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# CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	<b>COST AND RETURN ANALYSIS OF PADDY UNDER ORGANIC FARMING</b> <i>DR. K. THIRIPURASUNDARI, R. SWARNA &amp; S. V. DIVYA</i>	1
2.	<b>A MONTE CARLO RISK ANALYSIS OF THE REAL TIME GROSS SETTLEMENT SYSTEM OF FUND TRANSFER IN ZAMBIA</b> <i>MUDENDA COLLINS &amp; KRISTEN KOMBE</i>	4
3.	<b>SOCIO-DEMOGRAPHIC, ECONOMIC AND LIVING CONDITIONS OF THE TRIBAL WOMEN: A STUDY IN THE AGENCY AREA OF KHAMMAM DISTRICT OF TELANGANA STATE</b> <i>G. JANARDHAN &amp; DR. S. RADHA KRISHNA</i>	12
4.	<b>SOCIO – ECONOMIC CONDITION OF WOMEN ENTREPRENEURS THROUGH SHGS IN KANCEPURAM DISTRICT OF TAMIL NADU</b> <i>DR. P. RAJA &amp; V. R. RADHAAKRISHNAN</i>	15
5.	<b>SOCIAL INSECURITY IN KERALA: SOME REFLECTIONS OF CONSUMERISM</b> <i>DR. ABDULLA M.P</i>	18
6.	<b>DETERMINANTS OF DIVIDEND POLICY WITH SPECIAL REFERENCE TO SELECTED HOUSING FINANCE CORPORATIONS IN INDIA</b> <i>DR. V. MOHANRAJ &amp; S. SOUNTHIRI</i>	21
7.	<b>JOB SATISFACTION AS A FACTOR FOR EMPLOYEE RETENTION: CIVIL ENGINEERS IN CHENNAI</b> <i>DR. S. MEENA &amp; JERINCE PETER</i>	25
8.	<b>AN ECONOMIC STUDY OF SELECT FISCAL INDICATORS PERTAINING TO KARNATAKA ECONOMY FROM 2000-01 TO 2011-12</b> <i>MONICA M &amp; VIJAYA PRIYA S</i>	28
9.	<b>RURAL MARKETING STRATEGIES OF PEPSICO AND COCA-COLA</b> <i>A. KALAIMOHAN</i>	37
10.	<b>WHAT AFFECT SLOGANS?</b> <i>WAN-CHEN WANG</i>	41
11.	<b>REVIVAL OF MSME'S IN INDIA: A STEP TOWARDS SUSTAINABLE DEVELOPMENT</b> <i>DR. NIDHI SRIVASTAVA &amp; GAGANDEEP CHADHA</i>	46
12.	<b>ECONOMIES OF SCALE: AN EVIDENCE FROM CROSS SECTIONAL ANALYSIS OF FIRMS IN INDIAN TEXTILE INDUSTRY</b> <i>CMA. POTHARLA SRIKANTH &amp; VIJAYALAXMI B</i>	50
13.	<b>INCLUSIVE GROWTH AND THE INFORMAL SECTOR: A STUDY OF THE FEMALE DOMESTIC WORKERS IN SOUTH 24 PARGANAS, WEST BENGAL</b> <i>SANGHITA BHATTACHARJEE</i>	55
14.	<b>THE ECONOMIC REASONS OF RURAL TO URBAN LABOUR MIGRATION: A STUDY ON MURSHIDABAD DISTRICT OF WEST BENGAL</b> <i>SRIPARNA GUHA</i>	60
15.	<b>EMPLOYMENT ELASTICITY OF INDIA: A STUDY OF PRE AND POST-REFORM PERIODS</b> <i>DR. A. VAMSI KRUSHNA</i>	63
16.	<b>GROUND WATER: POTENTIAL AND CONSTRAINTS</b> <i>DR. N. SWAMINATHAN</i>	66
17.	<b>CUSTOMER RELATIONSHIP MANAGEMENT (CRM): A STUDY OF J&amp;K BANK AND HDFC BANK</b> <i>RIZWANA KHURSHID &amp; DR. ASHFAQ AHMAD</i>	68
18.	<b>SOCIAL RESPONSIBILITY: A CASE STUDY OF VISHAL MEGA MART SOCIAL RESPONSIBILITY</b> <i>DR. NARENDRA KUMAR</i>	70
19.	<b>AN ANALYSIS OF INDIA'S TRADE RELATIONS WITH THAILAND</b> <i>ANJU RANI</i>	75
20.	<b>CULTURAL SUSTAINABILITY IN KERALA VIA TOURISM</b> <i>SHIJI O.</i>	80
	<b>REQUEST FOR FEEDBACK &amp; DISCLAIMER</b>	83

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**GROUND WATER: POTENTIAL AND CONSTRAINTS****DR. N. SWAMINATHAN****ASST. PROFESSOR****DEPARTMENT OF AGRICULTURAL ECONOMICS****PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE & RESEARCH INSTITUTE****KARAIKAL****ABSTRACT**

*Groundwater problems emerging in many parts of the world reduce drought- buffer supplies, threaten environmental values, and increase risks for many of the world's poorest people. Programs to improve public understanding and basic scientific information regarding the resource base and to encourage the evolution of groundwater management systems are essential. Furthermore, because many countries will need years to develop systems for managing groundwater, policies should encourage users to adapt to water scarcity conditions rather than attempt to solve water problems per se.*

**KEYWORDS**

tube-well, aquifers, water extraction water dynamics, ground water management.

**INTRODUCTION****NATURE AND SCOPE OF GROUNDWATER PROBLEMS**

The Green Revolution, which led to dramatic increases in food production, especially in Asia, has also been called the "tube-well revolution" because part of what drove it was ground-water development on an unprecedented scale. The number of mechanized wells in India grew from a few thousand at the time of independence in 1947 to tens of millions today. As a buffer against drought and precipitation variability, ground-water plays a critical role in food and livelihood security. Increased access to groundwater has reduced risks substantially, enabling many farmers to move out of poverty. All such benefits, however, may have come at a high cost.

**MATERIALS AND METHODS**

Groundwater-level declines of 1-3 meters per year are commonly reported for monitored wells in arid and semi-arid regions. In extreme situations, shallow aquifers are almost depleted. Even in humid regions such as Bangladesh, water-level fluctuations may be increasing, and water is scarce during the dry season. Furthermore, scarcity and quality concerns are linked. Groundwater pumping often mobilizes water that is saline or contains natural contaminants such as arsenic or fluoride. When combined with increasing pollutant loads from agriculture, industry, and municipal sewage, this pumping can irreversibly contaminate aquifers. The threats to groundwater resources are clear, but their extent is far less so. Worldwide, most groundwater monitoring networks are relatively new and collect a limited array of data on water levels and basic water quality parameters. Detailed data on water quality and pollutants are rarely available except in relation to specific local concerns. Data are also often unavailable on critical components of the water balance-such as groundwater extraction, evapo-transpiration from native vegetation, and deep inflows to aquifers. Furthermore, data on water-level changes can be misleading. Aquifers can take tens to hundreds of years to equilibrate when disturbed. As a result, short-term water-level declines do not necessarily indicate overdraft. Nonetheless, water-level changes and fluctuations are the most important factors influencing access to ground-water for the environment and for human uses. For small farmers along the Ganges, the deep saturated basin beneath their fields is irrelevant. What they care about is whether or not water is available within the tens -of-meters range from which they can afford to pump. When levels decline below or fluctuate outside that range, farmers lose access to irrigation and households may lose access to drinking water. Fluctuations are equally important from an environmental perspective. Stream flows and wetlands often depend on high groundwater levels. Even modest seasonal declines can affect surface water bodies severely. Water quality is also affected when changing levels mobilize low-quality water or cause water logging and associated salinization problems. From the perspective of current usage, this dynamic-the interaction between groundwater levels, underground flow patterns, surface water bodies, and the economics of ground water access-is far more important than the overall balance between extraction and recharge within an aquifer. Moreover, this dynamic is highly variable, heavily dependent on local conditions, and often missed in the data sets collected by groundwater departments.

**RESULTS AND DISCUSSION****OPTIONS FOR MANAGING GROUNDWATER**

The lack of information and understanding regarding groundwater dynamics presents a major challenge for those developing effective management systems. The challenge is as much social as technical. Without both data and a shared understanding of the problems, the social consensus needed to implement decisions is difficult to generate-and groundwater management decisions are often difficult.

Standard approaches to reducing groundwater overdraft, for example, often require metering of all wells, establishment of formal water rights, and regulatory and economic mechanisms to bring extraction down to sustainable levels. The situation is more complex in locations such as India with tens of millions of wells and conditions that vary greatly even at local levels. Even where management is most advanced, it is socially and politically difficult to reduce groundwater extraction to sustainable levels. Wells are generally private and highly dispersed. Inventorying them and monitoring extraction are problematic. Furthermore, reducing use to sustainable levels in arid regions often requires substantial reductions in extraction, which can have tremendous economic and social impact. As a result, governments are not inclined to force reductions.

Groundwater experts often propose community management of groundwater as an alternative to state regulation. Although global experience in this area is limited, experience with resources other than water indicates that several factors are critical to the success of community management-for example, clear boundaries on the resource and its user group, the ability to control free riders, and information on the use and condition of the resource. Such factors are difficult to establish in the case of groundwater.

Successful groundwater management has been achieved through intermediate-level institutions such as the quasi-governmental groundwater districts in the western United States and somewhat similar organizations in parts of France.

Organizations of this type hold much promise. Their development, however, often takes decades, and to be effective they require data, technical capacity, and some degree of supporting social consensus.

Markets are also central to any framework for ground-water management. Water markets in the western United States are based on water rights systems that attempt to quantify the volume sustainably available in aquifers and allocate it among users. Transactions involve contracts and often the formal transfer of the water right as well as the water itself. In developing countries formal water rights are rarely involved. Instead, informal transactions occur between well owners and adjacent farmers for irrigation or tanker companies that deliver the water to urban customers.

Two points merit attention. First, because formal rights are not involved, prices reflect short-term pumping capacity, not the longer-term sustainability of extraction rates. Second, even with rights systems, markets indicate the value individual users gain from extracting groundwater but not the economic, environmental, and sustainable use values that accrue when groundwater is left in place.



Aside from groundwater market prices, energy is the primary variable cost affecting groundwater extraction. In countries such as India, energy subsidies were used to encourage groundwater development during the Green Revolution. Now, despite water-level declines and huge effects on state budgets, those subsidies have proved politically difficult to eliminate. As a result, agriculture now officially consumes more than 50 percent of total power production in some Indian states. Appropriately structured energy prices can provide users with a major incentive to use groundwater more efficiently. Still, given the high yields associated with groundwater and the numerous factors affecting the economics of agriculture, energy prices alone cannot be expected to reduce groundwater extraction to sustainable levels.

## CONCLUSION

### ACTION IN THE SHORT AND LONG TERM

How can emerging threats to the groundwater resource base be addressed? Most groundwater experts advocate the development of comprehensive integrated management systems. While important, such efforts require long-term data on aquifer conditions along with well-established institutional capacities that are unavailable in many regions. Therefore, integrated management initiatives rarely generate results over the short term. Alternative approaches in particular those that encourage populations to adapt to conditions of water scarcity and to reduce pressure on the resource base are essential. Existing coping strategies such as the migration of populations out of agriculture and into urban areas along with the development of non-agricultural economic systems-represent a starting point for reducing pressure on areas where overdraft levels are high. Although they do not ensure sustainability of the resource base, such strategies can provide essential breathing space for the longer-term development of management institutions.

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In this age of Commerce, Economics, Computer, I.T. & Management and cut throat competition, a group of intellectuals felt the need to have some platform, where young and budding managers and academicians could express their views and discuss the problems among their peers. This journal was conceived with this noble intention in view. This journal has been introduced to give an opportunity for expressing refined and innovative ideas in this field. It is our humble endeavour to provide a springboard to the upcoming specialists and give a chance to know about the latest in the sphere of research and knowledge. We have taken a small step and we hope that with the active co-operation of like-minded scholars, we shall be able to serve the society with our humble efforts.

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