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Ground-Water Quality Assessment for three Coastal-Islands of India with the help of Water Quality Index (WQI)

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ARTICLE INFO ABSTRACT

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Ten Physico-Chemical Parameters i.e., pH, TDS, Chloride (Cl⁻), Total hardness (TH), Sulphate (SO₄), Calcium (Ca⁺), Magnesium (Mg⁺), Nitrate (NO₃), Bicarbonates (HCO₃) and Fluoride (F⁻) as per APHA standard, were Chosen to perform a comparative analysis on the Remote areas like Andaman and Nicobar Islands, Diu islands, and Lakshadweep, though, rich in minerals, Bio-diversity, Energy, habitat, etc., the Water Management in these areas is quite complicated. Rarely, conditions are normal, Surface Water can appear on these islands in the form of Fresh-water Lagoons. In Most cases, Islanders rely on Ground water. Secondary data from Central Ground Water Board (CGWB) will be used to calculate Water Quality Index (WQI). BIS Standards will be used to rank the hosen locations from all the three states. The Objectives of this paper is to estimate the WQI for aforementioned islands and rank the districts/locations chosen into five classes i.e., Excellent, Good, Poor, Very Poor and Unsuitable for Drinking. This paper also finds the highest correlated Physico-Chemical Parameters. It was found that WQI values ranges from 36.458 to 51.876 for Andaman and Nicobar Islands, whereas, they ranged from 207.43 to 1463 for Diu Islands and 31.351 to 54.419 for Lakshadweep Islands. Unfortunately, this paper finds no such locations where water has been classified as excellent or suitable for drinking.

Keywords: *WQI, BIS standards, Union Territories, Physico-Chemical, Correlation.*

Introduction

Co-operatives are organization or entities formed with the main goal of satisfying social, economic, and cultural needs of their members. Co-operatives are present in diverse sectors, including agriculture, dairy, forestry, fisheries, credit and banking, housing, and construction. Many cooperatives are seriously active in the nation.

Co-operatives are essential in India's rural economy as they empower small farmers and producers to collectively address common obstacles such as access to markets, credit availability, and resource allocation. Despite their potential benefits, co-operatives in India face several significant problems that hinder their efficiency and sustainability. This report aims to

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explore the challenges faced by co-operatives in India and identify potential solutions to enhance their impact in rural development.

Cooperatives are a unique form of venture in which actually for the benefit of the societies. These cooperatives run by their members are a good substitute for existing capitalist organizations because they foster equitable sharing of benefits, participatory development and sustainable environment. Recent research has been able to clear up the complex processes involved in cooperative organizations as well as identifying their strengths and possible weaknesses. Cooperatives have been established to be successful in meeting both the member's needs and those of the larger community. They serve as both market coordination mechanisms and non-market coordinating mechanisms which balance between social, economic and environmental elements (Banerjee, 2021). (Siddaraju, 2012) The prosperity of a society depends largely on effective governance and management practices of cooperatives. (Mhembwe & Dube, 2017)

Co-operatives hold a crucial position in India's economy, particularly in the agriculture and rural sectors, playing a significant role in empowering small-scale producers, farmers, and artisans. These co-operative societies are designed as a collective mechanism to tackle socio-economic challenges, enhance market access, and promote inclusive growth. Nevertheless, despite their noble intentions and potential advantages, Indian co-operatives encounter a number of difficulties that impede their effectiveness and sustainability.

A significant issue faced by co-operatives in India is the lack of adequate financial resources and limited access to credit facilities. Many co-operatives struggle to secure affordable loans for investments in modern infrastructure, technology enhancement, and capacity building and skill development. This financial constraint restricts their ability to expand activities, introduce innovative practices, and compete in increasingly dynamic markets. As a result they become vulnerable to external shocks and market fluctuations.

Governance and management inefficiencies present another critical challenge for co-operatives in India. Weak leadership, poor governance structures, and inadequate training of members and staff often lead to internal conflicts, lack of management of resources, and operational inefficiencies. The absence of transparent decision-making processes, coupled with limited

accountability mechanisms, undermines the credibility and trust within the co-operative, hampering its overall performance and sustainability.

Market linkages and integration cause a problem for many co-operatives in India. Despite being formed to collectively bargain and access better markets, co-operatives often face barriers in establishing profitable relationships with buyers, negotiating fair prices, and navigating complex supply chains. This lack of market sophistication and bargaining power restricts co-operatives from maximizing the value of their produce, limiting their revenue potential and overall impact on the livelihoods of their members.

In addition to these challenges, regulatory complexities, bureaucratic hurdles, and inconsistent government policies add further layers of difficulty for co-operatives operating in India. Cumbersome registration processes, compliance burdens, and changing legal frameworks create barriers to entry and expansion, constraining the growth and innovation prospects of co-operatives. To address these persistent challenges, a concerted effort is required from policymakers, stakeholders, and the co-operative community to foster an enabling environment that supports the sustainable development and resilience of co-operatives in India.

Dr. Rabi N. Patra and Mahendra P. Agasty (2013) which clearly shows that cooperatives, credit cooperatives in particular, are an integral part of the Indian rural economy. This paper reviews the evolution of cooperative movement explaining its role and problems and highlighting its potential to adjust to the new perspectives in the context of Odisha, India. It concludes with some policy suggestions which take the cooperative sector to new heights and opportunities.

In another article written by Virendra Kumar, K.G Wankhede and H.C Gena (2015) discussed about the role of cooperatives in improving livelihood of farmers on sustainable basis. This paper reviews the presence of cooperatives in all the countries and in almost all the sectors, including agriculture, food, finance, health care, marketing, insurance & credit. It shows how dynamic a cooperative can be and the scope it has in different sectors. In a country like India where most of the farmers are small and marginalised, cooperatives should work very strongly to overcome the challenges. This paper discusses how the successful cooperatives in India like IFFCO (Indian Farmers Fertilizer Cooperative Ltd.) and KRIBHCO (Krishak Bharti Fertiliser Cooperative Ltd.) in the fertilizer sector, AMUL in Dairy Sector and Self-Help Groups (SHGs)

formed by various Institutions have immensely improves the performance of cooperatives by generating support in various programmes related with agriculture.

Cooperatives have achieved year-round employment and sustainable income through various farming systems, including crops, vegetables, fruits, livestock, and agroforestry. The role of cooperatives in providing support to farmers, including the disbursement of credit, distribution of agricultural inputs, and other economic activities that contribute to poverty alleviation, food security, and employment generation. They also address the historical context of the Indian Cooperative Movement, which has played a crucial role in the Indian economy, especially in agriculture and rural sectors. The progress of different types of cooperative societies in India, including production, marketing, service, and allied service cooperatives, it provides specific examples of cooperatives' success in sectors like dairy, sugar production, and agricultural marketing. Cooperatives can mobilize their members and organize for sustainable livelihoods. However, they require additional support and flexibility in rules and regulations to promote activities needed for improving rural livelihoods. The successful cooperative movement in India could serve as a model for other developing countries to enhance rural livelihoods.

Examples of some cooperatives:

We have studied five cooperatives which are **Amul Cooperative Society**, Midnapore Co-operative Milk Producers Union Ltd. (MIMUL), Sundarban Cooperative Milk and Livestock Producers' Union Ltd (Sundarini) based on West Bengal, Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd. (JASCOLAMPF) and Jharkhand Women self-supporting poultry cooperative federation limited (JWSPCFL) from Jharkhand.

1. Amul Cooperative Society:

Amul, the Gujarat Cooperative Milk Marketing Federation (GCMMF), founded in 1946 to address the exploitation of dairy farmers by middlemen, is one of the most successful cooperative societies in India. It serves as an excellent example to illustrate how leadership and cooperation in cooperatives can drive remarkable economic and social outcomes. Through democratic governance, strategic leadership, and member cooperation, Amul has achieved remarkable economic and social outcomes, transformed the lives of millions of dairy farmers, setting a global benchmark for cooperatives.

Amul Cooperative Society, also known as Amul, stands as a beacon of successful leadership and cooperation in the realm of dairy production. Founded in 1946 in Anand, Gujarat, India, Amul emerged from a visionary idea to empower local farmers and create a sustainable dairy industry.

The story begins with Dr. Verghese Kurien, often referred to as the "Father of the White Revolution in India," who played a pivotal role in transforming Amul into a cooperative powerhouse. Initially, farmers faced exploitation from middlemen in selling their milk. Dr. Kurien, along with local leaders like Tribhuvandas Patel, organized these farmers into cooperatives, empowering them with ownership over production and distribution.

In 1949, the Kaira District Cooperative Milk Producers' Union Limited was established, laying the foundation for what would become Amul. Under Dr. Kurien's leadership, Amul introduced innovative practices like the milk collection network, which ensured freshness and quality while eliminating intermediaries. This decentralized approach empowered farmers economically and socially, significantly improving their livelihoods.

During the 1960s, Amul spearheaded the White Revolution, a national initiative to enhance milk production through cooperative efforts. Dr. Kurien's leadership and strategic vision expanded Amul's reach beyond Gujarat, establishing the National Dairy Development Board (NDDB) to replicate the cooperative model nationwide.

Today, Amul is a multi-billion-dollar cooperative, owned and managed by millions of dairy farmers across India. Its story exemplifies how effective leadership, collaboration, and a focus on community empowerment can lead to sustainable economic development and social change.

In conclusion, Amul Cooperative Society's journey from a small dairy cooperative in Anand to a global dairy giant is a testament to the power of visionary leadership, cooperative spirit, and innovation in transforming lives and industries. Its impact extends far beyond dairy, demonstrating a model that fosters inclusive growth and prosperity.

2. Midnapore Co-operative Milk Producers Union Ltd. (MIMUL):

The Midnapore Co-operative Milk Producers Union Ltd. (MIMUL) was set-up in the year 1977 under Operation Flood program of West Bengal Government with the objective of uplifting the unorganized rural Milk Producers through socio economic development, by organizing

Primary Milk Co-operative Societies and strengthening them for increasing milk production, processing and marketing of milk and milk products. The Midnapore Milk Union was registered on 10/08/1977 under the West Bengal Co-operative Societies Act-1975 and started its functioning in the district. Since 1977, MIMUL- the Midnapore Milk Union has given a true and sustainable direction towards socio-economic development in the rural life of the dairy farmers in Midnapore District by uniting unorganized milk producers in the organized Anand pattern three tier cooperative structure(*Medini - Milk of Midnapore, Milk Producers in Pachim Medinipur, Milk Products in Midnapore, Best, Top, Branded, Supplier, Manufacturer, Kharagpur, Purba Medinipur, Paschim Medinipur, Jhargram, Howrah, Hooghly, Kolkata, West Bengal.* (n.d.). <http://www.mimulmilk.in>. <http://www.mimulmilk.in/>). Currently, about 27000 No dairy farmers have enrolled their names as the member of Primary Milk Co-operative Societies and supplying milk to MIMUL everyday through 232 no functional Societies. In return, MIMUL has been providing assured milk value to the farmers which has strengthened their backbone to live with dignity. The continuous support from the Government and NDDB towards animal health services, Artificial insemination, Vaccination, etc and implementation of different schemes like fodder development, Azolla cultivation, clean milk production, Ration Balancing Program, VBMPs, women empowerment, infrastructure development works have motivated the farmers in animal husbandry business. The Government has equipped the Milk Societies with modern milk testing facilities like AMCU (Automatic Milk Collection Unit) to ensure quality milk collection at the society level in transparent manner. Besides, various other plans are under active consideration for the overall development of the milk producers in the future

The cooperative work in a certain pattern and that pattern is discussed below:

- Farmer's Participation: Local dairy farmers join the cooperative and become members by contributing their milk production to the collective.
- Milk Collection: The cooperative collects milk from its member farmers either directly from their farms or at collection points.
- Quality Control: Milk is tested for quality and freshness to ensure it meets the cooperative's standards.

- **Processing:** After collection, the milk is transported to processing facilities where it is pasteurized, homogenized, and processed into various dairy products like milk, yogurt, cheese, or butter.
- **Marketing and Distribution:** The cooperative markets and sells its dairy products to consumers through various channels such as local stores, supermarkets, or directly to consumers.
- **Revenue Sharing:** Profits from the sale of dairy products are distributed among the member farmers based on factors like the quantity and quality of milk they contribute to the cooperative.

Overall, the Midnapore Milk Cooperative likely works to empower local dairy farmers by improving their performance and empowering them.

3. Poultry Cooperative Federation in Jharkhand

Thirty notified Scheduled tribes having different socio-cultural practices dwell in Jharkhand. The womenfolk of these communities play a pivotal role in the livelihood by performing two-third work of the total family level work. Yet, they are not considered leaders in the leaders in their village and society. The cooperative movement, however, proved a promising strategy in order to empower tribal women in Jharkhand.

Jharkhand Women self-supporting poultry cooperative federation limited (JWSPCFL) situated at Ranchi is one of the largest integration of poultry production belonging to smallholders. The tribal women are successfully running the poultry cooperatives in different districts across the state for almost two decades. These cooperatives not only provided employment but also put forward sustainable livelihood opportunities to the tribal families. All the cooperative members are women. These women leaders under the mentorship of Dr. Pankaj Das, the CEO of JWSPCFL has been governing cooperatives and has proved their excellence as successful leaders.

JWSPCFL got registered on 31st March, 2005 as an all women cooperative federation in Jharkhand. At present, there are 11 cooperatives running under this federation from different districts such as Bokaro, Gumla, Khunti, Lohardaga, East Singhbhum, Godda and Dumka. The governing board of the state level federation consists of the chairperson of the respective primary cooperatives.

The State Government supported the initiative of the women's poultry cooperatives to begin their activities. The initial financial support for the first two years was a huge milestone for the tribal women. All the cooperative societies along with the federation are registered under the Jharkhand self-supporting cooperative Act 1996 as well as associated with National Smallholder Poultry Development Trust (NSPDT). NSPDT is a private charitable Trust in New Delhi that promotes and advances smallholder poultry as an instrument for the upliftment of livelihood and improve the standard of living of rural people.

The leadership for the board of directors is rotated after a tenure of three years and elected through democratic procedure as per the laws and Acts under which these societies are running. The members and representatives of the cooperatives receives training on regular basis and are provided with information, motivational interactions and participate in decision making processes. The women leaders are democratic and disciplined. They carry out responsibilities and take risk for the growth of the cooperatives. They allow the managers to work democratically with minimal interference along with looking after the staff performance and seek help from authentic resources for the improvement of the business. They also transfer their roles and responsibilities to new candidates. The enterprise is functioning with more than hundred and thirty staffs in various departments such as Marketing, Production, Finance and Accounts besides hatchery and feed mill management. Door to door service is provided to producer members by more than three hundred skilled para-veterinary personnel.

Jharkhand Women self-supporting poultry cooperative federation limited (JWSPCFL) has three hatcheries, five feed-mills, parent broiler breeder farm a layer farm for the production of commercial eggs along with broiler poultry production.

Achievements

- ❖ At present, there are more than five thousand women poultry producer members having a capacity to handle ten lakhs of chicks' placement per month are working under this federation. The women membership is continuously growing to reach more than ten times in a span of sixteen years.
- ❖ Approximately, 20% of the total table chicken required in Jharkhand is served by these cooperatives. The state federation has the largest poultry production operation in eastern India.

- ❖ Sales turnover is accelerating through the operation years.
- ❖ A direct income of Rs 6853 lakhs to the women members is a clear evident of the economic success and independence provided by the cooperatives.

4. Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd. (JASCOLAMPF):

Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd. The only top commodities co-operative in India dedicated to lac, (JASCOLAMPF), originally known as BISCOLAMPF, was founded in 1963 with the goal of advancing the state's lac sector as a whole (*About*. (n.d.). <https://jascolampf.com/about/>). It is a Jharkhand State-registered organization. Tate Cooperative Societies Act, 1935. Being an apex Co-operative federation it has a commitment towards the social responsibility, hence it weighs more on services than profit. The lac farmers distribute the profit among themselves and thus their performance increases to a great extent.

5. Sundarban Cooperative Milk and Livestock Producers' Union Ltd.

Sundarban Cooperative Milk and Livestock Producers' Union Ltd. is a producer cooperative affiliated to West Bengal Cooperative Milk Producers' Federation Ltd. and is governed by West Bengal Cooperative Societies Act 2006 and West Bengal Co-operative Societies (Amendment) Act, 2011. The operational area of the Cooperative is South 24 Parganas district of West Bengal. The District Magistrate & Collector, South 24 Parganas acts as Special Officer of the organization (*Sundarini Naturals*. (n.d.). <https://www.sundarini.organic/about/>).

Conclusion

In spite of many challenges faced by the cooperatives, we can conclude that cooperatives play a vital role in the economic development. The present study reveals that when cooperatives are well-supported, they can truly transform rural economies. They offer not just stable jobs but also opportunities for skill-building and women's empowerment, weaving a stronger social fabric. The progress of different co-operative society has increased the success rate of different sectors like dairy, sugar and agriculture etc. This research adds to our understanding of how cooperatives can foster inclusive and sustainable growth in rural areas.

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