RURAL DEVELOPMENT DYNAMICS AND ITS LINKAGE WITH WATER RESOURCE DEVELOPMENT

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Abstract

To make India stronger in the 21st century and for allround development of the rural economy, efficient use and continuing sustainable development of water resources with emphasis on community participation is a pre-requisite. Besides tracing the implications of water resource development programmes namely increase in bio-diversity, food availability, employment generation, nutrition and food security, the paper points out the need for sustainable environment security. The article assumes vital importance the context of Governments' avowed objective of reduction of rural poverty through faster rural development and effective management of water resources.

Introduction

Development of water resources and their proper management are vital for adequate and safe drinking water supply, food grains production to meet the ever increasing demand from the burgeoning population, maintenance of basic health and sanitation, generation of hydropower, inland navigation, maintenance of ecology and production of industrial goods. The wealth of India, particularly rural India, consists in its land, water, climate and other natural resources. Among them, water is a prime natural resource and a basic human need not only for human beings and also for plants and animals. Therefore, its planning, development and management need to be governed by the overall national perspectives in furthering rural development dynamics.

With 2.4 per cent of world's land area and 4 percent of its fresh water, India has to support 17 per cent of the world's human population and 18 per cent of its cattle population. India being situated in the monsoon region has to face a paradoxical situation of scarcity amidst plenty. About 70 per cent of its arable land depends entirely on rainfall for crop production and this requires renewed attention on conservation of water and its integrated management for optimal use. The country receives an annual average rainfall of 1200 mm which, when multiplied by the geographical area, works out to 400 m.ha.m. After surface run-off and seepage, the available ultimate irrigation potential of the country has been estimated at 113m.ha.m.[1] Similarly, the available irrigation potential of Tamil Nadu has been estimated at 3900 thousand-hectare metres.[2] Though India is considered one of the oldest civilizations with a kaleidoscopic variety and a rich cultural heritage, an average Indian has hardly one-sixth of land and one-fourth of water needed for him, as compared to the world average. In view of the severe disparity in regard to supply of water, optimal use thereof, is inevitable to ensure comfortable living to the people of rural India. Therefore, various measures have to be devised for conserving every drop of rainwater, a major source of water.

Strategies to increase water use efficiency in agriculture involve three strategies viz., water management, soil management and crop management. All these measures should aim at increasing per unit returns from water use, including rainwater, surface water and ground water. Agricultural resources especially water has been severely degraded. Signs of agro eco-system stress and even its break down are abundant. Conservation and efficient management of existing of water

resource is vital for developing countries such as India with predominant agrarian economies where development of sustainable agriculture is essential for over all growth, alleviation of poverty and food security. As monitoring and management of water resources is vital for the sustenance of mankind, tackling of water scarcity and providing quality water to human beings is a priority agenda for any Government, across the globe. In the event of water becoming scarce, meeting the competing demand for water is an uphill task for many administration. Apart from causing restlessness to women and the family, water scarcity triggers social unrest, migration, reduction of livelihood options, denial of education and disturbance of day today life of the people. Therefore, it is of utmost importance to protect the quality and quantity of available surface water as well as ground water for ensuring continuous flow of benefits from ecosystem services and for reducing the cost of ecosystem degradation by promoting environment security.

Development Dynamics and its Linkage with Water Resource Development

Water resource management like the management of other resources is an important and evolving one depending on the improvement of technological knowledge and social needs, views, aspirations and management practices. The main objective of water resources development is economic efficiency, taking into account, cost-benefit analysis. Besides, economic efficiency, other rural development linkages encompassing water resources development are provisions of employment opportunities, promotion of regional development, redistribution of income in favour of the landless marginal and poor farmers, and finally nurturing of sustainable environmental quality. It is apparent from the above, the crucial importance being played by water resources development in improving the life styles of the people, particularly in developing countries. While serving as an engine of economic growth, water resources development programme, alleviate the sufferings of the poor people.

Properly planned water management and water development projects can make significant and lasting contributions to the social and economic development through their impact on primary, secondary and tertiary sectors in terms of time, spatial distribution and intensities. It is axiomatic that lack of water resources development and its management would result in a number of following grave problems.

1) Health problems- Water related diseases might occur frequently.

2) Economic problems- In the absence of sufficient water, poor people are forced to buy water from the vendors at high cost resulting in additional economic burden- Contaminated water might also result in poor health and loss of income due to sickness.

3) Social problems- Women and children are forced to spend considerable time in betching water from far away areas. This is one of the reasons for the prevalence of high dropouts of girl children in rural schools.

All the above problems are closely interrelated both in urban and rural areas. Along with this, the development of water resource programme, have a number of implications in terms of

(a) Increased food availability: It has increased on account of increasing yield per ha and expanding total cultivated area. In addition to this, adverse impacts of flood and drought have been mitigated to a large extent.

(b) Nutrition and food security: Both nutrition and food security have improved in the irrigated area due to crop diversification and more reliable food production.

(c) Employment generation: Employment opportunities have increased for skilled and unskilled labour in the irrigated area on account of

   1) Construction of infrastructure such as dams, canals, drainage systems and roads.

   2) Irrigated agriculture increases the need for labour and thereby employment opportunities in rural areas.

   3) Increased hydel power production leads to further agro-industrial development, stimulating further employment generation

4) Transport development is essentially required to link the dam sites in the upper catchments area to the lower regions providing direct and indirect development linkages in terms of trade, commerce, technology, educational and medical facilities

5) Energy availability: In the absence of adequate hydrocarbon reserves and to prevent costly import of petro-products, hydropower could be produced which is a renewable source of energy. Improved energy situation leads to increasing crop intensities along with bountiful food grains production, besides improving the social and economic conditions of people

6) Gender related issues: Women's literacy has increased as a result of development programmmes. This has been possible on account of increased employment opportunities for the family members in the same area

7) Increase in bio-diversity: All the available evidences indicate that water projects, significantly increase the bio-diversity in the project area. However, there remain certain negative implications also. They are as follows:

   1) Environment Impacts: Negative features of environment impact could be reduced through periodic environment impact assessment (EIA)

   2) Reduction in area under forest: Further, some have pointed out wrongly that development of water development programmmes would result in the reduction of area under forest.

The Government aims at prudent water management for reaching national development objectives and for improving the livelihoods of poor people through Integrated Water Resource Management (IWRM) at local, regional, national and river basin levels. IWRM not only ensures optimum and judicious use of precious water to all Indian citizens but also guarantees rural India's development and its prosperity besides viewing it as a welcome panacea for the water woes of the rural India.

Rural Development Through Improved Water Governance

Water Governance, as defined by United Nations Development Programme, is "the range of political social, economic and administrative systems that are in place to develop and manage water resources and the delivery of water services, at different levels of society. Water Governance facility, a new programme designed to support developing countries in their efforts to improve water governance was launched at Stockholm by the UNDP in April 2005. Water Governance is fundamental to the achievement of all Millennium Development Goals. The UN World Commission on Environment and Development, 1987 headed by Brundtland and the UN Conference on Environment and Development, 1992 held at Rio-de-Janeiro, Brazil (Rio Earth Summit) have linked the issue of environmental protection with sustainable development. Both have highlighted that the widespread scarcity, gradual destruction and aggravated pollution of freshwater resources demand a new approach namely. Integrated Water Resource Management (IWRM). This new programme will take an integrated approach to water resource management through improved governance solutions. It emphasizes further that prudent water management is crucial for reaching national development objectives and for improving the livelihoods of poor people. It is also a vital component of actions to improve economically efficient management of water resources and environmental sustainability by maintaining the integrity of ecosystems. It strives to achieve integrated water resources planning and management at local, national, regional and river basin levels covering all types of interrelated freshwater bodies including both surface and groundwater with due consideration to water quality and quantity. IWRM not only ensures optimum and judicious use of precious water to all Indian citizens but also guarantees rural India's development and its prosperity. Besides IWRM is viewed as a welcome panacea for the water woes of rural India.

Establishment of a Water Security System

Water will be the most important constraint in future for domestic as well as agricultural needs.

A sustainable water security system, the need of the hour, should comprise of water supply augmentation and water demand management.

Supply Augmentation: All avenues of increasing water supply, such as rainwater harvesting should be mobilized with the active involvement of local communities. All sewage and effluent water sources should be treated and recycled. Overexploitation of groundwater resources should be prevented and groundwater should be regarded as a social and not a private resource.

Demand Management: Maximum emphasis should be on the promotion of economy and efficiency in the use of water. There is immense scope for the well-to-do sections to economise on domestic water consumption, including the use of water for toilets and lawns, so that the poor can get another pot of water. There is also great scope for enhancing irrigation water use efficiency.

Environmental Refugees

Absence of sustainable water security system would lead to a number of problems; besides creation of environmental refugees. Environmental refugees are those who are displaced due to the destruction of their natural environment such as forests, watersheds, ground water resource and prime cropland and so on. Depletion of aquifer regime on account of over-exploitation of ground water has led to surface of harmful fluorides and salt, converting the land unfit for cultivation of crops. Consequently farmers have been forced to move out to eke their livelihood in the nearby periurban areas. These environmental refuges have often caused significant economic, socio-cultural, and political consequences in the area.

People flee their homes in search of food and jobs as the victims move; they carry their famine with them. They may impose intolerable burdens in terms of food requirements on the territory they enter. At the same time, they flood the labour market, creating a slump in wages, and endangering the economic security of the local population. Therefore, the situation calls for water security in the rural areas for alleviating rural poverty and to prevent exodus through sustainable agriculture.

In the context of the above problem, a survey has been carried out in the coastal and inland villages of Tiruvallur district and Kancheepuram district of Tamil Nadu to find out the extent of benefits of the ecosystem services and loss to the farmers of both the areas and to analyse the factors that are responsible for the costs of ecosystem degradation caused by the changing pattern of irrigation consequent upon over-exploitation of ground water and its related environmental damages[3].

The project study is an empirical and descriptive study, where two stage sampling design has been adopted to collect primary data from the villages of coastal areas and inland regions of Tiruvallur and Kancheepuram Districts. The study has observed that agriculture provided livelihood source to more than 65% of villagers giving them food, employment and income. Among the agricultural inputs such as land, water, labour, capital, fertilizer, seed and pesticides, water is considered as the basic critical input for increasing agricultural production. Two types of irrigation patterns have been observed in the study area, namely ground water and surface water irrigation.

A model has been used for analysing the primary data and the result is shown as follows:

$$\text{Out put} = \beta_0 + \beta_1 (CCA) + \beta_2 (COF) + \beta_3 (COS) + \beta_4 (COP) + \beta_5 (CHL) + \beta_6 (CBL) + \beta_7 (COI) + \beta_8 (REG) + \beta_9 (LU) + \beta_{10} (BW) + U_i$$

Where,

CCA = Crop cultivation area

COF = Cost of fertilizer

COS = Cost of Seed

COP = Cost of Pesticide

CHL = Cost of Human Labour

CBL = Cost of Bullock Labour

COI = Cost of Irrigation

REG = Region (Coastal and non coastal)

LU = Lake users

BW = Bore well users

$\beta_0, \beta_1, \ldots\ldots \beta_{10}$ are the parameters

U_i is the stochastic error term.

Estimated model:

Output = 453.856 – 61.59 (CCA) + 1.678 (COF)
(1.26) (5.553)*
+ 2.71 (COS) + 0.02 (COP) + 0.459 (CHL)
(3.66)* (0.028) (2.18)*
+ 1.84 (CBL) – 0.0054 (COI) + 501.39 (REG)
(7.465)* (.184) (3.718)*
- -255.73 (LU) – 325.588 (BW)
- (1.76)** (1.625)**
- * Significance at 5% Level
- ** Significance at 10% Level.
- R^2 = 0.92 F = 316.774.

The values given in the parenthesis are 't' values.

The results show that the value is significant (F=316.774). The co-efficient of determination indicate that 91 percent of variation in the output is due to the variation of the inputs given in the model. The 't' test shows that out of 10 variables, seven variables are influencing the output level significantly. The variable CCA is insignificant which indicates that the variation in the amount of land used for cultivation, has no impact on production. The analysis further reveals that pesticides used also had no impact on the production. The researcher has observed that the cost variation due to different sources of irrigation namely lake water irrigation and borewell irrigation have not made any significant impact on production. The variable cost of fertilizer is significantly related to the output. The results show that one-rupee addition in the cost of fertilizer resulted in an increment of 1.678 rupees value of output. The variable cost of seed is significantly related to the output. The results imply that additional one rupee would increase the level of output by 2.71 rupee. The partial regression co-efficient of human labour is 1.589, which indicates that one rupee additional investment would increase the level of output by 1.56 rupee. The partial regression co-efficient of bullock labour is 1.840, which shows that one rupee additional investment would increase the level of output by 1.84 rupee.

An attempt has been made to estimate the difference in output between the farmers among the coastal and non-coastal regions. A dummy variable has been introduced to know the effect due to the regional factor. The result shows that farmers in the non-coastal region on an average produce higher output to the value of Rs.501.39 than the farmers of coastal region. This might be due to the good quality of the water used for irrigation in non coastal areas and the fertility of soil.

The 't' test has been used to compare the cost of various inputs and output under various categories. However, the cost of production differs significantly in coastal and non-coastal villages. One of the factors responsible for this variation is the use of more fertilizer and pesticides, besides incurring usage cost for purchasing water from neighbouring farmers in the coastal belt. More over, another notable feature is the poor quality of soil in the coastal areas resulting in low food grains production.

Another phenomenon observed among the farmers in the study area is that they have evinced keen interest in raising paddy crop alone which is characterized as a water intensive crop. Farmers are influenced to raise paddy crop an account of the high supporting prices or procurement prices offered to paddy by the Central and State Governments.

On the contrary, it is observed, the farmers in the non-coastal regions incur less expenditure towards the purchase of farm inputs namely chemical fertilizer and chemical pesticides. More than this, naturally, the soil quality is superior in inland regions when compared to coastal areas.

Moreover inland regions possess a number of lakes, ponds and other rain harvesting structures. Therefore, the availability of surface water to the farmers of inland regions makes it possible to raise double crops or triple crops. All the above factors facilitate higher levels of food grains production resulting in lower cost. Therefore, it is observed that there is significant difference in the cost of production among the farmers of inland regions and the farmers of coastal areas.

The water sample study reports show an increasing trend in the electrical conductivity (EC) in micro S/cm. From this, it is observed that the ground water in the coastal villages have been found to be unfit for human consumption on account of high TDS level. In Vellivayal Savadi Village and Seemavaram Village, EC has crossed 4000 mic s/ cm. Further, the data reveals that the remaining

villages such as Mullaivayal, Athipattu, Gounderpalayam and Pattamanthiri, the EC level has gone beyond 2500 s/cm. Moreover, chloride as Cl is found to be more at 1070 mg/l in Seemavaram village of Ponneri Taluk. At Vellivayal Savadi Village, the water test reveals, chloride content at 547 mg/l. Therefore, it is concluded that water quality has become poor with high TDS content. However, the same trend has not been observed in the coastal villages of Kancheepuram district and inland regions of Thiruvallur and Kancheepuram districts. Therefore, Integrated approaches to water resources management and its use can help people living in poverty to secure their livelihood base and therefore their survival, health and productivity and may even help them to improve it. The situation calls for water security through integrated water resource management (IWRM) not only in the study area but also for the entire country for accelerating rural development through sustainable agriculture, which will certainly alleviate rural poverty. The analysis calls for raising the rate of investment, strengthening institutions and building necessary capacity in the water sector. Further, the following programmes may be adopted for reducing the water woes of the country.

- Prevention: Take preventive measures rather than curative have to be taken well in advance.
- Planning: Apply the principles of integrated water resources management.
- Foresight: Implement solutions flexible enough to adapt to new conditions.
- Subsidiarity: Act at the lowest level appropriate.
- Finance: Design financial schemes to sustain the plans and strategies.
- Social Solidarity: Include financial solutions to ensure affordable access to the poor
- People-centered: Involve people in decision-making about infrastructure, and consider local, low-cost, and easy to maintain and operate solutions for enhancing water use efficiency.

Conclusion

In the existing scenario of competing demand for water, IWRM aims at avoiding how both surface and ground water should be tapped conserved and used to the optimum level for avoiding the problem of environmental refugees. Restoration of rural eco system and rural development is possible with construction of percolation tanks, water conservation, modernization and proper maintenance of tank and other irrigation systems, exploitation of minor irrigation and adoption of micro-irrigation techniques for achieving optimum water use efficiency. To replenish further the aquifer regime, which is under stress, surface storage structures (percolation tanks) could also be built up across streams as water harvesting structures to impound rainwater and to retain it for a longer time for increasing infiltration. The water storage is expected to induce percolation and replenish the aquifer, which is being exploited through wells on the down gradient.

The research project has pointed out that the above measures have resulted in lowering the levels of TDS and chlorine in the study area. Restoring traditional water structures such as tanks and canals back to their original position along with suitable water management practices, precision farming techniques, micro irrigation techniques, fertigation techniques, participatory technology assessment and transfers, diversification of agriculture and community participation in environmental management are some of the measures which will go a long way in not only promoting benefits of ecosystem services and reducing the costs of ecosystem degradation but also in making rural economic development more dynamic.

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REFERENCES

1. **World Resources (A guide to Global Environment) 1994-95,** World Resources Institute, Washington, D.C., U.S.A., pp.181-185.
2. **Statistical Hand Book of Tamil Nadu,** 1999. Director of Economics and Statistics, Govt. of Tamil Nadu, Chennai - 6, p.96.
3. Rudrappan, D., 2001. **Changing pattern of Irrigation and its Impact on Agriculture: A study of Three Northern Districts of Tamil Nadu,** Unpublished Ph. D. Thesis submitted to the University of Madras, Chennai-5. p.47.
4. Rudrappan, D. 2003. **Management of Land and Water Resources for Ecological Security,** Journal of Sciences, Bangalore, Vol.2, No.2, Nov. 2003 pp. 111 – 115.