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Availability and Quality of Groundwater and its relationship with Monsoonal Rainfall: A case study of Jhansi District of Bundelkhand Region.

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Abstract:

The Bundelkhand region that stretches from south western Uttar Pradesh to north eastern Madhya Pradesh is spread over almost 70,000 km2 area in central India. The water scarcity is exacerbated by the lack of many perennial sources of water as the sources of water in Bundelkhand like ponds, tanks, streams wells, and irrigation canals are all mostly seasonal. The region is not only suffering from the availability of water but the portability of the water is also of great concern. The northern part of the district is occupied by the alluvium of quaternary age. The alluvium consisting of mainly fine to coarse sand, gravel, pebble, silt, clay and kankar attains a maximum thickness of about 60.00 meters. In southern parts of the district, the weathered zone of Bundelkhand granite-gneissic complex of Archean age and overlying residual soils largely forms the aquifer system. The aquifer system exhibits heterogeneity to some extent due to impervious nature of frequently occurring outcrops, hillocks and linear quartz reefs.

There are reports of high iron, nitrate and fluoride content at some pockets in the Bundelkhand belt, demanding a detailed investigation of the water resources for its better utilization and management.

Key Words: Bundelkhand, scarcity, irrigation, alluvium, granite-gneissic, soils, fluoride.

Introduction:

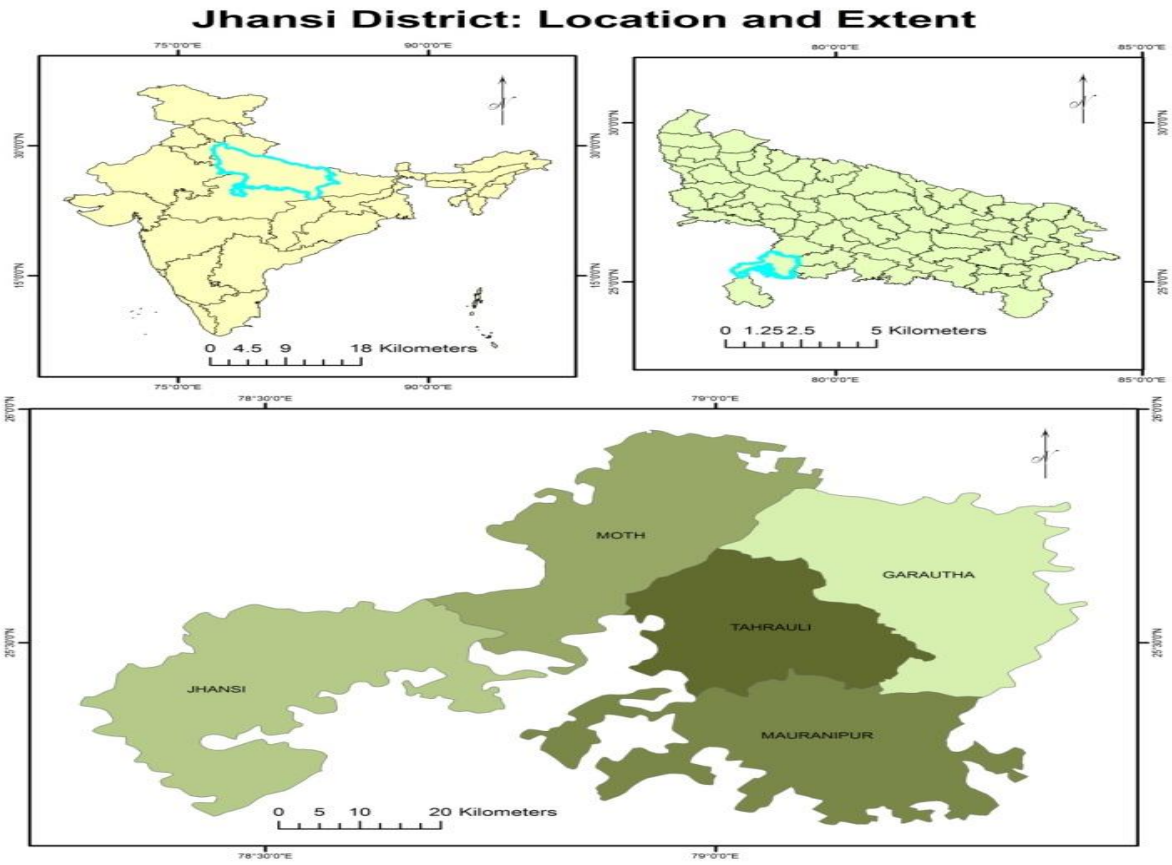
The Bundelkhand region that stretches from south western Uttar Pradesh to north eastern Madhya Pradesh is spread over almost 70,000 km2 area in central India, covering seven districts of south western Uttar Pradesh (Jhansi, Lalitpur, Jalaun, Hamirpur, Banda, Mahoba, Chitrakoot) and six districts (Sagar, Chhatarpur, Tikamgarh, Panna, Damoh and Datia) of north eastern Madhya Pradesh . The region is known for its rich cultural heritage, its dialect, and also for its socio-economic backwardness. For most of the year, the residents of Bundelkhand experience acute scarcity of water for agricultural, industrial and domestic uses (Singh et al, 2013)**.** The water scarcity is exacerbated by the lack of many perennial sources of water as the sources of water in Bundelkhand like ponds, tanks, streams wells, and irrigation canals are all mostly seasonal. The lack of perennial reliable source of water means that local agriculture is primarily subsistence rain fed single crop agriculture. The region is not only suffering from the availability of water but the portability of the water is also of great concern (Singh et al, 2013)**.** There are reports of high iron, nitrate and fluoride content at some pockets in the Bundelkhand belt, demanding a detailed investigation of the water resources for its better utilization and management (CGWB 2008). The presence of contaminating agents like iron, nitrate, fluoride, and arsenic can cause many water borne diseases and hence have the potential to cause adverse health impacts on the users in Jhansi district. Serious illness like cholera, guinea worm disease, typhoid, dysentery etc can result from drinking contaminated water. While many studies have been done on groundwater quality in Jhansi, there is a lack of literature on the health impacts of drinking such water in Jhansi. The present study would thus attempt to bridge the knowledge gap between available resource on groundwater quality and the impact of drinking contaminated water in the study area.

Study Area

The study area for the proposed project is Jhansi district in the Uttar Pradesh part of Bundelkhand region. Jhansi district situated in the south western part of the Uttar Pradesh, bounded

by latitude 25o70’ to 25o57’ North and longitude 78o10’ to 79o25’ East and covering geographical areas of 5,024 km2. Major rivers flowing and replenishing groundwater reserve in Jhansi district are Betwa, Dhasan, and Pahuj. A total population of 1,998,603 persons in Jhansi district is divided into eight administrative blocks. Most of the water for drinking, industrial as well as agricultural use is supplied from groundwater reserves (Singh et al, 2013), with some proportion of water coming from canals for irrigation Betwa and Dhasan are the major rivers controlling the drainage pattern and the natural slope of the area is in the north and northeast direction. The climate is sub-humid and characterized by a hot dry summer and cold winter. The average annual rainfall of the district is 850 mm and about 91 % of the annual rainfall takes place during the monsoon months of June, July, August and September. Jhansi district lies in the belt of drought prone regions of Uttar Pradesh. The large population (80 %) of the district is living in villages and dependent on agriculture, livestock and forest products. Mining of stones, sand, gravel and building materials represent very low activity and limited employment potentials for reducing dependent on agriculture. The life of the habitants becomes miserable in summer when the water supply source like dug well, tanks, ponds etc. dry up due to failure of monsoon.

Graph.1: Locational map of Jhansi district.



Objectives:

To study the quality of groundwater resource for drinking purpose in Jhansi district.

To study the adverse health impacts of contaminated groundwater in Jhansi.

To assess the sustainability of currently available groundwater reserves in Jhansi district.

To establish the relationship between rainfall and groundwater level.

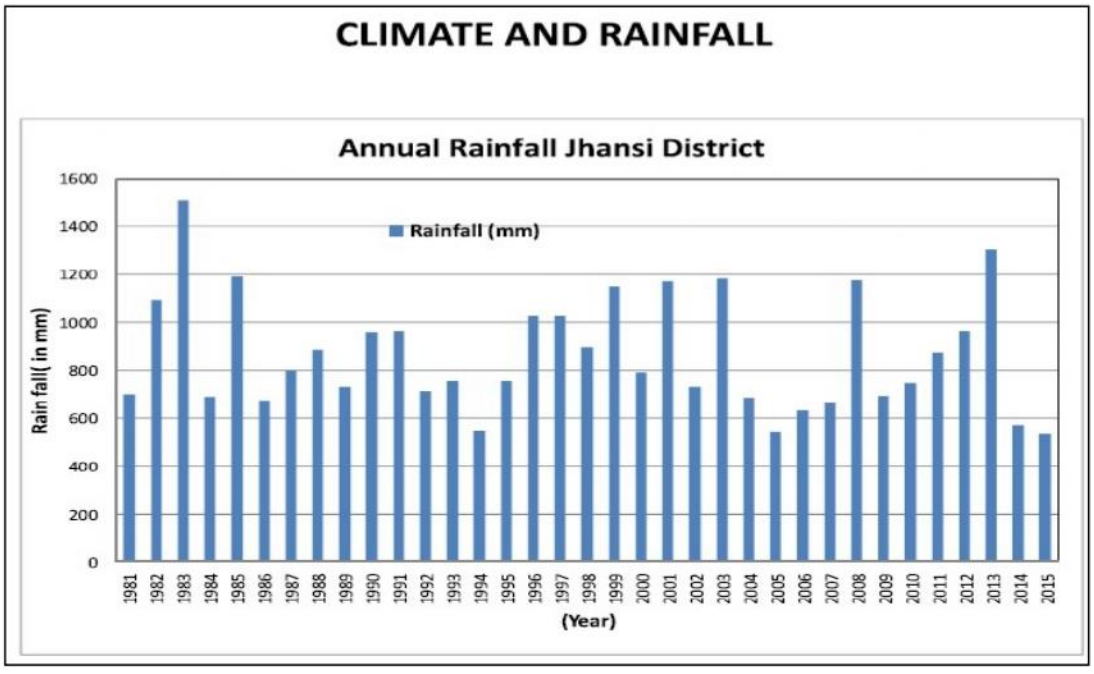
Table.1: Block wise average rainfall distribution in Jhansi district.

Blocks	**Average Rainfall (mm)**	**Area (sq. km.)**	**Volume of Water (mcm)**
Moth	850.00	644.24	547.60
Chirgaon	850.00	507.42	431.31

Bamaur	850.00	805.4	684.64
Gursarai	850.00	715.48	608.16
Bangra	850.00	524.53	445.86
Mau Ranipur	850.00	592.69	503.79
Babina	850.00	551.47	468.5
Badagaon	850.00	422.26	358.98

Source: Data taken from Report on Census of Minor Irrigation Schemes 2000-01, Ministry of Water Resources, Govt. of India.

Graph.2: Year wise annual rainfall data of Jhansi district.



Source: Statistical Diary U.P. Government and District Irrigation plan PMKSY.

Table.2: Year wise annual rainfall and drought analysis in Jhansi district.

Sr. no.	year	Annual Rainfall (in mm)	status of Drought
1	2003	1183.7	Above Normal
2	2004	448.6	Severe Drought
3	2005	594.8	Drought
4	2006	369.13	Very Severe Drought
5	2007	576.6	Drought
6	2008	1307.5	Above Normal
7	2009	1477.6	Above Normal
8	2010	713.5	Normal
9	2011	923.7	Normal
10	2012	722.3	Normal
11	2013	1438.3	Above Normal
12	2014	612.2	Drought
13	2015	688.2	Drought

Source: Analyzed by researcher.

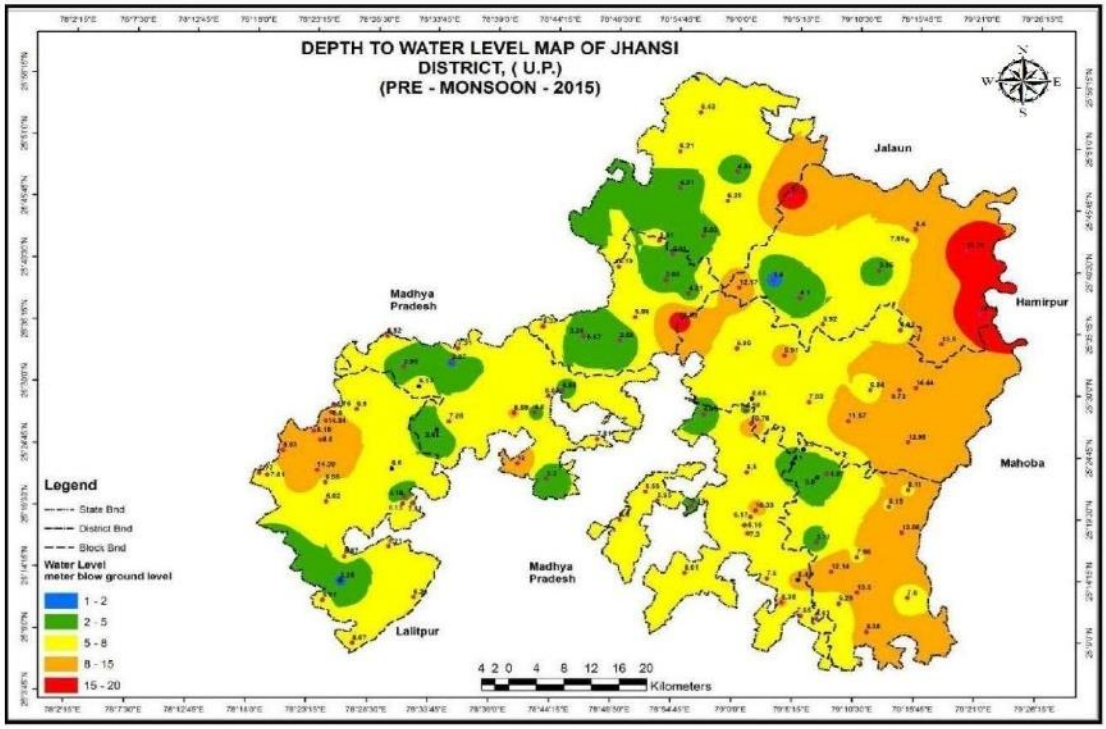
Table.3: Grounwater Scenario in Jhansi District

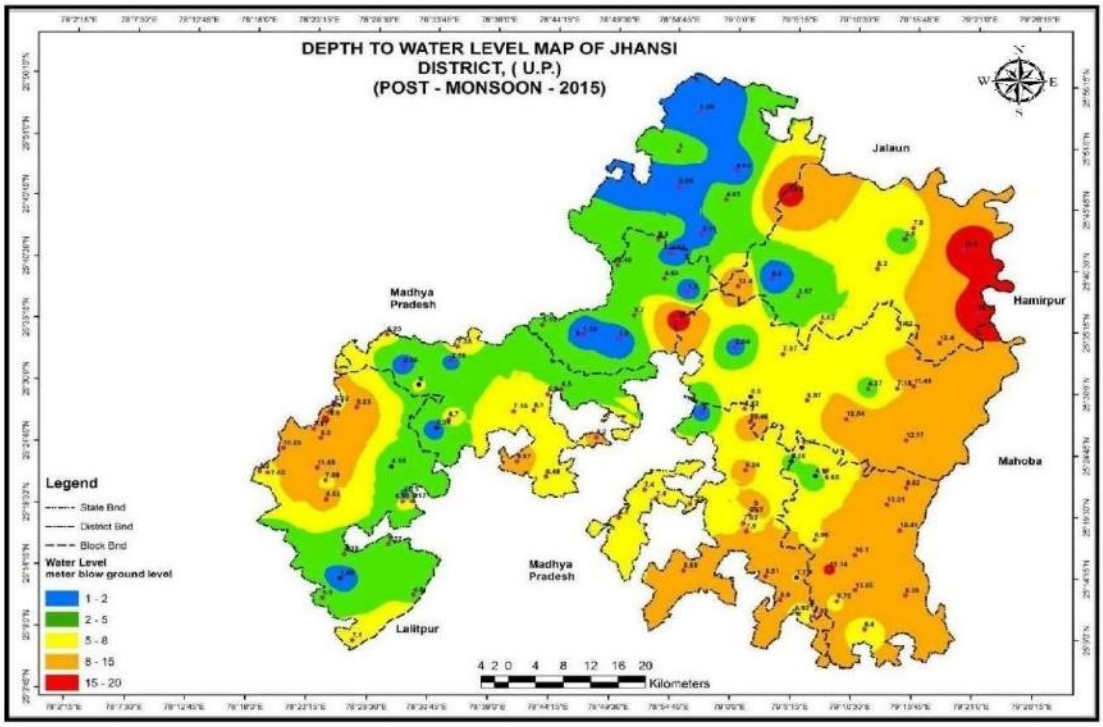
Srno.	Blocks	Pre Monsoon Decline (Cm/Yr)	Post Monsoon Decline (Cm/Yr)	Differences Between Pre & Post Monsoon	Net annual Ground water availability	Existing gross ground water drafts for all uses	Stage of ground water development(%)	Category

1	Babaina	8.30	3.54	4.76	6614.14	5505.14	83.23	Safe
2	Bamaur	8.84	7.31	1.53	7584.47	4083.25	53.84	Safe
3	Bangra	7.87	4.17	3.7	6431.73	4792.41	74.51	Safe
4	Badagaon	5.97	3.81	2.16	7878.06	6354.19	80.66	Safe
5	Chirgaon	6.95	4.43	2.52	9433.35	5249.37	55.65	Safe
6	Gursarai	10.91	5.54	5.37	9231.31	5052.06	54.73	Safe
7	Mau Ranipur	8.72	4.80	3.92	7606.70	5906.44	77.65	Safe
8	Moth	4.68	2.09	2.59	10853.36	50.24	46.29	Safe

Source: Statistical Diary U.P. Government and District Irrigation plan PMKSY

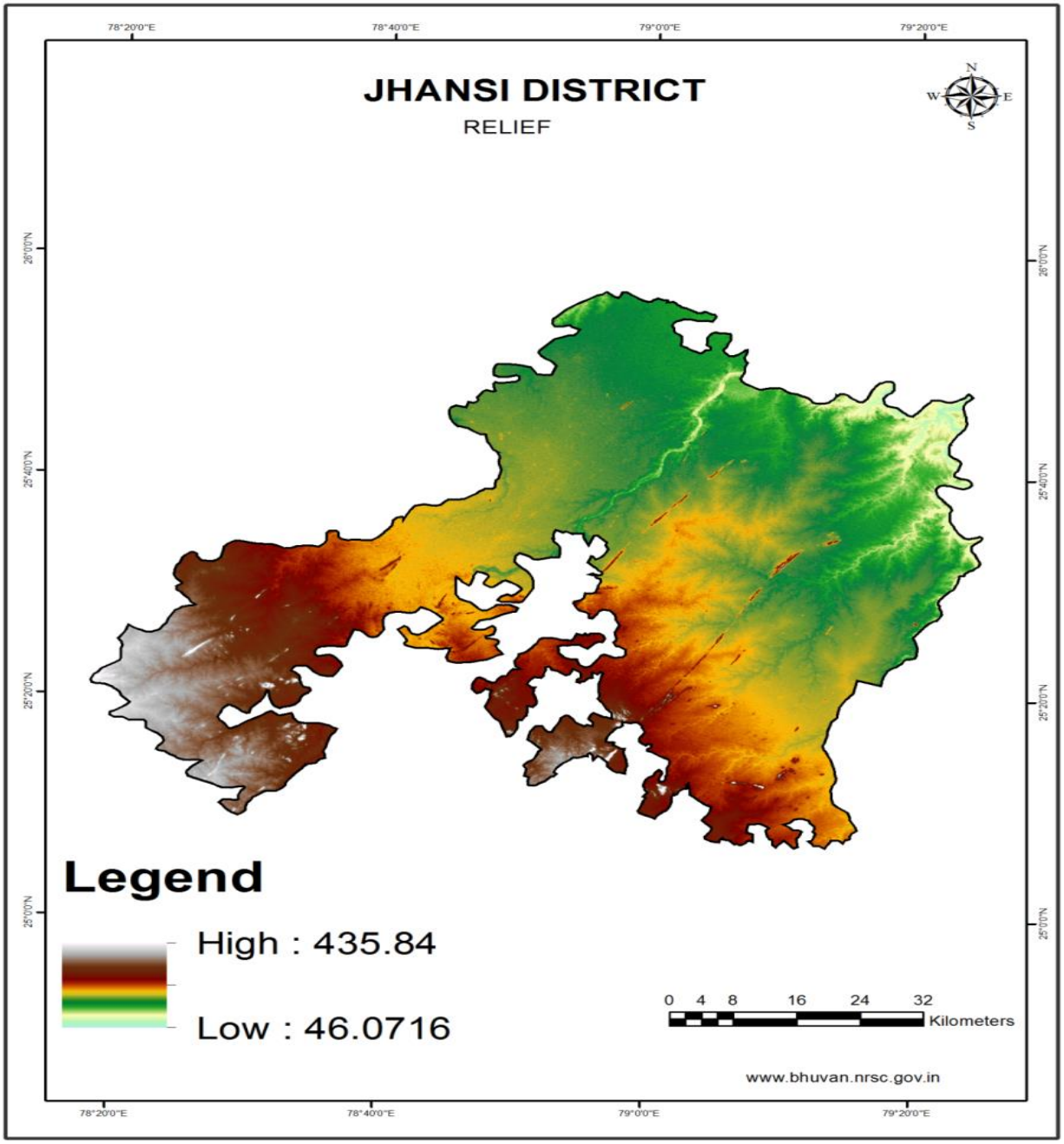
Graphh.3: Ground water level map of Jhansi district.





Source: Report of State Ground Water Department Uttar Pradesh

Graph.4: Relief map of Jhansi district.



Source: Map prepared by Remote Sensing and GIS tools.

Research Methodology:

The sources of data include both primary sources and secondary sources. Primary data will be collected through sample groundwater collection in different blocks of Jhansi district. As well as this, personal interview will also be conducted with residents of Jhansi to ascertain the perception of locals regarding availability and quality of groundwater in Jhansi. Secondary data will be collected from available literature on groundwater resources in India in general

and Jhansi in particular. These literature sources will be accessed through the Allahabad University Library System and other libraries. Apart from this, handbooks of Census of India, Information Bulletins of government agencies will also be used.

Results and Discussion:

- Babina and Badagaon block recorded maximum decreases groundwater level after monsoon and both block face water scarcity throughout year. Both block recorded minimum groundwater recharge due to undulated topography. Due to low water level in this area, people are not able to get pure water so number of water induced diseases is higher in this region.
- Moth and Chirgaon block recorded maximum water level due to be permeable rock structure and plain region so this region is rich in groundwater. This region has lowest water induced diseases.
- In the year when there is less rainfall, there is drought here because apart from rain, there is often lack of sources of water. And it the absence of other sources of water, agricultural production and groundwater level also is affected. And in this adverse condition people are forced to migrate.
- Recent industrialization and over population, this important resource has faced unprecedented stress in the form of over-exploitation and contamination.
- The region is not only suffering from the availability of water but the portability of the water is also of great concern.
- There are reports of high iron, nitrate and fluoride content at some pockets in the Jhansi belt, demanding a detailed investigation of the water resources for its better utilization and management.

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