environment has been affected very badly. Although the municipality is suffering a lot from this acute urban environmental problem and although the people of Krishnagar know the severe effect of this harmful carry bags, yet banning of this bags have not been materialized. Present study is to search those hidden causes for which banning of plastic carry bags has not yet been possible. Moreover, the work is trying to assess the magnitude of the problems, causes behind those problems and at the same time trying to suggest a best suited plan to mitigate the problem.

Key words: Plastic carry bags, Solid waste, Banning,Municipality and Cites

Introduction

Cities play a vital role in promoting economic growth and prosperity. The development of the cities largely depends upon physical, social and institutional infrastructure. But now is the technological age. Man has created many resources which give man a huge advantage for living. But in the manmade creation there are left some hidden but tremendous items that decline of our environments as well as civilization. Plastic bag is one of these elements. These carry bag elements are left in the environment as the same state, as they can be rotten by the micro organism. As a result it polluted water and soil and animals life. Even air is polluted by poisonous gas due to burning it.

Plastics are polymers i.e. large molecules consisting of repeating units called monomers. In the case of plastic bags, the repeating units are ethylene. When ethylene molecules are polymerized to form polyethylene, they form long chains of carbon atoms in which each carbon is also bonded to two hydrogen atoms.

Plastic bags are made from one of the three basic types of polymers -polyethylene- High Density polyethylene (HDPE), Low Density Polyethylene (LDPE), or Linear Low-Density Polyethylene (LLDPE). Grocery bags are generally of HDPE, and bags from the dry cleaner are LDPE. The major difference between these materials is the degree of branching of the polymer chain. HDPE and LLDPE are composed of linear, un-branched chains, while LDPE chains are branched.

Plastic grocery bags have been a part of daily life in developed countries since their introduction in 1977 (Williamson, 2003), and in more recent years, their use has spread too many developing countries as well (Environmental Literacy Council, 2005). Unfortunately, the most common final resting place for garbage bags is the garbage bin, resulting in countless numbers of bags filling landfills and spilling over onto essentially every other surface

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Table 1: Different Forms and Characteristics of Polyethylene and their Use

Form	Acronym	Recycle Code	Characteristics	Common Uses
high density	HDPE		hard to semi-flexible, waxy surface, opaque	fertiliser bags, car petrol tanks, gas pipe, tanks and rope
low density	LDPE		soft, flexible, waxy surface, translucent	packaging film, bags, waterproof membranes, wire sheathing, pipes
linear low density	LLDPE		flexible, translucent, glossy, strong	shopping bags, stretch wrap, greenhouse film

Source: Retrieved from internet

of the planet (Chauhan, 2003). Plastic bags are indestructible. Plastic bags take between 20 and 1000 years to break down in the environment. Even when they do break down they are not really gone. Plastic bags do not bio-degrade. They simply break apart into ever smaller pieces, eventually forming "plastic dust." No matter how large or small they are, plastic bits are not digestible by any creature on land, in the air, or under the sea. Due to many factors, not the least of which is their ready availability, 96 per cent of all grocery bags are thrown into landfills (Williamson, 2003). However, plastic bags decompose very slowly, if at all. In fact, a bag can last up to 1000 years, inhibiting the breakdown of biodegradable materials around or in it (Stevens, 2001). To exacerbate the problems of air and water pollution, most plastic shopping bags are made in countries with few environmental regulations, such as China, which results in even greater impacts on the environment and human health (Matlack, 2001). Impacts on human health are perhaps the most serious of the effects associated with plastic grocery bags, ranging from health problems associated with emissions, to death. Earlier this year, the city of Mumbai, India experienced massive monsoon flooding, resulting in at least 1,000 deaths, with additional people suffering injuries (The Asian News, 2005). City officials blamed the destructive floods on plastic bags which clogged gutters and drains, preventing the rainwater from leaving the city through underground systems. Similar flooding happened in 1988 and 1998 in Bangladesh, which led to the banning of plastic bags in 2002 (Environmental Literacy Council, 2005; World Watch, 2004). By clogging sewer pipes, plastic grocery bags also create stagnant water; stagnant water produces the ideal habitat for mosquitoes and other parasites which have the potential to spread a large number of diseases, such as encephalitis and dengue fever, but most notably malaria (Edu Green, 2005; Environmental Literacy Council, 2005; IRIN, 2005a; IRIN, 2005b; U. S. Environmental Protection Agency, 2005). This paper is about the banning problem of huge use of plastic carry bags. People of Krishnagar municipality know the problem of it. But they are not motivated to "say no to plastic bags". In this circumstance the present dissertation paper is trying to focus on 'Problem of Banning **of** Plastic Carry Bags: A Case Study of Krishnagar Municipality, West Bengal.

The Study Area

Krishnagar Municipality is a class 1 city and it is the district head quarter of Nadia, West Bengal, Krishnagar is situated on the almost middle part of Nadia, on the of the River Jalangi. Krishnagar is located within 23º25 ′-23º23 ′40 ″N and 88º28 ′40 ″-88º31 ′15 ″E coordinates. Area of Krishnagar Municipality is 15.96 km^2 with 24 wards. Total population of the town is 1, 39,110 with density 8716 per sq. km.

Objectives

This dissertation paper is an attempt to study plastic carry bag problem of Krishnagar Municipality Area. My main objective is to find out the attitudes of sellers and customers to use the plastic carry bags and it's after use problems in the environment. The central questions are designed below to fulfill my objective:

- To assess the quantity of plastic carry bags used in Krishnagar Municipality.
- To find out effect of waste plastic carry bags on urban environment.
- To find out causes behind banning problems of plastic carry bags in Krishnagar Municipality.
- To bring out some measures for reduction in use of plastic carry bags in Krishnagar Municipality.

Database and Methodology

The database, which is used to analysis in this study are basically of two kinds. Primary data on market wise sellers & customer's types and their attitudes to use of plastic carry bags at Krishnagar

Table 2: Spatial Variation to Produce of Plastic Waste in Krishnagar Municipality Area

NAME OF District / Town / C.D. Block / Out Growth / Village	No of House hold	Popula tion Person	*Average plastic waste Dg / Capita / Day (2013)
Krishnagar (M)	***30991***	***139110***	***75***
Krishnagar (M) - Ward No.1	1517	6864	161
Krishnagar (M) - Ward No.2	639	2732	86
Krishnagar (M) - Ward No.3	1831	8597	105
Krishnagar (M) - Ward No.4	1949	9472	101
Krishnagar (M) - Ward No.5	1486	6329	97
Krishnagar (M) - Ward No.6	1227	5402	52
Krishnagar (M) - Ward No.7	1069	4621	48
Krishnagar (M) - Ward No.8	1677	7756	74
Krishnagar (M) - Ward No.9	887	4103	94
Krishnagar (M) - Ward No.10	1485	6901	95
Krishnagar (M) - Ward No.11	1032	4661	54
Krishnagar (M) - Ward No.12	1464	6092	101
Krishnagar (M) - Ward No.13	1084	4708	52
Krishnagar (M) - Ward No.14	1238	5141	94
Krishnagar (M) - Ward No.15	1070	4765	49
Krishnagar (M) - Ward No.16	1186	5468	62
Krishnagar (M) - Ward No.17	1417	6787	75.2
Krishnagar (M) - Ward No.18	1223	6263	42
Krishnagar (M) - Ward No.19	1100	4538	54
Krishnagar (M) - Ward No.20	945	4008	49
Krishnagar (M) - Ward No.21	977	4241	34
Krishnagar (M) - Ward No.22	1116	4805	68
Krishnagar (M) - Ward No.23	1186	5020	59
Krishnagar (M) - Ward No.24	2186	9836	95

Source: Census of India, 2001 *Primary Survey, 2012

Decadal Change in Production of Plastic Waste

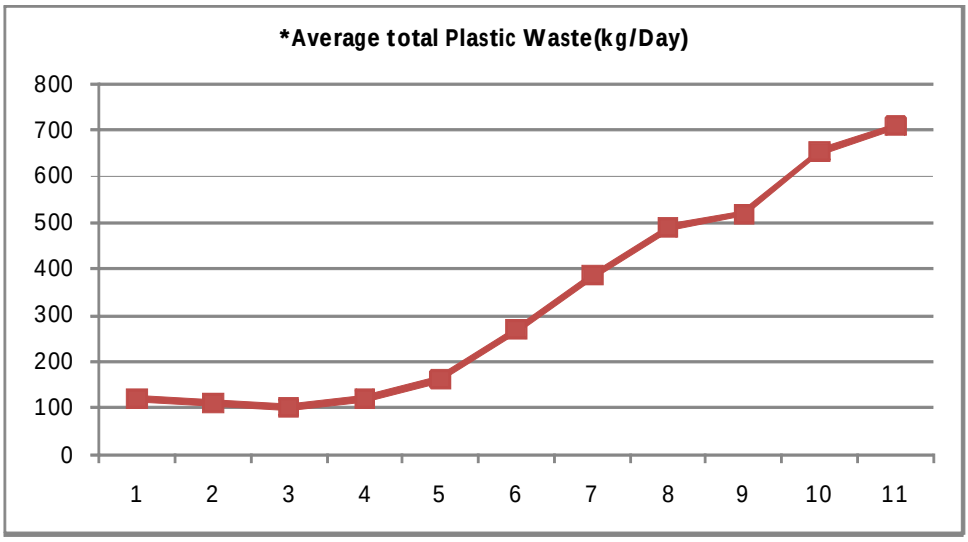

Fig. 1

Table 3: Temporal Variation in Production of Plastic Waste in Krishnagar Municipality Area

Year	Total Urban Population	*Average Plastic Waste (dg/Capita/day)	*Average Total Plastic Waste(kg/Day)
1901	24547	49	120.28
1911	23475	48	112.68
1921	22309	46	102.62
1931	24284	50	121.42
1941	32016	51	163.28
1951	50042	54	270.23
1961	70440	55	387.42
1971	85923	57	489.76
1981	98141	53	520.15
1991	121110	54	653.99
2001	139110	51	709.46

Source: Krishnagar Municipal Authority

Municipality were collected from field survey. Field survey on different word was also done for noting the location of dumping ground and waste land by plastic carry bag gathering. Secondary Data on Actual location and numbers of dustbin, dumping ground and data about proposed dustbin or dumping ground were collected from Krishnagar Municipality. Ward wise distribution of population was collected from census of India, 2001.

In order to fulfill the objectives of the paper collected data were arranged, analyzed and presented graphically applying simple statics, arithmetic and MS Excel. Average plastic waste per ward was calculated from weekly dump of plastic

Destination of Used Up Carry Bags

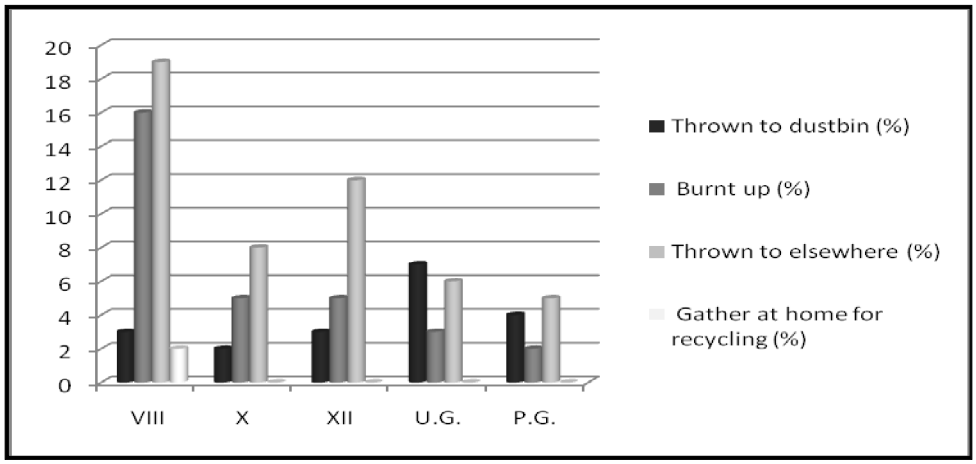

Fig. 2

waste by the corresponding ward divided by 7 and the number of population of the ward concern. Temporal increase in production of plastic waste was pictured in simple trend line. Arithmetic comparisons are used in studying variations in attitudes of users.

Findings and Discussions

Among 24 words, 1 no. ward produces the highest amount of plastic waste (161 decigrams / day / capita and 21 no. ward produces the lowest amount of plastic waste (34 decigrams / day / capita. Production of plastic carry bags waste is intermediate between these two extremes and is shown in the table 2. But crucial is that the use of plastic carry bags are increasing rapidly which is also revealed in case of Krishngar municipality (Figure 1, Table 2).

After using 80 percent plastic carry bag, often it is thrown to elsewhere. Then the plastic carry bag is gathered in the drain by the wind, water and man. Then it obstacles the natural flow of water through the drainage system. Thus stagnant sewage water creates pollution. As a result cholera, malaria, etc prevails. Burning of plastic carry bag produces carbon-monoxide and hydrogen-cyanide and then acid rain and associated problems to human society.

After uses the plastic carry bags 19 percent people, of whom maximum persons are highly educated, throw the plastic bags to dustbin. 31 percent people of whom maximum people are less educated, burn them and 50 percent people of whom less educated persons are maximum throw the bags elsewhere as they wish. It causes environmental pollution. Even only 2 percent people store them in their houses.

After uses the plastic carry bags are treated numerously. 19 percent people of whom maximum are service men throw the plastic bags to dustbin. 31percent people of whom maximum people are farmer or business men, burn them and 50 percent people of whom service men and business men are maximum throw the bags elsewhere as they wish. It causes environmental pollution. Even only 2 percent people who are mainly farmer store the carry bags in their houses.

After uses the plastic carry bags are treated numerously. 19 percent people of whom maximum are females throw the plastic bags to dustbin. 31 percent people of whom maximum people are females burn them and 49 percent people of whom male candidates are maximum throw the bags elsewhere as they wish. It causes environmental pollution. Even only 2 percent people who are mainly male store the carry bags in their houses.

There are 14 percent sellers are against the use of plastic carry bags. Usually they sale their goods with fold up papers and leaves of the Sal tree. Sellers of medicines, books, sweets etc do not

Figure 3 Causes of Receiving Plastic Bags as Shown by Different Users Groups

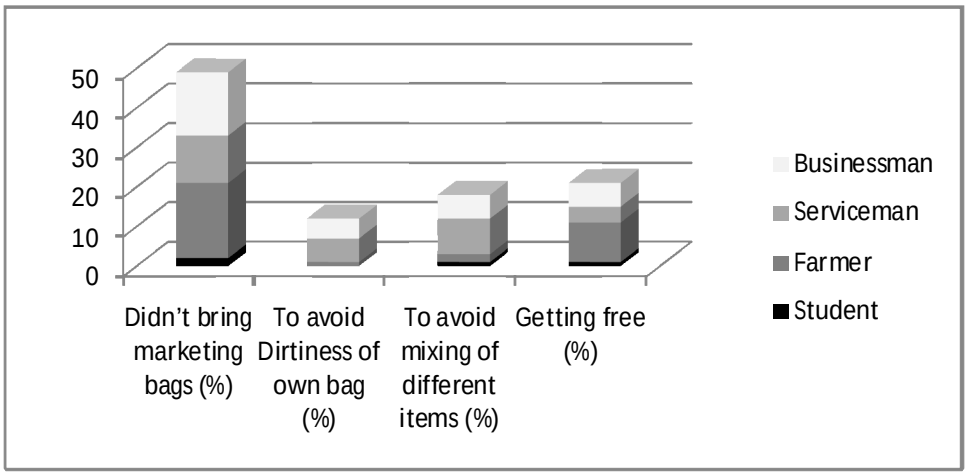

Fig. 3

give plastic carry bags to buyers.

Even 5 percent sellers are not agreed to stop the supply of plastic carry bags because selling of goods very convenient by the plastic carry bags. If administrative division will be forced to the use of plastic carry bags then their business will be faced various problems. Various shopkeeper likes butchery, grocery, etc.

Use of plastic carry bags are banded by the administration officially. But if it is not implemented it will continue to grow.

Attitudes of Customers Towards Banning of Plastic Carry Bags

Attitudes of the customers are diversified. Attendants of customers in case of receiving plastic bags were surveyed education level wise. Here, 49 percent people take carry packets as they don't carry marketing bags with them; among them numbers of less educated persons are high, only 2 percent graduate and 2 percent post graduate people belong to this group.

Even 12 percent people receive plastic bags as they want to avoid dirtiness of their own bags; among them only 5 percent people are highly educated (pg) the rest part belongs to less educated persons. 18 percent people receive plastic carry bags to stop the mixing of the different items and 21 percent people who are mainly less educated receive it as they get plastic bags at free of cost with the goods. (Figure No.2).

Here 49 percent people take carry packets as they don't carry marketing bags with them; among them service men, business men and farmers occupy lion shares and 12 percent people receive plastic bags as they want to avoid dirtiness of their own bags among them service men and business men also take lion shares. 18 percent people of which service men receive plastic carry bags to stop the mixing of the different items. 21 percent people of whom maximum are farmer take plastic bags as they get it at free of cost (as shown in Figure No: 3).

Here 49 percent people take carry packets as they don't carry marketing bags with them; among them females are highest. 12 percent people receive plastic bags as they want to avoid dirtiness of their own bags among them females occupier lion share. 18 percent people of whom 11percent are females and 7 percent are male receive plastic carry bags to stop the mixing of the different items. Lastly 21 percent people of whom 14 percent are females and 8 percent are males take carry bags as they get it at free of costs (Figure no: 4).

Why Someone Rejects Carry-Bags?

Among this category 76 percent people belong to the group who do not receive plastic carry bags as they bring their marketing bags with them.

Attitude of Male and Female to Accept Carry Bags

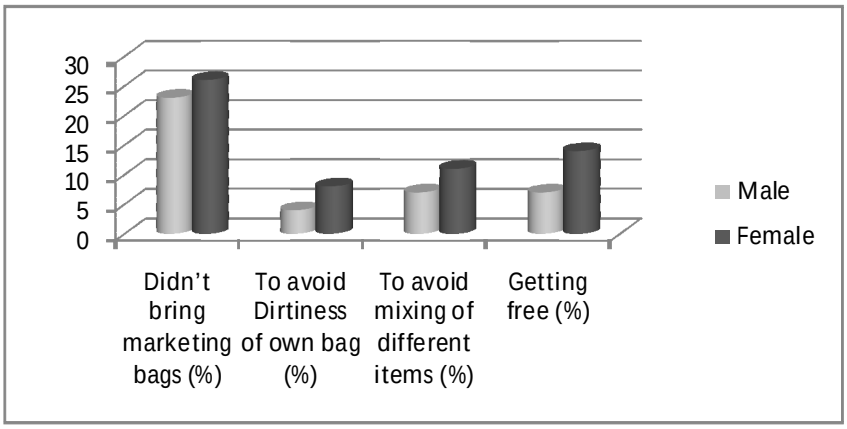

Fig. 4

Among this group, maximum people are less educated but they carry their bags in markets. 20 percent people avoid the plastic carry bags for being conscious of the problems of plastic carry bags to natural environment and only 4 percent people reject plastics for other reasons(as shown in Figure no: 5)

Among this category 75 percent people belong to the group who do not receive plastic carry bags as they bring their marketing bags with them. Among this group, maximum people are service men and business men. 20 percent people avoid the plastic carry bags for being conscious of the problems of plastic carry bags to natural environment and only 5 percent people reject plastics for other reasons. Among this category 75 percent people belong to the group who do not receive plastic carry bags as they bring their marketing bags with them. Among this group 44 percent are male and 31 percent are female. People are service men and business men. 21 percent people avoid the plastic carry bags for being conscious of the problems of plastic carry bags to natural environment and only 5 percent people reject plastics for other reasons.

Municipal Authority's Attitudes

Various kinds of laws are in having

Why Someone Refuges Plastic Carrying Bags

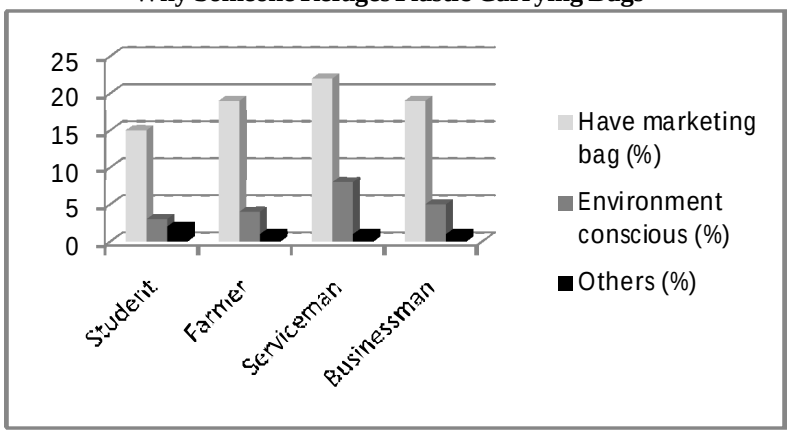

Fig. 5

constitution for banning the plastic carry bags. Municipal authority is very much careful. But they do not take rapidly action because there have not sufficient force in their hand. Many times sellers are fined by the authority but after some days again they supply plastic carry bags. It's not an argument.If we throw the plastic carry bags after use elsewhere, then soil, water and wind will be affected by the harmful elements. So that Municipal authority now a days, have set up some dustbin and managed some toly cars and employed some workers. In this way, we have known that, according to the municipal authority, if the upper administrative division dose not closes the production on company, use of plastic carry bags will be increased day by day.

Conclusion

Plastic carry bags are unquestionably harmful for the planet and for Krishnagar also. So it must be stopped or at least reduced. But -*What can we do?* Learn more about the impact of plastic packaging. Begin today to limit, and then eventually stop, your consumption of plastic bags. We can develop an iron will and a heart of gold to refuse plastic bags. Through alternatives to plastic bags and growing of consciousness, much of the goal is achievable. From the behalf of municipal authority there should be increased the number of dustbin and to compel to use of dust bin after use of plastic carry bags, which they should be set up in the suitable place in the area of market. Quick system of garbage management system should be in operation.

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Assessment of Groundwater Quality Using Physico-Chemical Parameters for Drinkingwater in Kathua Disrict, J&K, India

Shivani Verma* and Mohd. Sarfaraz Asgher**

Abstract

Ground water is a vital natural resource that is used for myriad purposes. Unfortunately, this vital resource is vulnerable due to contamination because of number of factors such as growing population, high rate of urbanisation, over use of pesticides and weedicides in agriculture sector, over extraction of underground water, solid waste disposal etc. In the last decade or so deteriorating water quality has emerged as a major challenge to the sustainability of water resources and so to inclusive growth and development of the country. In this paper an attempt has been made to assess the suitability of groundwater quality for drinking purposes in Kathua District, Jammu and Kashmir. For calculating present water quality status groundwater samples collected from springs, shallow and deep groundwater during pre-monsoon season for the parameters i.e. pH, Electrical Conductivity, CO_3, HCO_3, Cl, NO_3, F, Ca, Mg, Na, K, Fe, Total hardness, have been analyzed. The obtained results are compared with Indian Standard Drinking Water specification IS: 10500-1991 (revised in 2007) and WHO (2004). The study reveals that the concentration of major constituents in the water samples is well within the permissible limits of drinking water except in few cases where concentrations of one or more parameters are high which reveals that the water of the study area is fit for drinking purposes in most of the places except for few pockets which are contaminated.

Key words: Groundwater, Quality, Physico-chemical parameters, Drinking water and Natural resource

Introduction

Out of the total water resources available on the earth, 0.3 percent is available as surface and ground water for human use. As groundwater is the largest available source of fresh water with nearly balanced concentration of the salts for human consumption, it has become crucial not only to find out the groundwater potential zones, but also to monitor and conserve this important resource. The adverse effects on ground water quality are the results of man's activity at ground surface, unintentionally by agriculture, domestic and industrial effluents, unexpectedly by sub-surface or surface disposal of sewage and industrial wastes. Therefore, the quality of ground water varies from place to place, with the depth of water table, and from season to season and is primarily governed by the extent and composition of dissolved solids present in it. Indiscriminate development and unscientific management of this resource has led to multiple problems of decline in groundwater level. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Water quality analysis is one of the most important aspects in groundwater studies. It is necessary to know details about different physico-chemical parameters that are suitable for drinking, agriculture and industrial purposes. Chemical analysis forms the basis of interpretation of the

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quality of water in relation to source, geology, climate, and use. (Kanwar, 2014) Chemicals in drinking water can have acute and toxic effects on humans. WHO established guideline values for potentially hazardous water contaminants. During the last few years, the utilization of surface and groundwater for drinking, industrial and agricultural purposes has increased manifolds but consequently it is observed that the water is polluted and affecting the human health, soil nutrients, livestock, biomass and environment in certain areas. Hence a study has been carried out for the quality of the available groundwater. The present paper is an attempt to assess the quality of springs, shallow and deep ground water/ aquifers for drinking purposes in Kathua district using physico-chemical parameters like i.e. pH, Electrical Conductivity, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Flouride, Calcium, Magnesium, Sodium, Potassium, Iron and Total Hardness.

Location of Study Area

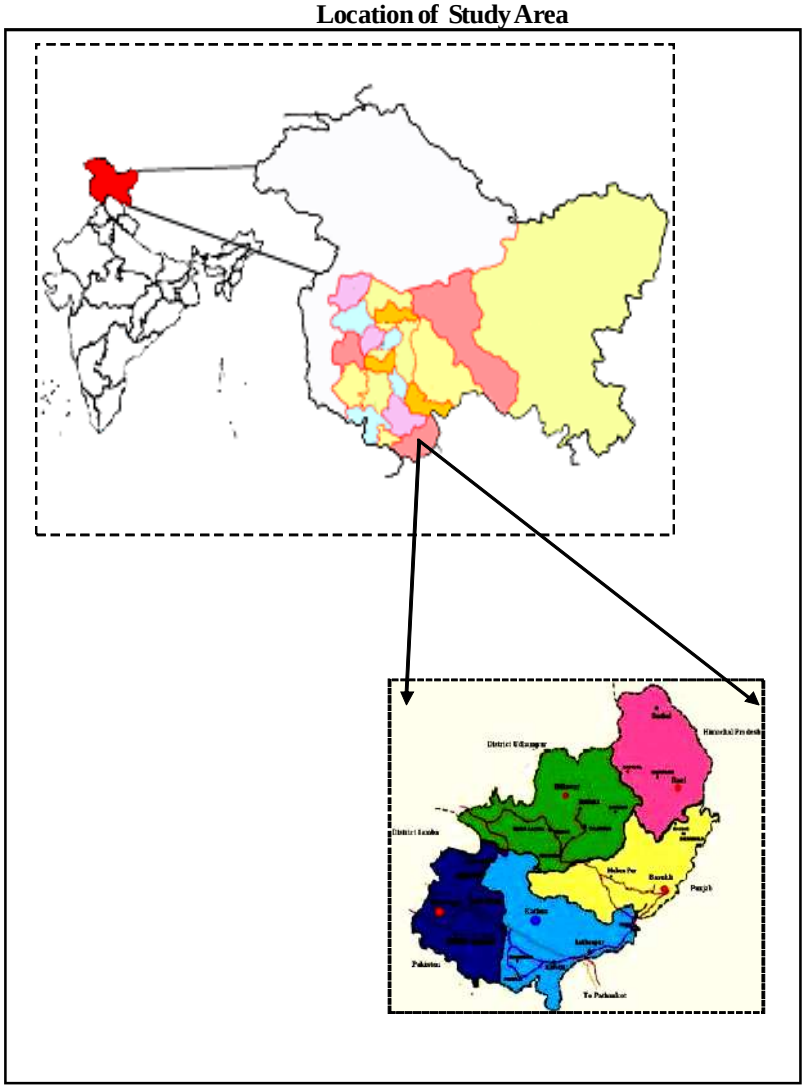

Fig.1

Source: http://kathua.nic.in/img/map.png

Objectives

- To study the general groundwater characteristics of Kathua district.
- To analyze the physico-chemical parameters of groundwater of Kathua district.
- To assess the quality of groundwater for drinking as per standard values given by BIS and WHO.

Database and Methodology

The present study is primarily based on field visit and secondary sources of data. The data related to the present topic has been collected from various offfices of Central and State Govt. The main Govt. Offices through which secondary data has been collected include Central Ground Water Board, NW Himalayan Region, Jammu and Water testing Laboratories. Data of 54 water samples collected from different sources (21 spring water samples, 30 shallow ground water samples i.e < 50m and 3 deep groundwater samples i.e. 50-200m) were monitored at National Hydrograph Network Stations by CGWB. The data was collected from CGWB and the analytical results were utilized to study the quality of groundwater samples. The quality analysis has been carried out for the parameters like pH, electrical conductivity, carbonate, bicarbonate, total hardness, calcium, potassium, magnesium, nitrate, sulphate, sodium, chloride, fluoride and iron by following the standard methods prescribed as per Bureau of Indian Standard (IS 10500-1991) revised in 2007 and WHO (2004) for drinking water.

The Study Area

Kathua is one of the prominent district of Jammu province and is often referred as the "Gateway of J&K". It lies at the southern most end of the State and is located between 34°16'00" to 32°55'00" North Latitude and between 75º06'to 75º54' East Longitude and is covered by SOI degree sheet No. 43 P. Administratively, the district is divided into 05 tehsils (Kathua, Hiranagar, Bani, Basholi and Billawar). The district is endowed with bountiful of rainfall, lots of springs, nalas, rivers and also number of tanks and ponds. Ravi River along with its tributaries namely Ujh, Tarnah and Bein drains the district from east to west.

Results and Discussions

- **Assessment of Groundwater Resources**

Table 1 and 2 give an assessment of the general characteristics of the groundwater resources in Kathua disrict. Of the total groundwater resources of the state, about 20.17 percent area is the command area for groundwater recharge where as the remaining 79.82 percent is non-command area. The total recharge of ground water involves several components and the rainfall being the major one. The other components are seepage from canal and return irrigation flow from surface water and ground water. The rainfall, which is one of the main source of groundwater recharge is uniform in both command as well as non-command area i.e. 1328.62mm but the water is present at much deeper level i.e. 12.68-13.22mbgl in the non command area to a shallower level of 5.06-7.52mbgl in the post and pre monsoon periods respectively. On the whole the total annual groundwater recharge is of the order of 20328.11ha m in the command area whereas 19111.22ha m in the non-command area. On the whole the net annual groundwater availability is 18295.30ha m in the command area and 17200.10ha m in the non command area.

- **Analysis of Physico-Chemical Parameters of Groundwater for Drinking Water Quality as per ISI and WHO Standards**

The suitability of water lies not in quantity but it is intrinsic quality that makes water an important resource for sustainable development. The chemical composition of water is an important factor to be considered before it is used for domestic, irrigation or industrial purposes. The physical and chemical quality of ground water is important in deciding its suitability for drinking purposes. As such the suitability of ground water for potable uses with regard to its chemical quality has to be deciphered and defined on the basis of some vital

characteristics of the water (CGWB, 2010). The standard quality of drinking water has been specified by world health organization (WHO) and ISI. It has given the permissible and desirable limits for the presence of various elements in the groundwater. Table 3, 4 and 5 depicts the water quality parameters of spring, shallow and deep groundwater samples of Kathua district and their comparison with the standard values as prescribed by BIS and WHO. The desirable and permissible limits of values of various parameters have also been listed.

Table 1: Kathua District- General Assessment of Ground Water Resources

Type of Rock Formation	Areal Extent (in Hectares)			
	Total Geographical Area	Hilly Area	Groundwater Recharge Worthy Area	
			Command Area	Non-Command Area
Alluvium	265100	177600	17653 (20.17%)	69847 (79.82%)

Source: Ministry of Water Resources, CGWB, NWHR, Jammu (J&K)

Table 2: Kathua District- General Characteristics of the Groundwater

S.No.	Characteristics		Command Area	Non-command Area	Total
1	Rainfall (mm)		1328.62	1328.62	
2	Rainfall Infiltration Factor		20%		
3	Average Pre-monsoon Water level (mbgl)		7.52	13.22	
4	Average Post-monsoon Water level (mbgl)		5.06	12.68	
5	Pre & Post-monsoon Water level Trend		Rise		
6	Average Fluctuation (m)		2.46	0.54	
7	Recharge from rainfall during monsoon season	In (ha m)	3755.21	14858.13	18613.34
8	Recharge from other sources during monsoon season		11505.15	322.60	11827.75
9	Recharge from rainfall during non-monsoon season		935.60	3701.89	4637.49
10	Recharge from other sources during non-monsoon season		4132.75	228.60	4361.35
11	Total Annual Ground Water Recharge		20328.11	19111.22	39439.33
12	Provision for Natural Discharges		2032.81	1911.12	3943.93
13	Net Annual Ground Water Availability		18295.30	17200.10	35495.40

Source: Ministry of Water Resources, CGWB, NWHR, Jammu (J&K)

- **pH-** pH of solution is taken as negative logarithm of H_2 ions. The pH of ground water in the study area ranges from a minimum value of 6.8 in Gandhir to a maximum of 8.85 in Mandli. When compared with the standard values, the samples are found to be in the permissible limit at most of the places with a few exceptions in shallow ground water samples which have high degree of pH i.e they are alkaline in nature. The shallow groundwater having high pH exceeding the maximum permissible limits for drinking water is found in Lalechak (8.60), Karol Krishna (8.80), Konthal (8.80), Naran (8.80) and

Table 3: Kathua Distict- Water Quality Parameters of Spring Water Samples

S.No	Location	Physio-Chemical Parameters												
		pH	EC µmho/cm	HCO3	Cl	SO4	NO3	F	Ca	Mg	Na	K	TH	Type of Water
				(mg/l)										
1	Kathla	7.78	293	177	9	1	0.1	0.13	42	9	9.9	12	140	$Ca-Mg_2-HCO_3$
2	Bagpan	7.65	281	171	7	1	1.2	0.11	46	6	5.9	18	140	$Ca-HCO_3$
3	Kotli	7.75	357	214	14	1	3.3	0.53	46	9	23	1.9	150	$Ca-Na-HCO_3$
4	Bhatiyari	7.01	200	92	18	1	6.8	0.19	24	6	9.6	0.7	85	$Ca-HCO_3$
5	Dharambota	7.02	330	201	9	1	5	0.19	46	11	10	1	160	$Ca-Mg_2-HCO_3$
6	Kandoli	7.8	320	177	9	1	0.6	0.17	48	7	4	0.5	150	$Ca-HCO_3$
7	Raini	7.02	570	256	43	1	15	0.06	88	28	22	1.9	260	$Ca-Mg_2-HCO_3-Cl$
8	Dher Manpur	7.1	465	275	14	1	20	0.14	62	16	25	2.4	220	$Ca-Mg_2-Na-HCO_3$
9	Raid	7.3	374	238	11	1	0.1	0.2	60	6.1	14	1.8	175	$Ca-HCO_3$
10	Thamillial	7.45	341	201	11	8	0.1	0.01	52	16	9.1	0.9	170	$Ca-Mg_2-HCO_3$
11	Tandi	7.6	225	134	7.1	1	0.1	0.12	38	4.9	4.8	0.4	115	$Ca-HCO_3$
12	Kotla	7.42	515	336	11	10	0.1	0.01	88	15	9.2	1.2	280	$Ca-Mg_2-HCO_3$
13	Jinota	7.55	345	214	11	10	0.1	0.01	48	12	14	1.1	170	$Ca-Mg_2-HCO_3$
14	Chamel	7.25	350	207	7.1	8	7	0.01	91	9.7	9.9	1	175	$Ca-Mg_2-HCO_3$
15	Jolsound	7.1	405	244	14	1	1	0.01	74	6.1	5	1	210	$Ca-HCO_3$
16	Jhoru	7.65	445	268	7.1	12	1.5	0.5	40	6.1	55	4.1	125	$Na-Ca-HCO_3$
17	Khir	6.9	210	116	11	9	3	0.01	32	6.1	8.5	0.6	105	$Ca-Mg_2-HCO_3$
18	Phinter	7.3	460	275	18	15	8	0.01	76	15	11	1	250	$Ca-Mg_2-HCO_3$
19	Kori	7.25	400	232	7.1	1	1.5	0.01	64	7.3	9	0.8	190	$Ca-HCO_3$
20	Gandhir	6.8	258	122	14	5	13	0.01	38	7.3	8.8	0.6	125	$Ca-Mg_2-HCO_3$
21	Malwal	7.2	405	226	11	25	14	0.01	78	7.3	5.5	0.6	225	$Ca-HCO_3$
Values as per IS 10500-1991	Desirable	6.5-8.5	250 WHO	*	250	200	45	1.0	75	30	*	*	300	
	Permissible				1000	400		1.5	200	100			600	

Source: Ministry of Water Resources, CGWB, NWHR, Jammu (J&K)

*- No limits Prescribed

Mandli (8.85) (Fig 3). Due to high pH, water has a bitter taste which makes it unfit for drinking. The high alkalinity of groundwater in certain locations in the study area may be due to the presence of bicarbonate and some salts.

• **EC-** Electrical conductivity of water is a direct function of its total dissolved salts. In the present investigation maximum conductivity 2200 µmhos/cm was observed at Karol Krishna of shallow ground water exceeding desirable limits for drinking water and minimum of 175 µmhos/cm at Krakhar of deep ground water. Out of the total 54 samples only 13 samples are having EC as per the limits prescribed by WHO (Fig 4). The remaining samples have high EC. This may be due to the increased dissolution of salts along with the monsoon rains into the groundwater.

• **Carbonate (CO_3) –** Whenever the pH touches 8.3, the presence of carbonates is indicated. Groundwater samples collected from spring and deep aquifer are having pH less than 8.3. So, no carbonate is found to be present in their water. 13 water samples out of the 30 shallow groundwater samples are having pH greater than 8.3 and their carbonate value ranges from 6 mg/l to a maximum of 48mg/l in Karol Krishna.

• **Bicarbonate (HCO_3) -** Bicarbonates concentration in water relies on pH and is usually less than 500 mg/l in groundwater. From an analysis of the data, the value of HCO_3 ranges from 677 mg/l in Karol

Table 4: Kathua District- Water Quality Parameters of Shallow Groundwater Samples

S.No	Location	Physico-Chemical Parameters													
		pH	EC µmhos/cm	CO3	HCO3	Cl	SO4	NO3	F	Ca	Mg	Na	K	Fe	TH	Type of Water
				mg/l												
1	Bhaoowal	8.45	190	6	98	7.1	Tr	2.8	0.19	22	7.2	8.7	1.7	Tr	85	Ca Mg HCO3
2	Chakkhatraian	7.80	220	0	172	11	Tr	4.7	0.08	26	7.2	10	1.8	0.52	95	Ca Mg HCO3
3	Chamanpa	8.05	340	0	220	7.1	6	Tr	0.26	58	8.5	7	1.8	0.12	180	Ca HCO3
4	Dubrechak	8.45	800	18	348	71	12	Tr	0.24	18	38	67	65	0.65	200	Mg Na HCO3
5	Feruchak	8.19	260	0	134	14	Tr	8.9	0.2	26	11	14	0.7	0.25	105	Ca-Mg-Na -HCO3
6	Gadyal	8.40	210	6	98	11	5	3.9	0.15	22	8.5	12	1.4	Tr	90	Ca-Mg-Na -HCO3
7	Jandi	8.25	1340	0	281	132	115	217	0.32	32	91	79	69	Tr	455	Mg-Na-HCO3-Cl-NO3
8	Kanal Krishna	8.80	2200	48	677	327	35	2.7	0.05	6	62	275	210	0.22	270	Na K Mg HCO3 Cl
9	Kathua	8.25	570	0	195	71	25	13	Tr	60	13	38	8.9	Tr	205	Ca Na HCO3 Cl
10	Kharpur	8.47	230	6	128	11	Tr	4.4	0.1	30	7.2	10	1.2	Tr	105	Ca-Mg-HCO3
11	Khukhial	8.45	1100	18	598	67	16	15	0.22	124	29	49	84	Tr	430	Ca HCO3
12	Konthal	8.00	260	12	73	25	Tr	14	0.1	12	15	18	0.9	0.95	90	Mg Na Ca HCO3 Cl
13	Kootah	7.90	540	0	262	36	Tr	23	0.1	82	11	14	3.4	Tr	430	Ca HCO3
14	Lakhanpur	8.16	250	0	140	11	Tr	3.7	0.18	34	6	9.7	1.8	1.74	110	Ca-HCO3
15	Lalechak	8.60	250	12	110	14	Tr	2.8	0.21	20	11	14	4.2	0.11	95	Ca-Mg-Na-HCO3
16	Londi	8.49	1930	30	439	323	160	4.4	0.8	50	108	200	35	Tr	570	Mg Na HCO3
17	Madhin	8.32	640	18	354	18	15	15	0.39	84	26	25	4.7	1.1	315	Ca-Mg-HCO3
18	Mukandpur	7.80	430	0	238	11	12	16	0.14	50	15	14	19	0.25	185	Ca-Mg-HCO3
19	Nagri	7.90	390	0	201	25	Tr	11	0.3	48	15	12	3	2.8	1180	Ca-Mg-HCO3
20	Nawan	8.80	250	12	159	7.1	Tr	Tr	0.12	8	22	20	2	Tr	110	Mg-Na-HCO3
21	Nicha	8.04	270	0	183	5.3	Tr	3.4	0.18	50	6	6.1	1.5	2.72	150	Ca-HCO3
22	Kotepanu	7.90	320	0	189	12	8	Tr	0.17	36	12	16	5.7	0.72	140	Ca-Mg-HCO3
23	Pansar	8.12	530	0	342	11	16	Tr	0.23	34	28	49	5.6	Tr	200	Mg-Na-Ca-HCO3
24	Parmala	7.97	310	0	128	18	20	4.5	Tr	32	6	19	1	14.7	80	Ca-Na-HCO3
25	Phangyal	8.10	220	0	122	21	Tr	5.3	0.15	18	13	14	1.5	0.39	100	Mg-Ca-Na-HCO3-Cl
26	Phinder	8.15	360	0	139	28	10	9	0.16	44	11	23	7.8	0.27	155	Ca Na Mg HCO3
27	Rajpura Gujroo	7.90	740	0	67	142	40	86	Tr	74	18	48	4	0.46	260	Ca Na Mg HCO3
28	Ramdi	8.85	550	12	220	39	15	3.2	0.15	4	15	92	3	2.60	70	Na Mg HCO3
29	Rawakot	8.40	270	6	140	21	Tr	5.3	0.05	12	17	26	1.3	Tr	100	Mg Na HCO3 Cl
30	Sukrunar	8.19	320	0	153	32	Tr	6.9	0.38	20	8.5	41	1.2	2.32	85	Na Ca HCO3 Cl
Values as per IS 10500-1991	Desirable	6.5-8.5	250 WHO	*	*	250	200	45	1.0	75	30	*	*	0.3	300	———
	Permissible					1000	400		1.5	200	100			1	600	

Source- Ministry of Water Resources, CGWB, NWHR, Jammu (J&K)

*- No limits Prescribed

Table 5: Kathua District- Water Quality Parameters of Deep Groundwater Samples

S.No	Location	Physico-Chemical Parameters													Type of Water
		pH	EC µmho s/cm	HCO3	Cl	SO4	NO3	F	Ca	Mg	Na	K	Fe	TH	
				(mg/l)											
1	Krakhar	7.41	175	98	7.1	Tr	5.2	Tr	22	6	5.7	1.7	0.2	80	Ca-Mg-HCO3
2	Janglote	7.1	180	85	8.9	Tr	8.2	0.2	18	6	6.7	1.2	1.1	70	Ca-Mg-HCO3
3	Lower Kharote	7.7	210	73	18	5	21	Tr	34	1.2	6.9	2.8	1.2	90	Ca-Mg-HCO3-Cl
Values as per IS 10500-1991	Desirable	6.5-8.5	250 WHO	*	250	200	45	1.0	75	30	*	*	0.3	300	
	Permissible				1000	400		1.5	200	100			1	600	

Source: Ministry of Water Resources, CGWB, NWHR, Jammu (J&K)
*- No limits Prescribed

Locations with pH Graters then Permissible Limit

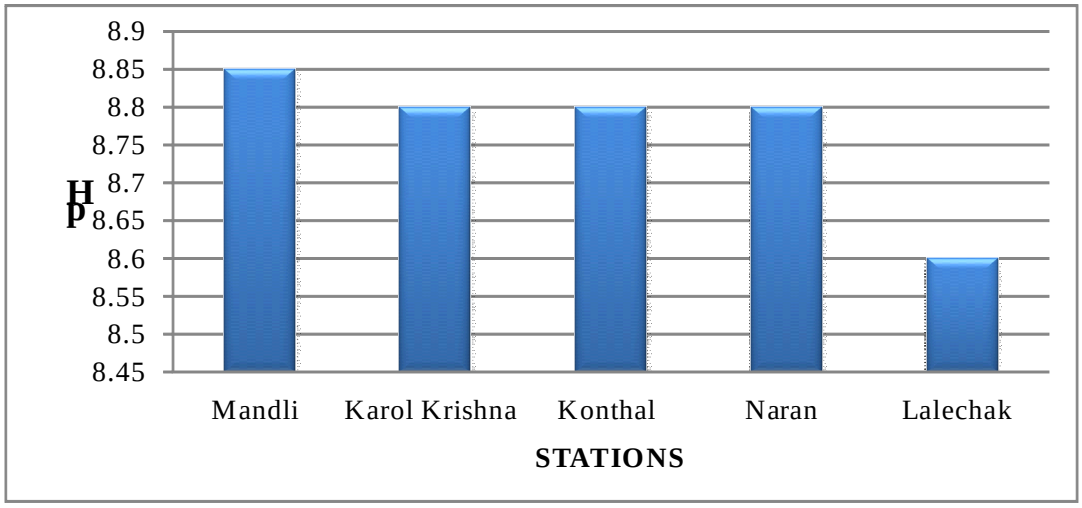

Fig. 2

Elecrical Conductivity

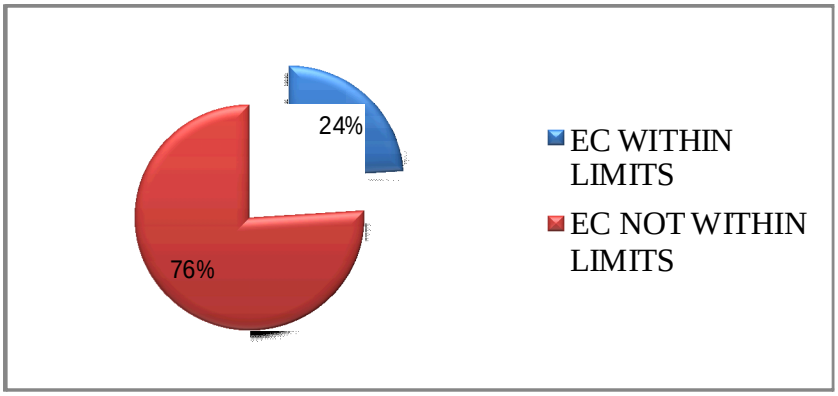

Fig. 3

Krishna to 67 mg/l in Nagrota Gujroo. (Both shallow groundwater) All of the stations have HCO_3 content less than 500 mg/l except for the one mentioned and Khukhial (598 mg/l). Bicarbonates affect alkalinity and hardness of water. The weathering of rocks add bicarbonate content in water.

• **Chloride (Cl) -** Chloride is mainly obtained from the dissolution of salts of hydrochloric acid as table salt (NaCl). Chloride values for almost all the stations are within the permissible limits

Stations with Ca Greater Then Permissible Limit

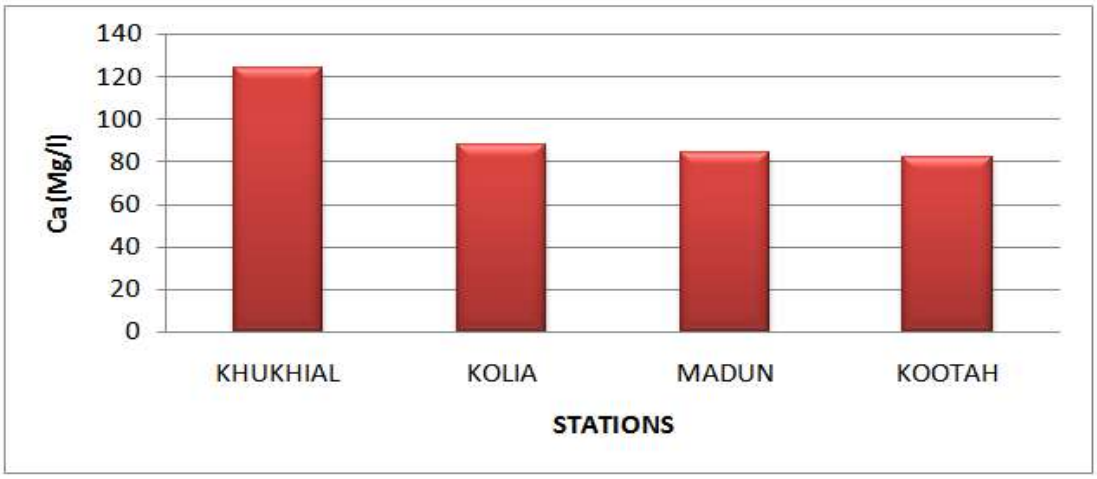

Fig. 4

except for two i.e. Karol Krishna (327 mg/l) and Londi (323 mg/l) in shallow aquifer. It is added through activities carried out in agricultural area, industrial waste, sewage, trade wastes.

• **Sulphate (SO_4) -** The sulphate ion is one of the important anion present in natural water. All the groundwater samples collected from spring, shallow and deep aquifers have sulphate content ranging from 1 mg/l in Baggan to 25 mg/l in Makwal and are within the desirable limit for drinking water. In some samples, sulphate content is found in traces.

• **Nitrate (NO_3) -** Nitrate is present in groundwater and mainly it is a form of N_2 compound. In the study area, the very high nitrate concentration is found in only 2 stations viz Jandi (217 mg/l) and

Value of Iron

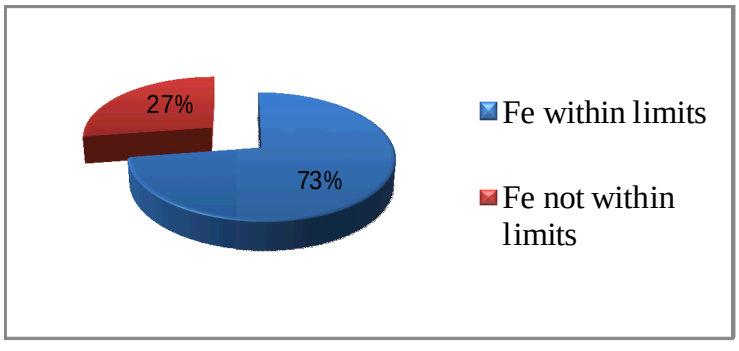

Fig. 5

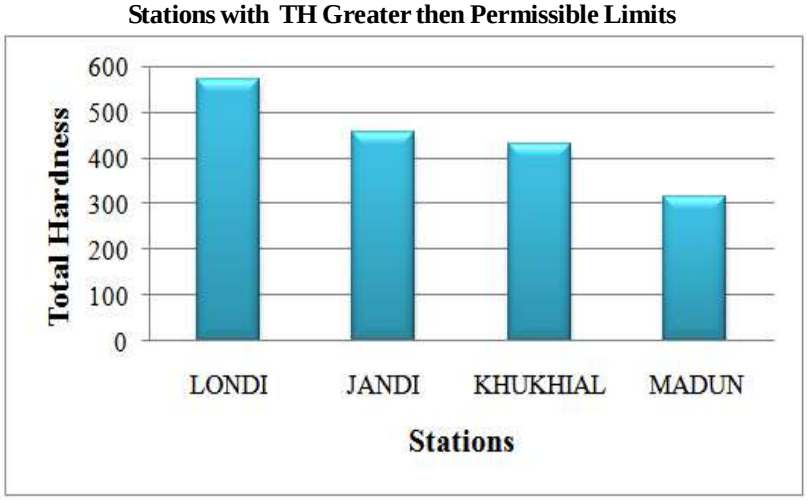

Fig. 6

Nagrota Gujroo (86 mg/l) exceeding the desirable limits for drinking water. In some samples, nitrate content is found in traces while other samples have nitrate concentration within desirable limits. The higher values of nitrate are the most common indication of agricultural impact on groundwater quality.

• **Flouride (F) -** Fluoride is one of the main trace elements in groundwater which generally occurs as a natural constituent. Concentrations of fluoride in samples taken from the study area varied from 0.01 mg/l in no of stations to 0.85 mg/l in Karol Krishna. Flouride values for almost all the stations are within the permissible limits.

• **Calcium (Ca) -** Calcium has high solubility and is very common in groundwater because of its availability in all kinds of rocks. Maximum concentration is found in Khukhial (124 mg/l) and minimum at Mandli (4 mg/l). From an analysis of the data, it is concluded that high concentration of Ca ions is found in Khukhial (124 mg/l), Kolia (88 mg/l), Madun (84 mg/l) and Kootah (82 mg/l) (Fig 5). Rest of the water samples have calcium content as desired. The sources of calcium are various types of rocks, industrial waste and sewage.

• **Magnesium (Mg) -** Magnesium is a natural constituent of water. Maximum concentration of Mg is observed in Londi of shallow aquifer i.e. 108 mg/l and minimum in Lower Kharote (1.2 mg/l). At higher concentration, it is considered as laxative agent and has unpleasant taste. In the study area, most of the locations are having low concentration of Mg. Such a low concentration somewhat effects health of residents as it is essential for human body.

• **Sodium (Na) -** Sodium is a silver white metallic element and found in less quantity in water. It is analyzed that the concentration of Na in spring and deeper aquifer is less with respect to shallow aquifer. Maximum presence is found in water sample from Karol Krishna (275 mg/l) of shallow water and minimum in Kardoh (4 mg/l) of spring water.

• **Potassium (K) -** Potassium is silver white alkali which is highly reactive with water. Only one location i.e. Karol Krishna has a greater amount of K i.e. 210 mg/l. Rest of the values of 54 stations lie between 0.4 mg/l in Tandi to 84 mg/l in Khukhial.

• **Iron (Fe) -** Iron is an essential element in the body system, being a metal that couple with ligand which constitutes blood. Out of the 33 groundwater samples tested for Fe concentration 9 samples are having Fe concentration exceeding maximum permissible limits for drinking water (Fig 6). Highest concentration is found in Parnala shallow groundwater station i.e 14.7 mg/l which is far above

the worst condition. At some places it is found in traces.

• **Total Hardness (TH) -** Hard water is characterized with high mineral contents that are usually not harmful for humans. Groundwater in the area exceeding the limit of 300 mg/l as $CaCO_3$ are 4 stations i.e. Londi (570 mg/l), Jandi (455 mg/l), Khukhial (430 mg/l) and Madun (315 mg/l) is considered to be hard (Fig 7). This may be due to solid waste leachate and geology of the rocks. Rest of the water samples have total hardness within the desirable limit for drinking water.

Conclusion

The analysis of ground water samples being collected from the different stations of Kathua district reveals that almost all water quality parameters i.e (pH, electrical conductivity, total hardness, calcium, magnesium, chloride, nitrate, fluoride etc.) do not comply with BIS and WHO standards. However most of them are within the standard limits. Majority of the groundwater samples satisfy the required quality needed for drinking uses. In general, most of the water from shallow wells in Outer Plains is suitable for drinking purposes. The results of current study indicate that the drinking water, used by the people residing in villages of Kathua district is potable except some few pockets which are contaminated. Village Nagriparole has been demarcated as the water challenge for J&K state because of contamination due to iron. Sustainability in water quantity must imply sustainability in water quality. Contaminated groundwater resources cannot be used as a resource. Therefore, every effort should be taken to ensure that groundwater quality is preserved for the benefit of present and future generations. The analysis reveals that the groundwater of some areas need some degree of treatment before consumption and it also needs to be protected from contamination. Care needs to be taken to monitor the interaction between the geological formations in the area and the groundwater, especially in the present scenario of over extraction of groundwater. Based on these results and analysis of water samples, it is also recommended to use water only after boiling and filtering or by reverse osmosis treatment for drinking purpose by the individuals to prevent adverse health effects. It is recommended that water analysis should be carried out from time to time to monitor the rate and kind of contamination.

Acknowledgement

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The Reality of Food Scarcity in Madhaya Pradesh: Is it a Glimpse or Not ?

Kalyan Sunder Som* and Ghansham Prasad Jhariya**

Abstract

Food scarcity has emerged as a matter of great concern through all over the world due to uncontrolled and unregulated growth of population. The majority of population are living below the poverty line and suffer from hunger and malnutrition and not able to access sufficient amount of food. Therefore, this study tries to find out the deficit or surplus production of food availability in terms of their total population in the study area. It also ascertains the population pressure, demand and supply of food stuff and demarcation of insecure areas. Secondary source of data have been used for the measurement of food scarcity, in the way consumption of net food available in terms of caloric value minus the consumption by the weighted total population (Noor Mohammad, dec.2002).

The scenario of 2005-06 is 57.78 percent districts have insufficient food in terms of their population. On the other hand after 5 years, there are only 22 percent districts are deficit in term of food availability where Burhanpur is the most deficit (56 percent) district .While 20 percent district are highly surplus district in the state where Harda and Hoshangabad districts are very high surplus district (5 times and 3.95 times) in term of food availability(2011). The drastic change (agriculture transformation) is happened due to government intervention in the agricultural sector.

Key words: Population pressure, Deficit or surplus region, Caloric value method and Agriculture transformation.

Introduction

Food scarcity means the lack of food grains and privation of food in a sufficient amount of nutrition in global, national, commodity or household level. There is a close relationship between nutrition and health. Nutrition plays very significance role in the attainment of normal growth and development and in the maintenance of health throughout the life. Population plays a decisive role in the human endeavor to attain food because food is intimately related to their economic as well social progress and peace (Sharma, 2007).

Population growth is an important pervasive phenomenon in the world. Its survival depends upon many daily needs and food is one of them. Global population has grown at an exponential rate, current numbers are estimated around more than 7 billion and are expected to rise 9.3 billion in 2050 (Olimer and Gurman, 2011). India has 121.01 crore population, which makes it as the second most populous country of the world. Agriculture is the primary base of India‘s economy, where 72 percent population is distributed among the villages and depends upon agricultural livelihood. Agriculture is a significant part of Indian economy. But inadequate agriculture development, paired with a rapid growth of population have made increasingly vulnerable to food scarcity and relied on food import.

In Madhya Pradesh, where per capita income as well as industrial development are low; a large

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portion of population are living under the below poverty line (37.43 percent) and where agriculture provides employment to three-fourths (71.5percent) of main workers; the food security of people predominantly depends on local agricultural production. Of course, production of food grains increased (from 7380 thousand tonnes in 1970-71 to 10184.9 thousand tonnes in 2000-01, recording growth of 38 percent) during later half of the century, but it could not keep pace with the growth of population (101.2 percent during the same period). At the same time, agricultural transformation has taken place and has established distinctive type of crop production system even in this backward state. Proportion of food crops in total cropped area is declining with the increasing commercialization of farming. Commercialization has direct bearing on availability of food grains. For example, proportion of area under all food crops declined from 78.16 percent in 1950-51 to 59.95 percent in 1999-2000. As a result per capita production of food grains declined from 673 gm in 1970-71 to 462 gm in 2000-01.

In spite of increasing yield rate the modernization of agriculture, use of high yielding variety of seeds the food grains production is increased 10185 thousand tonnes in 2000-01 to 23070.3 thousand tonnes in 2011-12. Thus per capita production of food grains is also increased and arrives at 870 gm per day. That means improvement of yield rate per hectare production of food grains in the state. Impact of this increasing availability, Madhya Pradesh has received "Krashi Karman Award" of year 2013 and 2014. So the glimpse of reality for food scarcity in Madhya Pradesh must be investigated.

Objectives

Food scarcity has emerged as a matter of great concern all over the world due to uncontrolled and unregulated growth of population .For this purpose this study will try to find out the deficit or surplus production of food availability in terms of their total population in the study area. It also ascertains the population pressure, demand and supply of food stuff and demarcation of insecure areas.

Database and Methodology

Present study is based on secondary source of data collected from various published reports of government i.e. directorate of agriculture, Government of Madhya Pradesh, Bhopal (2009-2011) and population related data have been collected from the PCA of Madhya Pradesh, 2011.

The method to measure food deficit or surplus regions is based on the consumption of net food available in terms of caloric value minus the consumption by the weighted total population (Noor Mohammad 2002).

Food availability has been worked out at district level by taking triennium average data of agricultural produce for the years 2009-10, 2010-11 and 2011-12. There are sources of leakage e.g. losses in transport and storage, destruction by insects and pests, kitchen waste, use of seeds etc., along with the production and consumption of agricultural product also the precise data for all these aspects are not available. Therefore, according to Chakravarty (1970), the total production of wastage, cattle feed and seed come out to be 16.8 percent of the total gross production. The co-efficient production is, therefore 0.832. This is the availability of food.

This population consists of the persons who belong to a different demographic and socio-economic condition, but the requirement of food is either in weight or caloric value varies accounting to the age, sex, occupation, body size, income, culture and climate. Hence, as for Singh's scale of consumption unit, the population is equal to 0.773 consumption unit or 1000 persons are equal to 773 consumption unit. Therefore, the population of each district has been multiplied by the co-efficient of 0.773 in order to get the consumption unit of the population. In the present study has been worked out in terms of caloric value which ascertains the access to food.

The Study Area

Madhya Pradesh is the second largest state of the country with an area of 308245 km^2 constituting 9.38 percent of total geographical area of the country. (Figure:1) It lies between latitude of 21°17' N and 26°52'N and the

longitudes of 78°08'E and 82°49'E. physiologically, the state can be divided into four regions, viz. the low lying area of north and north west of Gwalior, Malwa plateau, Satpura and Vindhyan range. Betwa, Chambal, Son and Narmada are four important river of the state. The rainfall decrease from eastern and south eastern side to western and north-western side, the average annual rainfall varies from 800 mm to about 1800 mm. Annual range of temperature varies from 22.5°C to 25°C. (Kumar, Pramila)

Agriculture and its allied sectors, including horticulture, sheep rearing, animal husbandry and fisheries are the core sectors of the state economy and major contributors to the state GDP. There are 11 agro –climatic regions which differs from each other in productivity.

The total population of the state is 72597565

Location of the Study Area

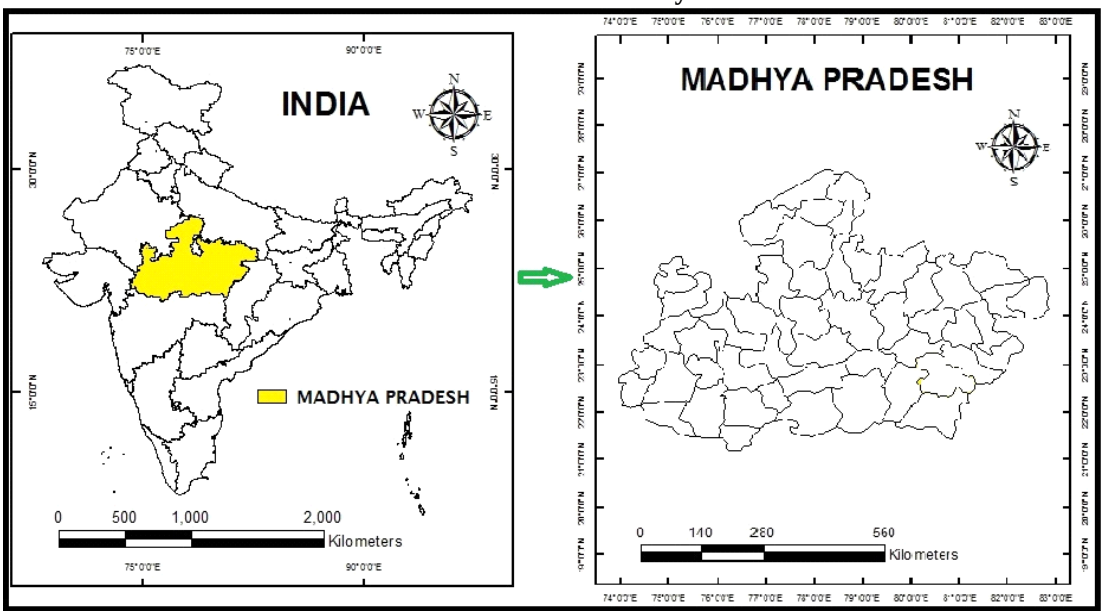


Fig. 1

(census2011) which constitute 5.998 percent of the country's population. The total population has been divided into 72.37 percent rural population and 27.63 percent urban population. The population density is 236 Person per km^2.

Result and Discussion

Demands and Production of Food Grain in the State: an Overview

One average man requires 60 gm proteins and 2550 calories energy; for which 268 gm rice, 137

Table 1: Requirement and Production of Food Grains in Madhya Pradesh, 2011 (In Thousand Tonnes)

Crops	Requirements	Production	Difference
Rice	7101.5	2279.9	-4821.6
Wheat	3630.2	14544.4	10914.2
Coarse grains	2013.9	2382.7	368.9
Pulses	2013.9	3718.6	1704.8
Total	**14759.5**	**23070.3**	**8310.8**

Sources: Based on Agricultural Statistics, Directorate of Agriculture, Govt. of Madhya Pradesh, Bhopal, 2001-12 and Census of India, M.P. 2011.

gm wheat, 76 gm pulses and 76 gm coarse grains are required. Principal source of foodstuffs in this state are cereals and pulses and more than two-thirds of the cropped area is devoted to these crops. Production of total food grains was 23070.3 thousand tonnes in 2011-12. Total population is 75.29 million in 2011. Thus per capita production of foodgrains arrives at 870 gm per day. Taking this average and considering population of 2011, requirements and production of these commodities are calculated and presented in the table-1.

Accordingly, total requirements of rice is 7101.5 thousand tonnes while the actual production is only 2279.9 thousand tonnes in the state, thus there is an overall deficiency of 4821.6 thousand tonnes. Fortunately production of other cereals and pulses are higher than their demand, although it is remarkable that Madhya Pradesh is the highest surplus producer of wheat and pulses in the country.

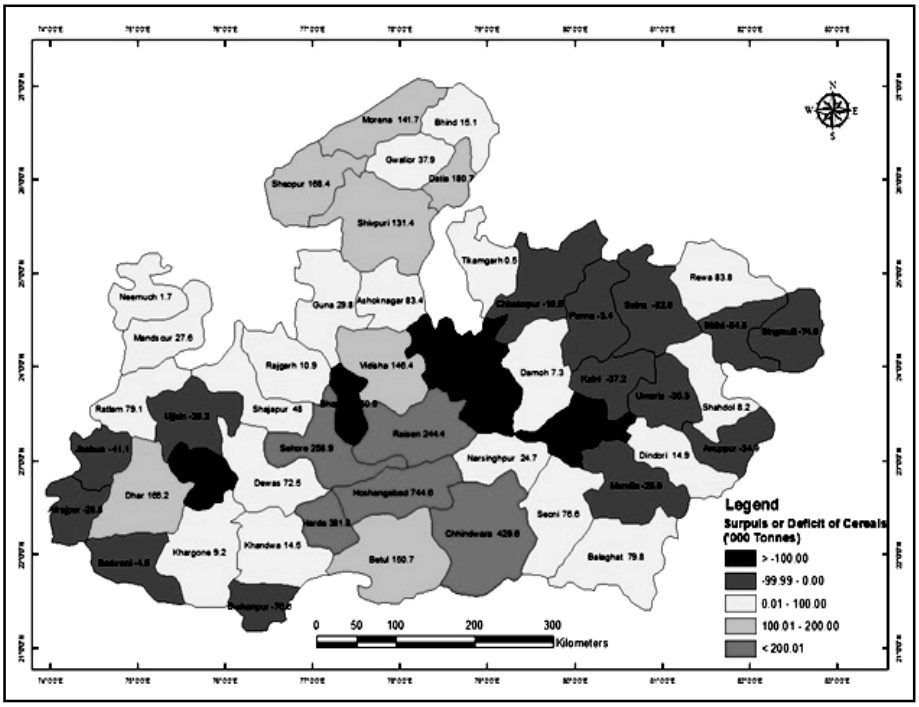
It is evident from the table 1 that total production (thousand 23070.3 tonnes) of foodgrains is higher than the total requirements (14759.5 thousand tonnes).

Temporal Change of Food Grain Production in the State

The proportion of area under all food crops is 78.16 percent in 1950-51 and declined 18.21 percent during 1951 to 2000. As a result per capita production of food grains declined from 673 gm in 1970-71 to 462 gm in 2000-01, while from 2001 the agricultural productions as well as per capita production of food grains are continually increased. The total food grain production of the year 2001 was 10184.9 thousand tonnes and it had been increased 23070.3 thousand tonnes in 2011. In 2011only rice crops deficit in reference of requirements of food for per head production otherwise wheat, millets and
pulses were surplus production.

There was some difference between requirement of the food grains and production the of food grains,

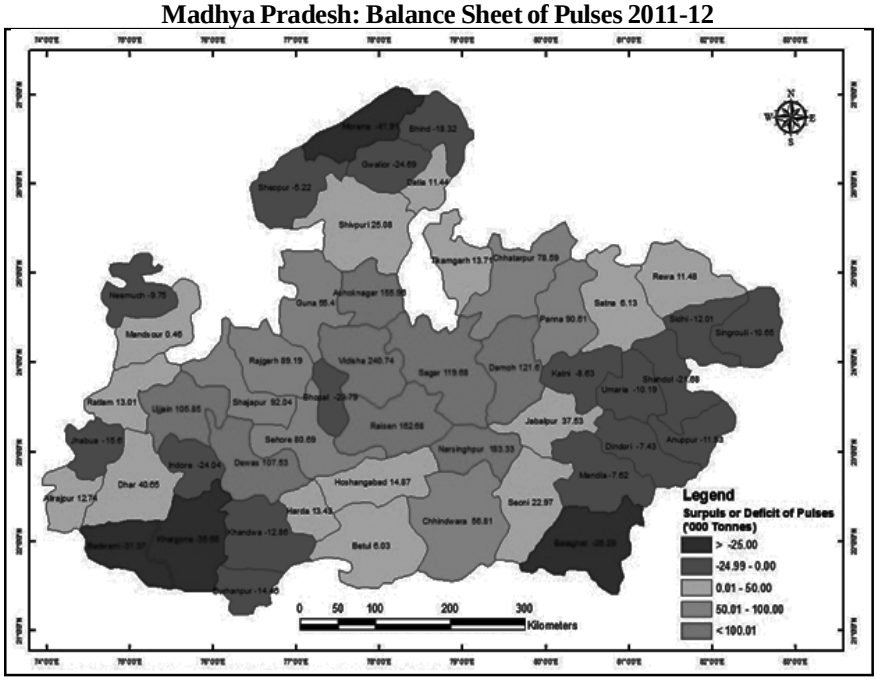
Madhya Pradesh: Balance Sheet of Cereals 2011-12



Source: Map Produced by Authors Based on Methodology

Fig. 2

Madhya Pradesh: Balance Sheet of Pulses 2011-12



Source: Map Produced by Authors Based on Methodology

Fig. 3

which was 2084.2 thousand tonnes in 2000-01, while in 2005-06 the difference was only 944.73 thousand tonnes. In 2011-12 total food grains production 23070.3 thousand tonnes and requirement was 14759.4 thousand tonnes. Which means that the production of food grains is positively increased 8267.9 thousand tonnes in 2011-12.

Spatial Pattern of Food Balance

District wise spatial pattern of food balance indicated that it varied largely from one part of the state to another. For showing the spatial pattern of food balance of Madhya Pradesh is calculated surplus/ deficit areas in terms of their requirement and production of food grains.

Spatial Pattern of Cereals

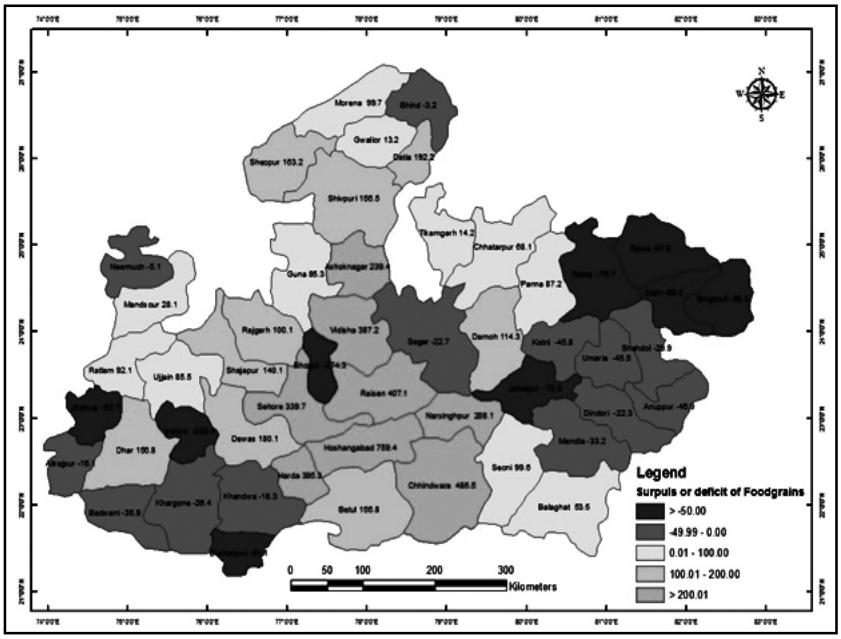
The district wise variation of cereals in Madhya Pradesh, the maximum deficit district is Bhopal (-250.53 thousand tonnes) to the highest surplus district is Hoshangabad (+744.55 thousand tonnes). There are 64 percent districts which have surplus production of cereals in reference to their requirement of food. (Fig. 2)

These districts lay two large and some other part in the state. One region is located in north and north western part of the state including north grid zone, some part of Malwa and another region located in south and south central part including Narmada valley of the state. Other district are Dhar, Rewa, Shahdol and Damoh have also the surplus production of cereals in the state, while only 36 percent districts are fall under the deficit food production of cereals even what they required. The most serious condition is found in the north- eastern part of the state known as Kymore plateau and northern hill region of Chhattisgarh, similarly the western half known as Jhabua hill of the state is also suffering from deficiency in production, the industrial districts (Indore, Bhopal, and Jabalpur) are more deficit districts in the state.

Pulses

Madhya Pradesh has 1611.6 thousand tones surplus production of pulses and varied from highest in Vidisha district (+240.74 thousand

Madhya Pradesh: Balance Sheet of Foodgrains 2011-12



Source: Map Produced by Authors Based on Methodology

Fig. 4

tonnes) to the lowest in Morene (-41.91 thousand tonnes) in reference of their requirement of pulses. Spatial pattern of surplus production district lies in three regions- one large region extend in the south to central and northern part of the state. (Figure. 3) They are concentrated in a compact block covering the Narmada valley, Malwa region, Bundelkhand and some part of Chambal valley in the south. There are only 42 percent districts is suffering from deficiency in production of pulses which lies in eastern and south eastern part, northern part and some part of south western in the state.

All Food Grains

Combined picture of spatial pattern of the districts with surplus/ deficit food grains production is not much different from that of the cereals (Figure: 4). The different between requirement and production of foodgrains ranges from -274.32 thousanad tones in Bhopal district to +759.43 thousand tones in Hoshangabad district. There is 58 percent districts produce surplus in the state. Out of them 16 percent

Table 2: Classifications of Districts by Production Status of Cereals and Pulses, 2011-12.

Production Status	Districts
Surplus of both Cereals and Pulses	Chhindwara, Seoni, Narsighpur, Damoh, Tikamgarh, Rewa, Dhar, Mandsour, Ratlam, Dewas, Shajapur, Shivpuri, Guna, Ashoknagar, Datia, Sehore, Raisen, Vidisha, Rajgarh, Hoshangabad, Harda, Betul (**22**)
Surplus of only Cereals	Balaghat, Dindori, Shahdol, Khargone, Khandwa, Neemuch, Morene, Sheopur, Bhind, Gwalior (**10**)
Surplus of only Pulses	Jabalpur, Sagar, Panna, Chhatarpur, Satna, Alirajpur, Ujjain (**7**)
Deficit in both Cereals and Pulses	Katni, Mandla, Sidhi, Singrouli, Umaria, Anuppur, Indore, Jhabua, Badwani, Burhanpur, Bhopal (**11**)

districts are more surplus, while only 42 percent districts are suffering from deficit production of food grain. Overall 78 percent districts record surplus production of cereals or pulses or both of them while only 22 percent districts fall under the deficit of both pulses and cereals (Table:2) In this list of deficit districts, some backward districts as Mandla, Sidhi, Singrouli, Jhabua, Umaria, Anuppur, Burhanpur and Badwani are present on one hand; and such advanced districts as Katni, Indore and Bhopal on the other. It indicates that causes of deficit production are not uniform among these districts. In backward districts it is mainly due to low productivity while in advanced districts it is because of very high pressure of population (Sharma, 2007).

Regional Pattern of Surplus/Deficit Food Grains Producation in Terms of Calories.

Status of food grains production in terms of calories per person per day can be measured on the basis of consumption of net food available in terms of caloric value minus the consumption by the weighted total population. Calories availability of food grain has been calculated in calories per head per day. The Indian council of medical research (ICMR) has worked out, that on an average; the standard calories requirement (Calories intake) is 2400 calories per person per day. The average daily caloric requirement in the world is 2800 calories per person per day. More than 70% of caloric intake in India is derived from food grains. Considering the distribution of person in different age and sex groups and in different activities in India, the average per capita requirement of calories would be about 2400 calorie (Kravdal, 2001, rather and andrabi, 2011). On the basis of this requirement the surplus and deficit regions have been find out for Madhya Pradesh. On the basis of this significantly large range of spatial variations the state has been divided into two broad categories and four sub categories (Table: 3).

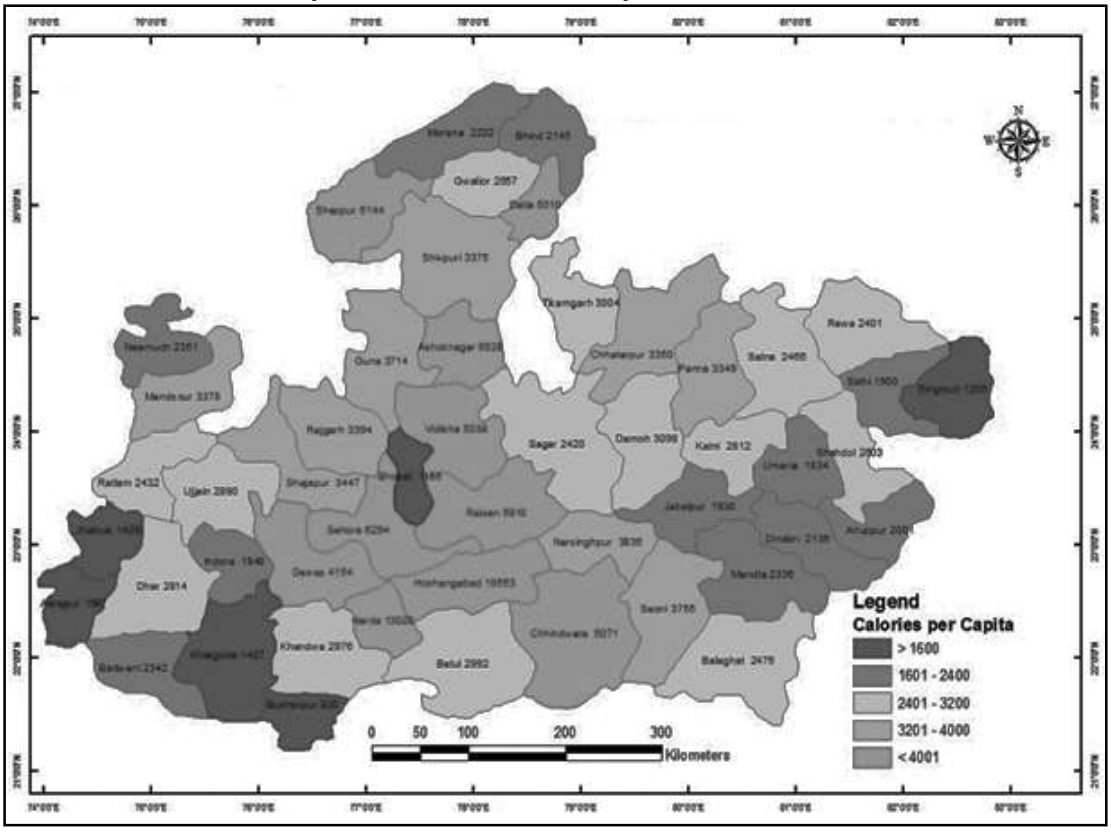
Table 3: Per Capita Daily Production of Food Grains in Calories, 2011-12.

Categories	Sub Groups	Name of Districts
Deficit	Very Low Deficit (Less Than 1600)	Singrouli, Jhabua, Khargone, Burhanpur, Alirajpur, Bhopal (**6**)
	Low Deficit (2400- 1600)	Jabalpur, Mandla, Dindori, Sagar, Sidhi, Umaria, Anuppur, Indore, Badwani, Neemuch, Morene, Bhind. (**12**)
Surplus	Medium Surplus (2400-3200)	Katni, Balaghat, Damoh, Khandwa, Tikamgarh, Rewa, Satna, Shahdol, Dhar, Ujjain, Ratlam, Gwalior, Betul. (**13**)
	High Surplus (3200-4000)	Seoni, Narsinghpur, Panna, Chhatarpur, Mandsour, Shajapur, Shivpuri, Guna, , Rajgarh. (**9**)
	Very High Surplus (More Than 4000)	Chhindwara Hoshangabad, Harda. Dewas Sheopur, Ashoknagar, Datia, Sehore, Raisen, Vidisha,(**10**)

The district wise distribution of food grain production in terms of calories in Madhya Pradesh is not uniform. It varies from 930 in Burhanpur district to 13028 in Harda district. State average production of food grain was 3169 calories per day per person in 2011. It is higher than the state average in 19 districts and lower in 31 districts. (Figure: 5)

It can be observed from the table that quit a part of the state i.e. about 12 percent of the districts namely Singrouli, Jhabua, Khargone, Burhanpur, Alirajpur and Bhopal have emerged as a region of considerably very high deficit in terms of per capita food production lower than 1600 calorie. This region lies in the northern part of the state. 24 percent of the districts fall under the low deficit in terms of per capita food production (1600-2400), which forms a central part in the state. Overall 36 percent districts are deficit in terms of per capita food production in the state. On the other hand about 28 districts of the state are surplus food grains production which is 26 percent districts are average surplus (2400-3200), 18 percent districts have high surplus while only 20 districts are under category of very high surplus production of food grains.

Madhya Pradesh : Food Availability in Terms of Calories 2011-12



Source: Map Produced by Authors Based on Methodology

Fig. 5

Table:4

S.No.	Name of Districts	Production In Calories/ Person/Day	Cereals			Pulses			All Food Grains		
			Prod.	Req.	Surplus/ Deficit	Prod.	Req.	Surplus/Deficit	Prod.	Req.	Surplus /Deficit
1.	Jabalpur	1930	316.1	432.0	-115.8	105.13	68.26	37.53	421.93	500.3	-78.3
2.	Katni	2812	189.6	226.7	-37.2	27.2	35.83	-8.63	216.8	265.6	-45.8
3.	Balaghat	2476	378.4	298.6	+79.8	20.9	47.19	-26.29	399.33	345.9	53.5
4.	Chhindwara	5071	796.7	366.9	+429.6	114.86	57.98	56.81	911.53	424.9	486.5
5.	Seoni	3755	318.7	242.1	+76.6	61.23	38.25	22.97	379.96	280.3	99.6
6.	Mandla	2336	159.4	184.9	-25.6	21.6	29.22	-7.62	181.0	214.2	-33.2
7.	Dindori	2136	108.7	123.6	+14.9	12.1	19.53	-7.43	120.83	143.2	-22.3
8.	Narsinghpur	3836	216.5	191.7	+24.7	213.63	30.29	183.33	430.09	222.1	208.1
9.	Sagar	2420	275.1	417.5	-142.4	185.66	65.29	119.68	460.79	483.5	-22.7
10.	Damoh	3098	214.5	211.8	+7.3	156.66	35.05	121.6	371.19	256.9	114.3
11.	Panna	3349	174.9	178.4	-3.4	118.8	28.18	90.61	293.73	206.7	87.2
12.	Tikamgarh	3004	254.2	253.7	+0.5	53.8	40.08	13.71	308	293.8	14.2

13.	Chhatarpur	3350	298.9	309.5	-10.5	127.5	48.9	78.59	426.46	358.4	68.1
14.	Rewa	2401	305.7	221.9	+83.8	77.06	65.57	11.48	382.79	480.6	-97.8
15.	Sidhi	1900	143.3	197.8	-54.5	19.23	31.24	-12.01	143.49	229.1	-66.5
16.	Singrouli	1205	132.2	206.8	-74.6	22.03	32.68	-10.65	154.26	239.5	-85.3
17.	Satna	2466	308.4	391.3	-82.8	67.96	61.82	6.13	376.39	453.1	-76.7
18.	Shahdol	2603	178.7	186.9	+8.2	7.86	29.54	-21.68	186.59	216.5	-29.9
19.	Umaria	1834	77.7	112.9	-35.3	7.66	17.85	-10.19	85.36	130.8	-45.5
20.	Anuppur	2001	96.7	131.6	-34.9	8.86	20.79	-11.93	105.52	152.4	-46.9
21.	Indore	1848	342.2	574.5	-232.3	66.73	90.77	-24.04	408.93	665.3	-256.4
22.	Dhar	2814	499.7	383.5	+166.2	101.26	60.6	40.65	600.96	444.2	156.8
23.	Jhabua	1429	131.7	179.7	-41.1	12.8	28.4	-15.6	144.46	208.2	-63.7
24.	Khargone	1437	337.9	328.7	+9.2	16.26	51.94	-35.68	354.22	380.7	-26.4
25.	Badwani	2342	238.8	243.3	-4.5	7.06	38.43	-31.37	245.82	281.7	-35.9
26.	Khandwa	2976	244.5	229.9	+14.5	23.46	36.32	-12.86	247.92	266.2	-18.3
27.	Burhanpur	930	56.3	132.9	-76.6	6.53	20.99	-14.46	62.79	153.9	-91.1
28.	Alirajpur	1597	99.1	127.9	-28.8	32.96	20.21	12.74	132.09	148.1	-16.1
29.	Ujjain	2890	328.5	348.78	-20.3	160.96	55.10	105.85	489.42	403.9	85.5
30.	Mandsour	3378	262.9	235.2	+27.6	37.63	37.16	0.46	300.49	272.4	28.1
31.	Neemuch	2351	146.8	145.0	+1.7	16.13	22.91	-9.75	162.89	167.9	-5.1
32.	Ratlam	2432	334.4	255.4	+79.1	53.36	40.34	13.01	387.79	295.7	92.1
33.	Dewas	4154	346.9	274.4	+72.5	150.9	43.64	107.53	497.8	317.8	180.1
34.	Shajapur	3447	313.5	265.5	+48.0	134	41.95	92.04	447.53	307.7	140.1
35.	Morena	2232	486.7	345.0	+141.7	12.6	54.51	-41.91	499.26	399.5	99.7
36.	Sheopur	6144	289.2	120.8	+168.4	13.86	19.08	-5.22	303.06	139.9	163.2
37.	Bhind	2145	314.2	299.1	+15.1	28.93	47.25	-18.32	343.13	346.3	-3.2
38.	Gwalior	2557	394.4	356.5	+37.9	31.63	56.32	-24.69	426.03	412.8	13.2
39.	Shivpuri	3375	434.4	302.9	+131.4	72.96	47.87	25.08	507.39	350.9	156.5
40.	Guna	3714	247.7	217.9	+29.8	89.83	34.42	55.4	337.56	252.	85.3
41.	Ashoknagar	6028	231.7	148.4	+83.4	179.43	23.46	155.96	411.16	171.8	239.4
42.	Datia	5010	318.8	138.1	+180.7	33.26	21.81	11.44	352.23	159.9	192.2
43.	Bhopal	1155	165.2	415.8	-250.5	41.9	65.69	-23.79	207.13	481.5	-274.3
44.	Sehore	6294	489.2	230.2	+258.9	117.06	36.36	80.69	606.22	266.5	339.7
45.	Raisen	6910	478.2	233.8	+244.4	199.63	36.94	162.68	199.63	270.7	407.1
46.	Vidisha	5038	402.4	256.0	+146.4	281.2	40.45	240.74	281.2	296.5	387.2
47.	Rajgarh	3394	282.4	271.5	+10.9	132.1	42.9	89.19	132.1	314.4	100.1
48.	Hoshangabad	10553	962.4	217.9	+744.6	49.3	34.42	14.87	49.3	252.3	759.4
49.	Harda	13028	481.9	100.1	+381.8	29.26	15.82	13.43	29.26	115.94	395.3
50.	Betul	2992	427.3	276.6	+150.7	49.73	43.69	6.03	49.73	320.3	156.8
51.	**M.P.**	**3169**	**15055.8**	**12745.5**	**+2310.2**	**3625.5**	**2013.85**	**1611.6**	**3625.5**	**14759.4**	**3928.8**

Conclusion

Food scarcity is a central issue with regard to social and economic development. The present study of the food scarcity of Madhya Pradesh on district level is present wide- variation in food situation. More than half of the districts are secure in respect of food availability measured in terms of either per capita available quantity or caloric output.

Overall 56.3 per cent surplus production of food grains in terms of their food requirement. There are only rice is deficit production about 67.89 percent. The district wise spatial pattern of food grain availability in terms of their requirement and find that it is basically physical and industrial districts constraints that leads to the lower availability of food grains and hence food scarcity in the concerned region. But the major parts of the state which are physically great are surplus production of food grains.

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