Chapter – 3
LITERATURE REVIEW

Chapter Contents

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Having understood the water scenario at National level and steps taken by the government to improve the water availability and reduce water scarcity over various plan periods and through specific schemes and having discussed the water scenario in Gujarat and specific schemes launched in the State of Gujarat the present chapter attempts to discuss the research studies carried out by various authors on RRWSS, published in various journals, conference proceedings, manuals and reports published by the eminent National and State government and non-government agencies, World Bank, Asian Development Bank, World Environment Federation etc.

The chapter discusses the research studies regarding the water tariff, water supply services and performance indicators aspects of the RRWSS.

In this research work, the researcher undertook a review of literature on RRWSS on water tariff, role of community, users in water supply services and performance indicators. Operation and maintenance of rural water supply schemes is an important aspect to deliver regular and satisfactory supply of water to the communities. The researcher has focused on water tariff recovery and performance indicators. This chapter highlights the contributions made by the various academicians in the field of regional rural water supply scheme.

Periodical monitoring is the key in evaluation of performance of the scheme and to assess how far away the objectives are achieved. In rural water supply scheme also, monitoring of several parameters on regular intervals helps in checking the overall performance. This helps the implementing authorities in new planning and making policies for the future schemes.

The chapter is divided into the reviews of Indian studies and the reviews of foreign studies.

3.1 REVIEW OF INDIAN STUDIES

The studies carried out with reference to Indian scenario are summarized in this part. The reviews are mainly divided into (1) water tariff, cost recovery and affordability (2) role of community or users in water supply services and (3) performance indicators- development as need. Within each subsection the studies are arranged on the timeline.

3.1.1 Water Tariff, Cost Recovery and Affordability

Major part covers of Water tariff, cost recovery and affordability of Regional Rural Water Supply Scheme.

Mazumdar (2002)[1] reported that the dynamics of rural transformation at the grass roots level in India requires a proper understanding of the relationship between technology and society and also economy at the village and the household levels. The selection of a suitable technology is not an isolated activity, but needs to be based on choice level of services in a way, which will be effective, equitable, sustainable, efficient and replicable.

Singh *et al* (2005) [2] studied that with the high level of capital investment and the history of government subsidized services, full cost pricing of water services has yet to take hold in India. As a result, it remains broadly under-priced leading to public perception that water is "free". The current tariff levels in India are too low to cover even operating costs. This paper examines the existing Indian urban water tariff models (fixed tariff, volumetric tariff, increasing block tariff *etc*.), their relevance and problems. It was found that none of the tariff structures could satisfy all the design objectives (cost recovery, economic efficiency, equity, affordability etc.). Also subsidies are not explicit and well targeted for poor population. There are several studies and issues that do demonstrate the opportunities for tariff increase and improved cost recovery. This paper highlights the results of such studies and brings out issues needing consideration. Improved cost recovery would lead to improved financial status of the water utilities. Also, subsidies, if designed suitably and well targeted, would serve the

concerns of the economically weaker sections. Such reform process would eventually lead to socio-economic sustainability.

Augustin (2008) [3] studied urban water crisis in Delhi, stakeholders responses and potential scenario due to inefficient water supply. The author observed that according the system prevalent water charges as well as the operation and maintenance cost is charged to the users and this is very high as considered by World Bank. It studies the relevance of current investment strategies resulting from the existing institutional set-up. A long term perspective on realistic goals, whether it can be achieved at the lowest cost and with the most sustainable result, could lead to reconsideration of the tools used for regulation, with a priority given to incentives towards source control.

Misra Smita (2008 *a.*)[4] has carried out survey of Monitoring and Evaluation of water supply and important performance management tools. The main object is to provide useful feedback and information for taking corrective actions in the design of policies and programs. The Monitoring and Evaluation of the rural water supply programs in India is being done mainly through periodic physical and financial programs reports, visits of area officers and other government officials and evaluation studies and sample survey conducted from time to time. The main purpose of the Monitoring and Evaluation activities is to find out whether programs are being implemented as per their objective and to identify bottlenecks, if any, in the implementation of the programs. The study also focusses on the latter aspects of program performance – captured through indicators developed in the 10 state studies of India on the effectiveness of rural water supply schemes undertaken by the World Bank. The study used 17 key indicators of water supply service on the basis of which four indices of effectiveness were constructed relating to reliability and adequacy, affordability, environmental sustainability and financial sustainability. The data for these indicators were obtained through a random sampling of representative schemes across the states.

Misra Smita (2008 *b.*)[5] has carried out, analysis of the comparative performance of multi village schemes. There are a large number of multi village water supply

schemes including regional schemes in India. The prime motivation for setting up multi village schemes is based on the desire to provide full water supply coverage to rural areas despite local water scarcity and increasing contamination of sources. In such circumstances it becomes necessary to make use of distant water source. However, treating and piping water from remote sources is often complex and expensive and it is felt that the cost of supply can be reduced and options broadened if a number of villages are served by one scheme. The analysis brought out that the multi village schemes are more costly than single village schemes with inferior performance and lower cost recovery. The capital cost per household of multi village schemes is found to be about 25% higher than that of the single village schemes while the operation and maintenance cost of multi village schemes is about 11% higher.

Under the ambit of World Bank **Misra Smita (2008 *c.*)** [6] carried out, a study of ten states of India on the effectiveness of rural water supply schemes. The various aspects of 'inefficiency' along with major issues were studied. This has been estimated for supply driven and demand driven piped water supply schemes for the various states covered in the study. The overall efficiency of schemes under demand driven program is greater than that of schemes under supply driven programs. To achieve reduction in the inefficiency of rural water supply schemes following solutions recommended:

Decentralization: A substantial part of the inefficiency is traceable to high institutional cost. This can be reduced through decentralization. For example decentralization can be resorted to by shifting the responsibility of mini water schemes and single village schemes to Gram Panchayats and user communities, unbundling multi village schemes into smaller schemes and handing over the operation and maintenance responsibility of intra- village schemes to the GPs. In short, incentive for a state wide approach could be provided to states that commit upfront to developing a state wide and sector wide approach and adopt sector reforms irrespective of sources of financing.

Economies of Scale: Cost reduction can be made by ensuring that new schemes are large enough to reap adequate scale economies. The analysis of cost data

suggests that significant economies of scale can be achieved when designing rural water supply schemes, unless local conditions are such that only a small scheme is cost effective.

Accountability: Institutional changes are needed to establish greater accountability and thereby improve efficiency. Going for contractual relationships with performance improvement targets to improve service performance will definitely help.

Misra Smita (2008 *d.*)[7] studied the norms for rural water supply in India, currently adopted to provide drinking water to rural people under the Accelerated Rural Water Supply (ARWS). The Government standard norms have been fixed for the provision of rural and urban water supply service. The number of households showing a public source is much lesser than the norm. Rural people expect a far better service than what, a sharing of source would offer as per the norm. The study shows a clear preference for domestic connections and willingness to pay for piped water. Hence, the rural communities should be offered a higher level of service subject to availability of water and willingness to contribute.

Misra Smita (2008 e.)[8] compared actual expenditure on operation and maintenance in piped water supply schemes with 'good practice.' Operation and maintenance expenditure incurred on R_nWSS in India is commonly much less than required and this has serious implications on their performance. In main policy, low expenditure on the operation and maintenance of water supply schemes can be traced to inadequate fund allocation and low cost recovery from beneficiary households. The cost recovery and the allocation of more funds for the maintenance of schemes, ensures that useful life can be extended. To improve operations as well as cost recovery, the ownership of single village scheme is implemented. In this paper desirable state to achieve is one in which the operation and maintenance cost needs to be properly assessed and fully recovered through user charges.

Misra Smita's (2008 f.)[9] studies on the 'willingness to pay', provides an indication of the value that consumers place on improved water supply and an

assessment of the demand for service improvement. A study of affordability provides guidance on tariff setting, helping to ascertain how far the consumers will be able to pay the cost of improved services. The contingent valuation method has been used in the study to assess the willingness to pay for improved services by rural households. The payment card format was used to elicit respondent's willingness to pay for improved services of hand pump, while the payment ladder method was used to elicit respondent's willingness to pay for improved piped water supply. Limited literature is available on the methodology to assess the amount that a house hold can afford to pay for water supply and sewerage services. Asian bank has suggested a norm of 5 percent of household income, and the World Bank a norm of 3-5 percent for water charges. In a number of studies undertaken in the UK, the affordability criterion is taken as 3 percent of income for multi village water supply scheme in India. They find that there is a positive correlation between the ranks of states in term of affordability and willingness to pay towards the operation and maintenance cost of pipe water supply. Punjab state tops in both affordability and willingness to pay, while Andhra Pradesh and Uttarakhand rank low, both in terms of affordability and willingness to pay. In general, the household willingness to pay in different states is less than the assessed affordability.

Landge, *et.al.* (2008)[10] suggested the basic criteria for designing the survey format to derive appropriate information, methodology to assess willingness to pay and level of affordability of the beneficiaries and usefulness to decide the requirement of the scheme. A survey methodology based on contingent valuation method is suggested to assess willingness to pay and affordability. The survey conducted in three towns of Maharashtra indicated the extent of affordability of households, their willingness to pay for better water supply services as well as the need for existing water supply schemes in towns. The database generated through survey and its analysis, enables the local bodies and the decision makers in selection of new schemes for water supply and designing and implementing tariff structure for its long term sustainability.

Karthic and Yohan (2009)[11] presented on effect of reforms on revenue of the water utility through discounted connection charges at Vijayawada Municipal

Corporation. The operating revenue of the utility is indicating un- sustainability of the utility due to insufficient number of connections and tariff. Therefore, the house service connection had been rationalized by the Vijayawada Municipal Corporation in order to circumvent the operating issues and to recover the capital investments of the utility. Discounted price list of connection charges gives some solace to the poor and the dispensation in the rates is in the affordable range of the dwellers. In this study effect of reforms such as 25% discount in connection charges, new slab for urban poor, liberalization in the connection taking process etc., has been evaluated. They concluded that the reduced connection charges are affordable for many house owners and the price satisfies the customer willingness to pay range. Habitations are satisfied with the liberalized connection procedures, improved subscriber management and complaints redressed.

Dhanabalan M. (2009)[12] described the methodology and procedures to fix the water tariff in water supply schemes. The water tariffs design was to harness the objectives of the 24x7 service delivery in Hubli-Dharwad, Belgaum and Gulbarga Municipal Corporations in the state of Karnataka, which mainly categorize the water tariff structure for domestic consumer, non-domestic consumer and commercial/industrial consumer. The 24x7 water supply facility was operationalized on Belgaum South, Belgaum North and Hubli Demo zones by demonstrating the stipulated performance targets and was expected to be carried out in Dharwad and Gulbarga Demo zone. It can be considered that a sustainable pressured 24x7 water supply facility could reduce the consumption to the extent of actual utility by reducing the wastages considerably.

Ahuwalia (2009)[13] attempts to review the various tariff structures in different municipalities of India and abroad and lists the reasons documented by selected municipalities for choosing a particular tariff structure. In achieving that investment target requires innovative financing solutions. Government subsidies in the financing of infrastructure projects are rapidly becoming a thing of the past. Studies in different parts of the world have found that capital investment support by central and state governments to cities and towns has been reduced more steeply than any other element of spending during periods of tight budget

constraint. To sustain investment levels in the face of reductions in central government capital grants, local authorities will have to make greater use of borrowing as a way to finance capital projects and improve revenue generation at the local level. The study attempts to review the various tariff structures in different municipalities of India and abroad and summarizes the conclusions of different studies on improvements required in the prevalent tariff systems.

Singh *et al* (2014)[14] studied that the urban water supply sector in India is entrapped in a vicious circle of poor tariff structure to poor cost recovery and hence poor service delivery to consumers. Urgent steps are necessary for improving the management of urban water sector and ensuring sustainability. In the paper, current status of water supply sector is discussed along with the details of different types of water pricing practices adopted in India and problems associated with them. It is observed that in India, state governments generally set the minimum water tariff for various municipal bodies, which in turn have option to set the tariff above this minimum level for individual cities in order to recover cost. As a result, there is wide variety of water pricing practices across various cities in India. Design of rational water tariff structure though is very difficult and challenging but would balance various conflicting objectives such as affordability, economic efficiency, equity, and cost recovery etc. The study presents a rational water price structure, which could balance the major three dimensions (utility, consumer and environment) of urban water, leading to sustainable urban water management.

Concluding Remarks

From the above studies following major conclusions can be drawn.

- The selection of suitable technology needs to be based on choice level of services in a way, which will be effective, equitable, sustainable, efficient and replicable.[1]
- Improved cost recovery would lead to improved financial status of the water utility. However, subsidies if designed suitably and well-targeted would serve the concerns of the economically weaker sections.[2]

- A long term perspective on realistic goals whether it can be achieved at the lowest cost and with the most sustainable result could lead to reconsideration of the tools used for regulation.[3]

- It was observed that the household willingness to pay in different states was less than the assessed affordability. It is seen that desirable state to achieve is one in which the operation and maintenance cost needs to be properly assessed and fully recovered through user charges.[4,5,6,7,8,9]

- One of the studies enables the local bodies and decisions makers in selection of new schemes for water supply and designing and implementing tariff structure for its long term sustainability.[10]

- The reduced connection charges are affordable for many house owners and the price satisfies the customer willingness to pay range.[11]

- One of the studies it can be considered that a sustainable pressured 24x7 water supply facility could reduce the consumption to the extent of actual utility by reducing the wastages considerably.[12]

- One of the studies attempts to review the various tariff structures in different municipalities of India and abroad summarizes the conclusions of different studies and improvement required in the tariff system.[13]

- It presents a rational water price structure, which could balance the major three dimensions (utility, consumer and environment) of urban water, leading to sustainable urban water management.[14]

3.1.2 Role of Community or Users in Water Supply Services

In this para, the studies related with role of community or users in water supply services have been reviewed.

Tripathi and Lal (2001)[15] defined the reforms in Indian rural water supply sector and community participation initiatives of Uttar Pradesh, Kerala and West Bengal. They studied the Indian initiative in community participation in rural water supply in many experiments. These experiences could be replicated

throughout the country with constructive efforts being put in by not only the Government, but also the people, their political representatives, NGOs, media and the private sector. Having achieved appreciable coverage through the normal programs implemented with 100% Government funds, it was envisaged that these programs should be reoriented to become community- based demand-driven programs. It was envisaged that sector reform pilot projects under rural water supply would go to improving the quality of life of the common people, especially the rural poor. It was concluded to empower them to shoulder the responsibilities of taking up other related rural development programs on a community-based structure, and revolutionize the total development activities on a long term and sustainable basis.

Mhaisalkar and Gawalpanchi (2002)[16] studied sustainable rural water supply with focus on community participation. They studied community participation at various stages of rural development *i.e.,* starting from planning and design, construction, operation and maintenance and its implication on health and other socio-economic aspects. To support and validate their study they thoroughly analyzed health education and community participation for sustainable water supply in Borujwada of Maharashtra. From their study, they found that the community was very much involved during the planning of the RWS project including site selection and location of Pipe scheme projects and contributed ₹20,000/- towards their share of expenditure on the project. The maintenance of the plant and the distribution system are managed entirely by the village representatives. Importance of community participation in achieving the success of rural water supply programme has been stressed.

ORG Nielsen (2007)[17] study is to critically examine and evaluate the performance of RRWSS with respect to the objectives envisaged while implementing schemes and its impact in area of health, hygiene and quality of life. The methodology is a combination of quantitative research techniques that had been adopted for this study. Quantitative tools mainly included structured and semi structured questionnaires, which had been canvassed amongst different type of respondents. Qualitative techniques *viz,* in depth interviews had been undertaken with officials of Gujarat Water Supply and Sewerage Board at the

division and sub division level. Focus group discussions were carried out with various target groups at the village level to develop a qualitative understanding on key issues pertaining to programme delivery and the targets of different components. They find that 78% reported paying water tariffs to the Panchayat or water committee. The per capita willingness was found to be ₹12 based on responses. However, in the tail end villages the willingness was the highest with ₹16 as the amount which people were willing to pay per person per year.

WASMO report (2007)[18] related to critical examination and evaluation of Performance of Sanghi RRWSS with respect to the objectives envisaged while implementing scheme and its impact in the areas of health, hygiene and quality of life. This is essentially to improve the performance of the RRWSS by taking corrective measures and desired goal of the scheme. To achieve the objectives of study, information was collected from primary as well as secondary sources. The primary data were collected through the household interview schedule and the focused group discussion. The data collected from the both the sources were analyzed by using the simple statistical techniques and SPSS. It is observed that a close perusal of RRWSS operation and maintenance, supply and demand, revealed that most of the villages face several problems regarding getting adequate quantity of potable water. Some gram panchayats were found to be willing to operate and manage the water supply scheme based on their local source of water. However, people were not aware about the actual expenditure that is being incurred on operation and maintenance. It was suggested that appropriate agency should take responsibility of overall management of water supply, finance, maintenance and repairs.

Katpatal and Gupta (2008) [19] describe approach and methodology used to design cost model and its applicability in the Public Private Partnership (PPP). In developing countries, the private partners are not generally attracted towards PPP arrangement in providing water supply services because of its complex operation and maintenance cost structure and difficulty in fixing tariff for a longer period. Risks are involved due to increase in the cost of energy, chemicals, manpower and other allied items. On the other hand, non-affordability of levied tariff results in under utility of the scheme and less

revenue collection. A well- designed cost model is therefore necessary that can provide the cost of each component, which contributes to the total operation and maintenance cost at any time of the PPP arrangement. This cost model should take care of the increase in demand with the increase in population and incremental cost required to meet it throughout the PPP arrangement.

Patel (2012)[20] focused on analysis of regional water supply scheme in rural areas. This case study is an effort to look at water supply system works in one of the water scarce area Kutch of Gujarat. She also tries to look into various approaches used by different institutions to provide safe and secure water supply in the region. There were 492 R_nWSS in Gujarat out of which 127 R_nWSS were in Kutch. Kutch is one of the water scarce regions of Gujarat. R_nWSS are considered as a unique feature, which provide safe and regular water with minimum transmission. 19 R_nWSS supplying water to 71 villages serving population of 58,332 in Bhuj taluka have been selected as case study scheme. The methodology of the collection of literature on strategies and policies followed for drinking water purpose in India. To collect information, institutions both government and NGO, in rural water supply sector were approached. This was carried out by visiting and meeting with the concerned department authority. This provided data as well as current scenario of the status of rural water supply system. The study of the scheme has undergone tremendous changes and is suffering from technical, management and financial problems. Problems in each RRWSS should be tackled differently on grass root level.

Concluding Remarks

Based on above study following major conclusions can be drawn.

- The community participation be enhanced for rural development. Even the maintenance of plant and water distribution system be managed entirely by the village representatives. The willingness to pay based on geographical region has been examined by ORG.[15,16,17]
- WASMO report concluded that it was found that appropriate agency should take responsibility of overall management of water supply, finance, maintenance and repairs.[18]

- Katpatal and Gupta concluded that a well- designed cost model is therefore necessary that can provide the cost of each component, which contributes to the total operation and maintenance cost at any time of the PPP arrangement.[19]

- Patel concluded that the scheme has undergone tremendous changes and is suffering from technical, management and financial problems.[20]

3.1.3 Performance Indicators – Development as Need

Identification and development of indicators for the evaluation of overall performance is common management practice. In rural water sector, despite large involvement of community and expenses occurring worldwide, evaluation of overall performance indicators still stands as a challenge. This para discusses the studies carried out regarding performance indicators.

Dwivedi and Bhadauria (2008)[21] have defined the Performance Indicators (PIs) as variables, whose purpose is to measure change in process or function. They have categorized the Performance Indicators for Evaluation of water supply namely, users' opinion and satisfaction PIs, Management PIs, Financial PIs, Level of Services PIs and Materials, Parts and Equipment PIs and Personnel PIs. However, this fails to include the role of community participation, affordability issues, willingness to pay, water tariff and subsidy issues, which are obviously affecting the sustainability of the water supply schemes.

The World Bank (2008)[22] study was an attempt to check the performance of the Rural Water Supply Schemes implemented in 10 states (excluding Gujarat). This covers largely the rural water supply schemes based on Hand pumps, Mini water supply of single or several villages and few multi village or regional water supply schemes. The period of study 1997-98 to 2005-2006 covering more than 600 rural drinking water supply schemes, is a large-scale empirical analysis of the traditional target-driven (supply-driven) programs of the Government and the more recent model of decentralized community-driven approaches. It attempted to look at various aspects of rural water supply, including flow of funds and expenditure incurred performance of schemes, cost of supply, household coping strategies and costs, as well as household willingness to pay

and affordability. The study focused mainly on the cost and performance of service delivery without covering the health impacts, or the sustainability of sources for rural water supply with an argument that though both aspects are crucial elements of success in the delivery of rural water, they would require separate detailed studies. The performance indicators indices relate to reliability and adequacy : Liters per capita per day (from the pipe water scheme) in summer and in other seasons, proportion of household requirement of water met by water from the scheme in summer and in other seasons, number of days of water supply each week in summer, hours of supply each week other than in summer, time taken to fill a 10 liters bucket, time spent on water collection each day in other seasons, time spent on water collection each day in summer, incidence of supply system getting affected by frequent breakdowns, household assessment of water quality. Affordability: operation and maintenance cost per household served as a ratio to the average income of private connection users, operation and maintenance cost per household served as a ratio to the average income of stand post users. Environmental sustainability: incidence of source drying out during summer and financial sustainability: extent of operation and maintenance cost recovery, proportion of private connection users regularly paying water charges. These indices are based on 17 key indicators of water supply service.

On studying supply side it was found that there is an ample scope for reducing costs under the traditional supply-driven programs. The study showed that the large public entities in some cases incur excessive institutional costs like salaries and overheads; at times incur unnecessary high capital expenditures and most significantly perhaps, spend less than half of what they should be spending on operating and maintaining their running (piped water) schemes. As a result, only a fraction of the public finances is actually available for improving rural water supply services. Interestingly it was found that the cost-recovery performance of schemes managed by village communities is distinctly better than the public entity-managed schemes. The institutional costs are also low in the decentralized community-driven (demand-driven) programs. Hence, a relatively larger fraction of the money spent through demand-driven programs can be utilized for creating infrastructure for rural water supply services.

A study made on the consumer side revealed that contrary to popular belief, rural households already spend a considerable part of their limited incomes on acquiring clean drinking water, often having to tap a range of different schemes running in their villages, in addition to private provisions like investing in bore wells, storage tanks, and so on. The average expenses on water by a rural household is ₹81 per month, and the Willingness to pay survey shows that they are quite open to spending up to ₹60 per month on just operating and maintaining a water scheme, provided they are assured a regular and dependable supply. The study also pointed out that the mere adoption of the 'decentralization' agenda cannot by itself improve the functionality and sustainability of schemes.

Yadav, Singh, and Shah (2011) [23] have discussed on performance evaluation of water supply services in Surat city. In this paper, performance evaluation of water supply services for Surat city has been carried out. The nine performance indicators were suggested by Ministry of urban development, Government of India to evaluate the performance of Surat Municipal Corporation (SMC) water supply. The nine performance indicators are: coverage of water supply connection, per capita supply of water, extent of metering of water connections, continuity of water supply, and quality of water supplied efficiency in redressal of customer complaints, cost recovery of water supply services and efficiency in collection of water supply related charges. Among all the indicators coverage of water supply, cost recovery in water supply services has good performance while efficiency in redressal of customer complaints, quality of water supply and efficiency in collection of water supply related charges showed best performance.

Concluding Remarks

- Based on the above studies carried out on performance indicators it can be concluded that the researchers and World Bank have tried to develop performance indicators. The classification of World Bank[22] was based on reliability and adequacy, affordability, environmental sustainability and financial sustainability. Whereas Dwivedi and Bahadauria[21] classified as management PIs, Financial PIs, Level of Services PIs and Materials, Parts and Equipment PIs and personnel PIs.

- It is Performance indicators coverage of water supply connection, per capita supply of water, extent of metering of water connections, continuity of water supply, and quality of water supplied, efficiency in redressal of customer complaints, cost recovery of water supply services and efficiency in collection of water supply related charges.[23]

3.2 REVIEW OF FOREIGN STUDIES

This para presents the review of related studies for the foreign countries.

3.2.1 Water Tariff, Cost Recovery and Affordability

Shah Binay (1998)[24] presented a methodology for an appraisal and prioritization of rural water supply schemes in Nepal with reference to major factors like technical viability, needs assessment/hardship, community's willingness to participate, financial resources, etc. He found that Fourth Rural Water Supply and Sector Project executed with the support of the Asian Development Bank has also developed its own set of priority index and a set of objectives scoring criterion, which is employed to prioritize eligible schemes. He studied that the Fourth Rural Water Supply and Sector project gives sixty percent weightage to the ratio of hardship scores to per capita costs and the remaining forty percent weightage is allocated to community participation.

Azuma and Jayakaran (2001)[25] reported the study dealing with the issues of transition and growth of the community-based operation and maintenance system before and after adoption of the National Water Policy and the WASHE (Water, Sanitation and Health Education) concept in Zambia. This comparative study focuses on roles of the village water committees, which have gradually evolved from the groups for maintenance of water supply facilities to those for policy/decision making in improvement of their living conditions. Secondly, changes in support system by the local administrations and approaches of interventions by the external agencies were examined.

Raghupati *et al* (2002)[26] in study on "Water tariffs and Subsidies in South Asia" noted that relatively little information is available as to the level of tariffs needed for full coverage of operating and maintenance costs. They provide results from several consultant studies which suggest average rates of operating and maintenance costs. There is substantial inefficiency in terms of excess staffing and wastage of water, which in an efficient company may reduce the tariffs. However, incorporation of capital costs for which no public information is available, would raise the tariffs needed. Hence, if tariffs could be raised closer to the level of operating and maintenance costs and some kind of targeting mechanism be introduced, significant performance improvements could be achieved in terms of cost recovery, economic efficiency and fairness and affordability. As a result, the state could significantly reduce its current subsidy budget, and the financial position of water utilities could be strengthened allowing them to reduce the burden of coping costs and provide better service.

Hoering (2002)[27] described that public private partnership in Ghana in the water sector is more extensive and more complicated in terms of contractual arrangements in order to ensure a fair distribution of profit and risks and to prevent abuse of the monopoly situation. It observed that due to limited successes, negative impacts and growing opposition by local population groups, trade unions and municipal utilities, the liberalization of the water sector is being pushed at the cost of alternative solutions.

Chambouleyron (2003) [28] suggested marginal cost pricing in which each water user pays a price that reflects the incremental cost of water used in Argentina. Marginal cost refers to one unit change while incremental cost usually refers to multiunit changes. Setting the price, of water equal to marginal cost means that each consumer pays price equal to the incremental cost imposed on the system for providing service.

Ward (2007)[29] reviews research on the application of economic concepts and tools to the analysis of the preservation, conservation, development, consumption, supply and allocation of water resources in Mexico. It summarizes research on economic analysis to support policy formulation, implementation

and evaluation, including both project appraisal and the design of institutions. For effective designing and recovery of tariff, which is likely to be increased due to additional infrastructure, one has to ascertain the economic value of water, the amount that a rational user of publicly or privately supplied water resources is willing to pay. Willingness to pay for water reflects the water users' willingness to forgo other consumptions and is measured by demand schedule relating the quantity of water used at each of a series of different prices. So the economic value of an added unit of water supplied decreases as greater quantities are offered to water users. Economic analysis has considerable potential to improve economic equity and sustainability in water resource policy. Advancing cost-benefit analysis and better communicating its limits could better inform debates over the design and implementation of water policies and management actions. Improving the measurement of economic benefits of water programs through use of contingent valuation methods would provide greater confidence that Contingent valuation methods measured values reflect actual values held by individuals.

Lehmann (2011) [30] suggests that an important criterion for the design of urban water prices is the affordability of water supply for poor customers. This paper presents a typology of water pricing options which policy-makers have at their disposal in order to address affordability. A review of theoretical insights and empirical experiences reveals, however, how the real-world performance of these options depends on the characteristics of their technological and socio-economic environment. Moreover, possible trade-offs between affordability and other criteria, including efficiency, financial sustainability and administrative simplicity, are pointed out. Thereby, the paper is meant to assist policy-makers in identifying water pricing options which are appropriate for their context.

Smits *et al* (2013)[31] studied that there is widespread recognition of the importance of support to community-based water service providers for sustainability of rural water supplies. However, there is little quantitative evidence to back this claim and a very limited understanding about the characteristics of support agents that are most significant in providing effective support. This paper presents the results of a study on support to service providers

in Columbia, including a quantitative analysis of the impact of different support agents on service levels, performance of service providers and functionality of infrastructure assets. The methodology included: 1) characterisation of seven different support agents and their performance, 2) analysis of service levels, performance of service providers and functionality of infrastructure for 29 service providers that received structured support, and 3) analysis of the same factors for 11 service providers that did not receive structured support. All service providers in this study were found to receive some type of support, but sometimes this was unstructured and irregular. The providers receiving support in a structured and frequent manner performed better against a list of expected functions than the ones receiving ad hoc support. However, there was no clear effect found between support and the level of service that users received or the asset status. The paper also concludes that there is scope to improve the effectiveness of support agents, with key factors identified the effectiveness, key factors are the frequency of support, the institutional capacity of the support agent and the targeting of support to different types of communities.

Garcia- Rubio *et al* (2015)[32] state that in the context of the Integrated Water Resources Management, demand policies are playing a more important role as opposed to traditional supply policies based on the construction of large hydraulic infrastructures. In this new context, water tariffs have become an important tool in achieving economic efficiency, environmental sustainability, and social equity. This paper reviews the situation of urban water tariffs in Spain, a country subject to high water stress. It analyses the capacity of urban water tariffs to recover service costs and to promote efficiency, sustainability, affordability, and equity. Although it has made significant progress in recent years, the Spanish urban water tariff system still faces many challenges. Many of these challenges would be better addressed by a national independent regulatory body.

Concluding Remarks

Base on above foreign studies on water tariffs, cost recoveries and affordability following major conclusions can be taken.

- It is observed that major factor affecting the R_nWSS gives 60 % weightage to the ratio of hardship scores to per capita cost[24]. The comparative study focuses on roles of the village committees for maintenance of water supply facilities[25].
- Raghupati concluded that, if tariffs could be raised closer to the level of operating and maintenance costs and some kind of targeting mechanism be introduced, significant performance improvements could be achieved in terms of cost recovery, economic efficiency and fairness and affordability.[26]
- One of the study described that public private partnership in Ghana in the water sector is more extensive and more complicated in terms of contractual arrangements in order to ensure a fair distribution of profit and risks and to prevent abuse of the monopoly situation.[27]
- It was found that marginal cost pricing in which each water user pays a price that reflects the incremental cost of water.[28,29]
- Lehmann presents, typology of water pricing options which policy-makers have at their disposal in order to address affordability.[30]
- Smits studied that there is widespread recognition of the importance of support to community-based water service providers for sustainability of rural water supplies.[31]
- Water tariffs have become an important tool in achieving economic efficiency, environmental sustainability, and social equity.[32]

3.2.2 Role of Community or Users in Water Supply Services

In this para, the foreign studies related with role of community or users in water supply services are reviewed.

Timothy (2003)[33] emphasized the importance of community participation in the sustainable rural water supply in Nigeria. Community effort at maintenance is largely hindered by lack of spare parts and adequate institutional support. Water service providers in the rural areas must work closely with the community empowering them in decision making as regards site selection, choice of

technology, community involvement, etc. It is when the community participates freely and willingly that a water supply project stands a good chance of providing long-term benefits.

Shanthasiri and Wijesooriya (2004)[34] carried out a case study on community involvement in rural water supply of Sri Lanka and reported various advantages such as feel of ownership, decision making amongst beneficiary, concerns for non-revenue water, etc. and disadvantages such as time-consuming activity, non-participation in labor contribution, non-acceptance for chlorination due to traditional habits and reluctance for installation of water meters due to its high cost.

Hickey (2008)[35] considered two primary objectives: The first is to understand the evaluation of an installed municipal water supply delivery system by identifying all the physical components of any specific water distribution system. The second objective is to provide recognized practices for conducting water supply tests at prescribed intervals to measure the water system delivery capability and ensure that the system is meeting the water supply demand.

Okeola and Sule (2010)[36] introduced the evaluation of management alternatives for urban water supply system using multi criteria decision analysis. The study introduced three management options that are formulated on the prevailing nation's water supply sector and foreign countries' models. These three options are Public ownership and operation; Public ownership and private operation; and private Ownership and operation. The stakeholders have chosen public ownership and operation as the most sustainable operation of urban water supply service delivery under scrutiny of environmental, economic, technical, institutional and socio-cultural criteria.

Moriarty *et al* (2013)[37] studied that in providing first-time access to water lie, a number of pressing challenges to the dominant approach to rural water supply in developing countries, namely community management a demand-responsive approach. These challenges manifest themselves in poor performance of service providers, high rates of hardware failure, and very low levels of service. The

paper argues that tackling these challenges requires a shift in emphasis in rural water supply in developing countries: away from a de-facto focus on the provision of hardware for first-time access towards the proper use of installed hardware as the basis for universal access to rural water services. The outline of the main actions required to achieve this shift are becoming clearer. Chief amongst these are the professionalization of community management or provision of direct support to community service providers; adoption of a wider range of service delivery models than community management alone; and addressing the sustainable financing of all costs with a particular focus on financing capital maintenance and direct support costs.

Tadesse *et al* (2013)[38] describes that wise utilization of water resources is becoming very important as world faces water crises. The main objective of this study was to investigate the rural water supply systems with case study in Adama area, in central Ethiopia. Both quantitative and qualitative data were collected and analysed. Four sample water schemes were selected and totally 148 representative households were selected for answering the questionnaires. Key informant interviews and group discussions were also conducted. The study assessed issues such as community participation, water committee empowerment, management and governance of water supply schemes, women participation, functional status of water supply scheme, sanitation and hygiene issues, external support, and monitoring system of water supply schemes. The findings indicated that the community participation in planning and implementation was very good while for monitoring mechanism of operation and management as well as community participation on choice of technology was poor.

Concluding Remarks

- Based on above foreign studies on community participation, it can be concluded that, community participation is considered important[33] and it also brings advantages like feel of ownership etc,[34] however, given the option about the ownership, considering sustainability public ownership is much preferred.[36] One of the study also indicated that community participation in planning and implementation was very good while for

monitoring mechanism of operation and management as well as community participation on choice of technology was poor.[37,38]

3.2.3 Performance Indicators – Development as Need

This para discusses the foreign studies on development of performance indicators.

Stephen[39] **(2000)** described the Key Performance Indicators developed for the several rural water supply schemes in South Africa's Reconstruction and Development Program (RDP). The Performance Indicators fall into three categories, *viz.,* Quality of Service, Financial Health and Accountability of Water Committees. The result suggested that in rural area, the challenges are of achieving functional and financial sustainability of water schemes. The diligent recording of performance indicators cannot in itself produce a sustainable scheme. A careful assessment and evaluation of the performance indicators will greatly improve the scheme's chances of success.

Foster and Jens[40] **(2003)** carried out a monitoring and evaluation of rural water supply in Ghana and revealed the importance of monitoring and evaluation system and also noted that the four main performance indicators serve as a basis of the monitoring and to estimate the community's overall Operation and maintenance performance *viz,* Management performance, Operational performance, Maintenance performance and Hygienic Operation performance. The indicators are given different weights depending on the estimated importance *i.e.,* the Management performance is given significantly higher weight than the hygienic performance and likewise the questions are given different weights for their contribution to the performance indicators. Each indicator measured different strategies and levels of quality assurance and quality control.

D. A. and Balfour A. F.[41] **(2006)** described the key performance indicators in benchmarking of rural water supply schemes. South Africa has seen a number of evaluation and monitoring initiatives in water supply sector. There is a tendency,

however, to embark on or promote ambitious monitoring programme, with scores of indicators, and this is simply not sustainable in practice; is evident from the fact that at present very little monitoring is happening. In reality the only successful ongoing rural water supply monitoring programme which has been observed in the field is that which was from 2001 until 2005 conducted by service support agents under contract to the Alfred Nzo Municipality. They reported that the monitoring program with key performance indicators *i.e.,* Water quality, Reliability and Source sustainability are only three Key Performance Indicators for evaluation of health of the water supply schemes.

Concluding Remarks

- Based on above foreign studies on performance indicators (PIs) for water supply schemes it can be concluded that the PIs mainly relate to, quality of service, financial health and accountability of water committees;[39] management performance, operational performance, maintenance performance and hygienic operation performance;[40] as well as to water quality, reliability and source sustainability.[41] It all depends on for which scheme the evaluation is being carried out and from which angle the evaluation is being carried out.

3.3 SUMMING UP

This chapter carried out the review of literature for studies related to India and foreign countries. The reviews are broadly presented in three parts *viz*. on water tariff, cost recovery and affordability, role of community or users in water supply services and the performance indicators. As the present study mainly focuses on the Performance Indicators, it is worth mentioning here that, for Indian and foreign studies following PIs are identified by the researchers: reliability and adequacy, affordability, environmental sustainability, financial sustainability, management, level of service, materials, parts and equipment, personnel, water quality, financial health and hygienic operation performance. It was very difficult to find scheme wise detailed analysis relating to water charges, water connection charges, satisfaction about the scheme as well as the

affordability for water charges. In the context of above, the present study bridges this gap in literature by examining number of aspects of selected RRWSS. This chapter had accounted the theoretical development in RRWSS as well as reviewed the academic literature of academicians, practitioners and researchers who have through number of research studies examined various aspects of RRWSS in India and Abroad.

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