

Hierarchical cluster analysis of water conservation works completed through MNREGS in Ghazipur District, Uttar Pradesh

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ABSTRACT

Ghazipur district of Uttar Pradesh stretches over an area of total 3384 sq.km with a population of 36,22,727 (census 2011). Lack of job opportunities and limited availability of resources for sustainable development of these villages is the prime factor towards the economic growth of the nation. The Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) is a landmark legislation aimed to create durable assets and strengthen the livelihood resource base of the rural poor. The present paper evaluates the performance of water conservation works completed during last 5 years under MNREGS in 16 blocks of Ghazipur District. The database was retrieved from the web site of MNREGS. Trend analysis and hierarchical cluster analysis (HCA) was performed using Microsoft Excel₂₀₀₇ and SPSS₂₀ to assess the comparative performance of 16 blocks in terms of employment generation, fund allocation and works completion. The result of trend analysis revealed that completion rate of water conservation related work was found comparatively higher (24%) than the other category of works except road connectivity work (49%). The result of HCA grouped the best (Cluster-1) and poor (Cluster-2A and 2B) performed blocks. Manihari block (Cluster-1) and Mardah block (Cluster-2A) were represented better performing blocks of Ghazipur District as compare to other 14 blocks (Cluster-2B). Therefore it can be concluded, that by improving the work completion rate of water conservation works under MNREGA, the availability of safe drinking water and irrigation water in rural India can also be increased and reduce vulnerability to climate variability apart from employment generation.

1. Introduction

The National Rural Employment Guarantee Act (NREGA), enacted on 25 August 2005 and renamed the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) on 2 October 2009. The Mahatma Gandhi National Rural Employment Guarantee scheme (MGNREGS) was originally launched in 200 districts of the country and subsequently it was extended to another 130 districts in 2007-08 (Randhawa, 2013). Currently, the scheme is in implementation in all the rural districts of the country. The main objective of the Mahatma Gandhi National Rural Employment Guarantee Scheme is to enhance livelihood security through generation assets, protecting environment, empowering rural women, reducing migration and fostering social equality. MNREGS provides a legal guarantee for at least 100 days of paid employment in every financial year to adult members of any household willing to do unskilled manual work related to public work at the statutory minimum wage of Rs 120 per day (MoRD, 2005). The scheme had provided 4.48 billion days of employment over a period of three years since 2006. During the initial three years of MNREGS implementation about Rs 34,600 crore has been spent on wages (Tiwari, 2011). This indicates the gigantic size of this programme intended to benefit the rural population of the country. Therefore the assessment of impact of the scheme on livelihoods of rural population and the nature and utility of the assets created through the works under MNREGS is become important to further strengthen the scheme. This study attempts to examine the impact of this scheme on employment generation and the assessment of various categories of water

conservation activities carried out in different blocks of Gazipur district during last five years.

2. Methodology

The study is based on the secondary data collected from Books, journals, articles, news papers and internet, Ministry of Rural Development (www.mgnregs.nic.in.) for the financial year 2012-13 to 2016-17. Gazipur district of Uttar Pradesh state is selected for this study to measure the performance of scheme at block level. The block level data compilation and analysis is carried out for three key performance indicator employment generation, fund allocation and work completion using descriptive statistical methods like percentage and average, Pearson correlation analysis to draw the conclusions on the performance of scheme. Hierarchical cluster analysis is performed to categorize best and poor performing study sites. All the statistical analysis is performed using MS-Excel₂₀₀₇ and SPSS₂₀.

2.1. Brief profile of Gazipur district

Gazipur district of Uttar Pradesh covers over a geographical area of 3,384 square kilometers, with the total population of 3,622,727 as per census 2011. Out of the total population of 3,622,727, rural population is 3,348,855 and urban population is 273,872. Average literacy of rural population is 73.62% and that of urban population is 82.05%. The district consists of 16 blocks (Figure-1).

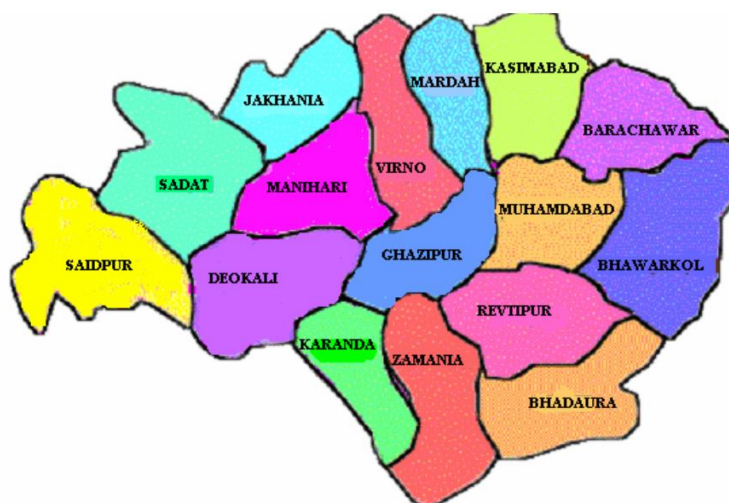


Figure-1: Block map of Gazipur district, Uttar Pradesh

Each block has several Gram panchayets (GP, cluster of villages) and each GP has several villages. Total 2583 inhabited villages and 781 uninhabited villages are there in the district.

3. Result and discussion

3.1. Descriptive analysis of completed work

3.1.1. Drought Proofing: Tree Planting/Afforestation

Drought proofing involved planting trees on crop and tank bunds and wastelands. Leaf manure, oil seeds and fuel wood

and carbon sequestration are the potential benefit of drought proofing work (Tiwari et al., 2011). At the Gazipur, district level, about 650 (3%) activities were completed during five years (FY 2012-13 to FY 2016-17), which included planting trees on cropland bunds, tank bunds and as block plantations (Table-1; Figure-2). Majorities of works were completed in Karanda (79), Kasimabad (73), Bhanwarkol (69) and Saidpur block (64). This may be due to increased incidences of drought in different districts of Uttar Pradesh viz. Gorakhpur, Basti, Deoria, Ballia, Ghazipur, Mirzapur and Varanasi.

Table No-1: Description of various categories of work completed under MNREGA

Block Name	Type of works					
	Drought Proofing	Land Development	Water Conservation	Road	Sanitation	Other Work
Bhadaura	46	156	429	362	8	37
Bhanwarkol	69	139	68	293	11	11
Devkali	31	168	453	888	135	73
Ghazipur	51	51	175	398	103	25
Jakhania	28	116	378	1067	194	169
Karanda	79	174	184	658	236	59
Kasimabad	73	381	530	898	211	62
Manihari	23	262	338	712	73	66
Mardah	6	44	88	363	14	53
Mohammadabad	48	51	249	487	154	25
Revatipur	54	22	401	635	93	27
Sadat	12	139	631	1729	454	102
Saidpur	64	21	370	517	17	107
Varachakwar	40	343	194	542	9	89
Virno	11	128	252	577	24	14
Zamania	15	7	242	158	18	12
Total	650	2202	4982	10284	1754	931

3.1.2. Land Development

Land is a precious limited natural resource on the earth. Degradation of land may affect our existence and hence its

conservation and restoration is important (Saha, 2015). Land development activities includes rehabilitation of degraded waste lands and wetlands through planting native vegetation, removal of alien vegetation, other man introduced structures and

restoring water streams. This is beneficial to restore the ability of land to provide environmental services such as rain water harvesting, carbon sequestration and providing habitat to endangered species (Datta and Sharma, 2011). In Gazipur, district about 2202 (11%) land development activities were completed during five years, which included rehabilitation of partly degraded land (Table-1; Figure-2). Majorities of works

were completed in Kasimabad (381), Varachakwar (343) and Manihari block (262). The continuous use of agricultural land for dumping/land filling of municipal solid waste for longer period may form denudation hill due to differential erosion and weathering. These resistant formations enhance land degradation rate and result waste land formation (Nishanth et al., 2010).

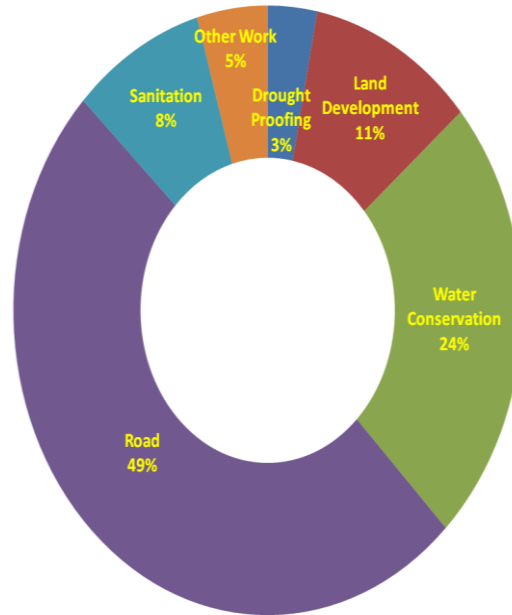


Figure-2: Doughnut chart of works completed under MNREGA

3.1.3. Water Conservation

The water management works specifically includes water conservation, water harvesting, minor irrigation canals, renovation of traditional water bodies and flood-control works. During past five years total 4982 (24%) water management related works have been completed in Gazipur district (Table-1; Figure-2). The maximum numbers of works were undertaken in Sadat (631) and Kasimabad block (530). The major water conservation activities approved under MNREGS includes digging of new tanks/ ponds, farm ponds, percolation tanks, small check dams, de-silting of tanks/ponds/old canals/traditional open well and construction/ repair of drainage system in water logged areas. De-silting of water bodies provides several sustainable benefits including rise in the groundwater level, increase in irrigated area and better soil fertility, increasing food production, and contributing to water and food security in drought prone villages. Construction of percolation tanks and check dams enhance recharging of shallow aquifers and increase the availability of irrigation water for agriculture (Tiwari et al., 2011).

3.1.4. Road Connectivity

The rural population's quality of life and Indian farmer's ability to transfer produce to market post-harvest is mainly affected due to poor shape of road. Over 30 percent of Indian farmer's harvest spoils post-harvest because of the poor road infrastructure. Many rural roads are of poor quality, potholed, and unable to withstand the loads of heavy farm equipment (Neogi et al., 2016). The provision for all weather access road for the rural area is permitted as per the NREGA guidelines

(MoRD, 2005). During the past five years total 10,284 (49%) rural road construction related works have been completed in Gazipur district (Table-1; Figure-2). The majorities of works were undertaken in Sadat (1729) and Jakhania block (1067). This may be due to existence of poor quality of road in these blocks, which has increased the completion rate of road construction in comparison to other work completed under MNREGS (Pandey, 2016).

3.1.5. Rural Sanitation

Over a billion people worldwide defecate in the open, causing worsen disease externalities among children in developing countries. Sanitation is the hygienic means of promoting health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage or wastewater (Hammer and Spears, 2016). Rural sanitation activities that can undertaken under MNREGS includes; a) Construction of individual household latrines (IHHL); b) Construction of anganwadi toilet unit and school toilet unit as institutional projects; c) Solid and Liquid waste management (SLWM) works (Krishnan et al., 2015). The total number of sanitation related works completed under NEREGS in Gazipur district during five years were 1754 (8%), with the highest share in Sadat block (454), followed by Karanda (236) and Kasimabad (211) blocks (Table-1; Figure-2). This indicates the improvement in awareness level of rural community regarding importance of sanitation and hygiene.

3.2. Block-wise MNREGS performance

3.2.1. Employment Generation

The MGNREGA scheme has generated huge employment opportunities to the rural livelihood. The MGNREGA can target development using huge demand for casual jobs (Dey, 2016; Rao and Reddy, 2018). During the five years of implementation (FY 2012-13 to FY 2016-17) in Gazipur, district, total 4.99 lakh persons were employed with the average of 31.20 thousand employed person per block. Sadat block had provided the maximum employment to 75,297 persons followed by Jakhania block where 48,655 persons were employed during five years. Karanda (14,461) and Bhanwarkol (13,462) blocks were provided minimum employment to villagers during five years (Table-2). The provision for material component for the various works is permitted to the tune of 40 per cent as per the NREGA guidelines (MoRD, 2005). Low employment generation can be due to the escalation of material cost of more than 50 per cent as reported in many district of Madhya Pradesh and Jharkhand (Kareemulla et al., 2009; Sarkar et al., 2018). Therefore carefully monitoring of material cost increase is needed because wage employment creation is the main objective of MNREGS scheme.

3.2.2. Work Completed and Expenditure

The implementation on MNREGS scheme in Gazipur district completed total 20,803 works during five years with the cumulative expenditure of Rs 6.25 crore (Table-2). Among the

major MNREGS implementing blocks, Sadat was on the top with 3067 (14.74%) work completed, followed by Kasimabad block with 2155 works completed (10.36%) and Jakhania block with 1952 works (9.38%) completed. Lowest work completion rate below 3% was reported in Zamania block with 452 works, followed by Mardah block (568 works) and Bhanwarkol block (591 works). However the cumulative expenditure on various categories works carried out under MNREGS was reported maximum in Manihari block with Rs 4.24 crore (68.02%), followed by Mardah block 1.25 crore (20.02%). The average commutative expenditure for each completed work was estimated Rs 3000 per work completed, whereas for each work completion average 25 employed persons were involved. This indicates the physical and financial performance on MNREGS in Gazipur district. The MNREGS guideline provides 60% allotment for labour and 40% for material, but more than 90 percent of the fund spent to labour as wage (Naikoo et al., 2018; Singh and Negi, 2018). Many of the work started on 2011 has yet not been completed by the MGNREGA scheme. Poor infrastructure and no utilization of the fund provided under MNREGS, leading to improper implementation of scheme (Gupta and Gupta, 2016; Roy and Singh, 2016).

Table No-2: Description of employment generation, expenditure and works completed under MNREGA

Block Name	Employment Generation		Expenditure (Rs. in Lakhs)		Works Completed	
	Numbers**	Percentage	Amount	Percentage	Numbers**	Percentage
Bhadaura	27895	5.59%	32409	0.05%	1038	4.99%
Bhanwarkol	13462	2.70%	1220642	1.96%	591	2.84%
Devkali	31195	6.25%	333975	0.54%	1748	8.40%
Ghazipur	19941	4.00%	30081	0.05%	803	3.86%
Jakhania	48655	9.75%	164742	0.26%	1952	9.38%
Karanda	14461	2.90%	44508	0.07%	1390	6.68%
Kasimabad	38457	7.71%	42009	0.07%	2155	10.36%
Manihari	34564	6.93%	42459665	68.02%	1474	7.09%
Mardah	31173	6.25%	12495097	20.02%	568	2.73%
Mohammadabad	29769	5.97%	3805	0.01%	1014	4.87%
Revatipur	20960	4.20%	1596810	2.56%	1232	5.92%
Sadat	75297	15.09%	3087109	4.95%	3067	14.74%
Saidpur	36375	7.29%	899939	1.44%	1096	5.27%
Varachakwar	24036	4.82%	2197	0.00%	1217	5.85%
Virno	21927	4.39%	2774	0.00%	1006	4.84%
Zamania	30878	6.19%	2310	0.00%	452	2.17%
Total	499045	100.00%	62418072	100.00%	20803	100.00%

** Significant correlation between employment generation and works completed (Correlation coefficient (r) = 0.780 and p Value = <0.001)

The result of Pearson correlation analysis found significant correlation (r=0.780, p-Value=<0.001) between total employment generation and works completed under MNREGS during last five years in Gazipur district. This indicates the impact of employed man power on cumulative completion of work (Mishra and Dubey, 2016; Tripathi and Singh, 2018).

Financial expenditure shown no significant correlation with employment generation and works completed. This may be due to improper utilization of fund allotted for labour wages and material purchase.

3.3. Hierarchical Cluster analysis

Hierarchical Cluster analysis (HCA) groups the different study sites into clusters on the basis of similarities within the cluster and dissimilarities between the different clusters (Vega

et al., 1998; Dabgerwal and Tripathi, 2016). HCA rendered a Dendrogram (Figure-3), which has grouped all the 16 blocks of Gazipur district into two statistically significant clusters.

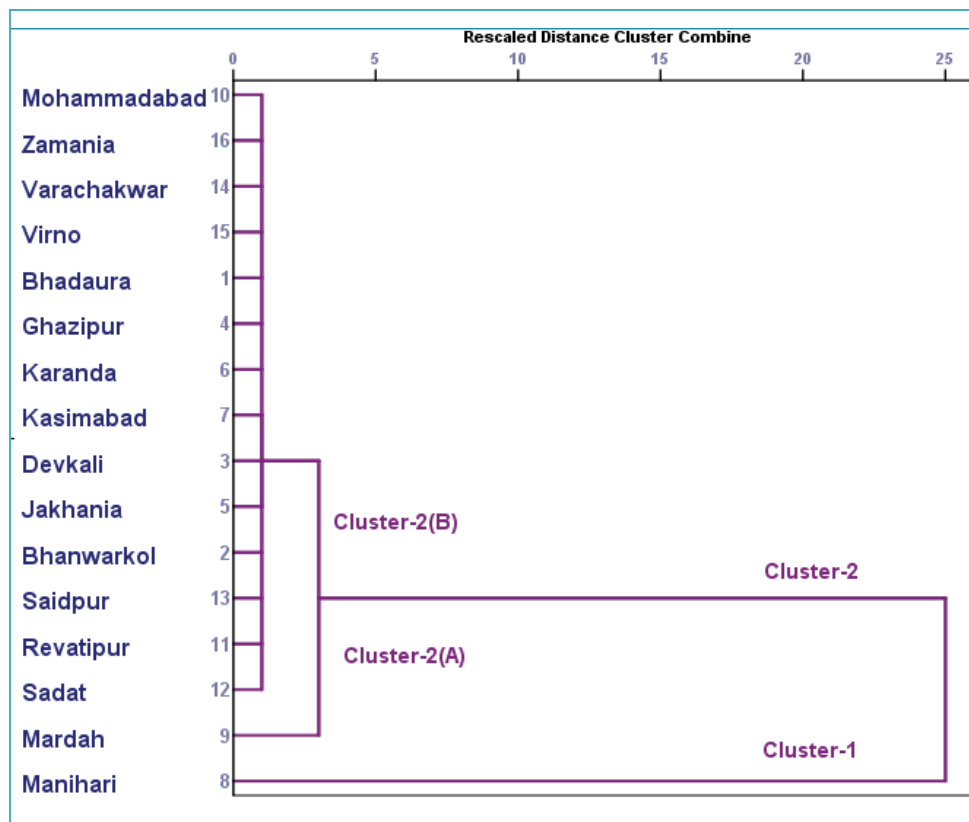


Figure-3: Dendrogram of block-wise performance

These clusters represent categorization of best and poor performed blocks under MNREGS (Table-3). Cluster-1 represents only one Manihari block of Gazipur district, which performed better than the other 15 blocks, in terms of employment generation (6.93%), fund allocation (68.02%) and work completion (7.09%). Cluster-2 grouped rest 15 blocks into two sub clusters 2A and 2B. Cluster 2A represents Mardah block in which employment generation (6.25%), fund allocation (20.02%) and work completion (2.73%) was found better than the other 14 blocks. Cluster 2B represents the poor performed rest 14 blocks i.e. Sadat, Revatipur, Bhanwarkol, Saidpur,

Devkali, Jakhania, Karanda, Kasimabad, Bhadaura, Ghazipur, Mohammadabad, Virno, Zamania and Varachakwar. The average employment generation (6.20%), fund allocation (0.85%) and work completion (6.44%).

This technique supports the result of trend analysis (Table-2) of block performance as a confirmatory statistical tool. It is very useful in offering a reliable and more economical classification of multiple study sites without losing any significance of the outcome (Sreenivasulu et al., 2014; Dabgerwal and Tripathi, 2016).

Table-3: Characterization of clusters of blocks

Characteristics of clusters	Number of clusters		
	1	2A	2B
Number of blocks	1	2	14
Employment Generation	34,564 (6.93%)	31,173 (6.25%)	30,951 (6.20%)
Fund Allocation (Rs. In crore)	4.24 (68.02%)	1.24 (20.02%)	0.05 (0.85%)
Works completed	1474 (7.09%)	568 (2.73%)	1340 (6.44%)

4. Conclusion

In India more than 70.00 per cent of the population is living in rural areas. The majority of villagers depend upon agriculture and during the lean agricultural season they become unemployed and migrate to cities in search of jobs. Rural areas are the most affected with the problem of poverty. In this

background, MGNREGA, an employment guarantee scheme provides 100 days guaranteed wage employment for all demands for work. The scheme shares one-third of its total employment generated for guarantee employment to women. Other backward groups like SCs, STs and others are allowed to get developed own private lands.

This study was undertaken in Gazipur district to understand the benefits of the MNREGS in enhancing water conservation activities. The findings clearly indicate that in the Gazipur district, the scheme has been oriented more towards the water conservation and water harvesting, drought proofing, flood control and protection of environment in comparison to other activities except road connectivity work. These environment

protection activities have brought many positive changes on improving the livestock production and crop production in rural areas for sustainable growth apart from employment generation. Therefore proper implementation of MNREGS with accountability and obligation to the laws can efficiently contribute towards the inclusive economic growth of the country and reduce vulnerability to climate variability.

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