STRUCTURING THE UTILITY OF COMMON PROPERTY RESOURCES (CPR) FOR SUSTAINABLE INFRASTRUCTURE DEVELOPMENT-CONTEXT OF DRINKING WATER IN RURAL INDIA

Nagachethan SM
IndusInd Bank Ltd

Prashant Hegde
Axis Bank Ltd, Belgaum

ABSTRACT

Common Property Resources (CPR) has been much studied concept in the context of developing countries from past one century. With emergence of issues like climate change, the very concept of CPR is undergoing a major change and challenge. The change is seen in the broadening base for inclusion of new resources such as drinking water, pure air etc and is not limited to erstwhile studies like water used for irrigation or land that is used for grazing.
Rapidly dwindling resources accompanied with climate change and lack of accurate planning and actionable measures call for collective consciousness building exercise for sustainable future.
In this paper we have taken water as the main element of study and have observed various socio-political and environmental aspects that are attached with the same and the evolving collective consciousness in rural India. We also observe agents of change that have caused collective consciousness to be built in people and what are the advantages and disadvantages these pose for our future. The paper attempts to study drinking water in particular as a CPR and generates ideas for policy changes for sustainable development in rural India. The paper attempts to answer the need for collective consciousness through building new generation of institutions which are economically viable, legally sound and environmental friendly.

Key Words
Availability, Accessibility, Collective consciousness, Affordability, Awareness, Drinking water, Sustainability

Key Points

- Collective consciousness would emerge when the marginal collective cost of drinking water is lesser the marginal individual cost of drinking water.
- Critical mass “n” from the population needs to come together for a collective consciousness to emerge and to make the model sustainable.
- COMBSI model puts sustainability in limelight rather than profit
- COMBSI model can be replicated across different villages or region.

INTRODUCTION

Water is one of the most precious gifts to mankind. It is a well known fact that though water covers 70% of earth's surface usable water proportion is much lesser. Per capita availability of utilizable water has gone down from 5177 cu.m. in 1951 to 1820 cu.m. in 2001 in India. It is expected to go further down from current level to 1140 cu.m. by 2050. The data on per capital availability is only a mathematical calculation. In reality, availability of water differs from person to person; place to place and season to season. The available usable water to a person in Western Ghats region is different from a person in Thar dessert. Water availability to a rich person in the Thar dessert may be different from a poor person from same locality. Same person may get different quantity of water in different seasons. Some people do not have access to usable water source at all. This uneven distribution has put huge pressure on certain regions and certain section of people. Pressure is further mounting as some people are completely oblivious of gravity of the situation and use the water with little care.

Providing safe water for drinking and sanitation are social goals and water is also needed for industrial production, pollution assimilation and a variety of environmental services (Frederick 1993; Glieck 1997; Seckler et al. 1998). According to a Government of India report, by the year 1997 India had made substantial improvements in providing safe drinking water and water for domestic and irrigational purposes. But with the increase in population and incidence of global warming and therefore climate change, there has been enormous pressure on limited resources of fresh water. Six major river basins in India are already water stressed and local scarcity and environmental problems are endemic in all basins (World Bank – GoI 1998). As water scarcity increases the financial and environmental cost of its use increase enormously. (Dinesh Kumar, 2001). The approach to planning, development and management of water resources has been by and large, centralised, sectoral and segmented (World Bank – GoI, 1998). This paper attempts to study water in general and drinking water in particular as a common property resource and methods to institutionalise the use and protection of this resource for sustainability of the society more so in particular to Rural India.

WATER AS A CPR

Water as a natural resource endowment is seen in various forms. We can broadly classify them as fresh water resource and saline water resources. Ground level water table, ponds, lakes, rivers are examples of fresh water resource and vast seas and oceans are sources of saline water. Except for limited industrial purposes, most activities that the mankind is involved revolve around fresh water. Hence there are obvious conflicts for the distribution and usage of fresh water.

The concept of common property resources (CPR) is complex and controversial. It has different meaning, scope and coverage according to many schools. But the most accepted concept indicates that these are nothing but communal property where all members of an identifiable community have some degree of property rights and they can exclude outsiders and regulate their use according to community needs. Unlike public property, CPRs are geographically confined and sense of ownership lies with a group of people or community rather than the state. Singh (1994) is of the opinion that common property resources are owned in common by an identifiable group of people, regulated by social convention and legally enforceable rules. Application of CPR concept to water requires reasonable understanding of source of water and its distribution. Two broad categories, ground water (bore well, pond, lake and open well) and surface water (mainly river), can be observed with respect to water source. The very characteristics like community control and geographical boundary enable us to treat former as CPR and the latter as public property. However, latter can distantly be CPR if the vantage point changes to state or country as a community. Though most of the bore wells and open wells are owned by individuals, our submission is that fundamental source i.e. ground water is owned by no single individual. It is necessarily confined by geographical boundary which is not visible on the surface. Surface water-river water-is not confined to any community or a particular location.

Groundwater for example is a renewable natural resource and is a common property resource that is a resource which is used by a common identifiable group of owners owning the overlying land. *De jure* property rights in groundwater are not clearly defined but *de facto* it is accessible to all those who own the overlying land. But for members inside the identifiable group (commons), it is an open access property and its use is not governed by any written rules. However, in India, the differences in caste, income levels and influence a person has over his common affects his/her usage of the resource. Also, with increase in industrialisation and clustering of industries in urban and semi-urban areas stress on both groundwater and surface water has increased tremendously.

WATER – DEMAND AND SUPPLY SITUATION IN IMMEDIATE FUTURE

Water demand in India would increase in the near future. The population growth would reduce the per capita availability of water. With increase in population there would be stress on agriculture to produce more food

grains, which would demand more irrigation and therefore increased use of surface or ground water for irrigation. Ever increasing industries are also putting pressure of water endowments. Climate change may reduce the levels of precipitation and there by sources of water may get dwindled.

Also, growth in urban population would induce rise in domestic water consumption and this would be higher than the demand of rural population for domestic purposes. This would be mainly because of higher population growth rate and increased income levels in the cities. The available evidences indicate that water demand is highly elastic at low income and low water use levels and the elasticities for domestic water will decline gradually as income and water use rise (Rosegrant et al. 1999). This would in the long run create a conflict between urban and rural population. The domestic water requirements for the rural areas are widely spread from livestock rearing to drinking water whereas the consumption patter of the urban areas is highly concentrated. As the availability of water is limited in urban areas, the additional requirements of urban areas would be managed from rural supplies. As urban areas would comprise influential policy makers, corporate bodies, it is very likely that these lobby groups would exert pressure and deprive economically weak and poorer rural areas of their share of water. Current political economy of growth based on industrialisation and urbanisation encourages re-allocation of water meant for other uses in favour of industries and urban areas leading to conflicts (Ballabh et al. 2000) Also, Industrial water use can conflict with rural drinking, irrigation and urban drinking in future. (Ballabh et.al, 2000). There were incidences of such conflicts in semi arid areas like Western Gujarat, where farmers protested against the diversion of water from Mahi irrigation command to Ahmedabad for urban uses.

In an early article, Demsetz (1967) showed that when natural resources come under pressures of population growth, technical change and commercialisation, common property rights tend to give way to more explicit regimes of private property rights. When such changes are prevented, common property rights readily yield to open access regime. It is commonly believed that since these changes basically involve relationships amongst people with respect to appropriation and use of natural resources, the best way to handle this crisis is to encourage the forging of new types of institutions to manage these resources in an efficient, equitable and sustainable basis. (Shah Tushaar, 1993).

The other alternative to this approach are the markets and regulations as instruments of water allocation (Frederick 1993; Howe et al 1986). Howe and co-authors suggest six criteria for allocating water comparing that with alternative institutional arrangements (a) flexibility in allocating supplies in response to both short term and long term changes (b) security of tenure to encourage investment in and maintenance of water-using system while allowing for users to respond voluntarily to incentives to reallocate supplies (c) whether the user is confronted with real opportunity costs of the resource (d) predictability of the outcome of transfer (e) equity impacts (f) whether public values are adequately reflected in the process.

There have been experiments with respect to water and drinking water from the government or local agencies as well as from the non-governmental organisations in market-regulatory model and collective model respectively. But the experiments are proven to be far from sustainability. Many studies prove that water supply from the government is prone to issues like political bias, caste related exploitation etc. Similarly the interventions from the non-governmental organisations in the field of drinking water have been on a franchisee model or investor centric model. In this, the community may not develop ownership and hence long term sustainability of the project becomes difficult. In the following section we present our findings and framework based on our studies based in three villages in rural India with respect to development of a **collective oriented market based sustainable initiative** (COMBSI) for drinking water.

METHODOLOGY

The study was based in three villages spread in three different states of India. One village was in the coastal plains of Andhra Pradesh, another in the delta region of Tamil Nadu and another hilly tribal village in the interiors of Maharastra. In each village we had a sample of thirty households from different hamlets or localities. The methodology adopted was interviews with the household head of the respective families. The interviews were done through a simple questionnaire to find the cost incurred by the family per month to fetch the required amount of drinking water. Also we understood from each respondent about the availability and accessibility of water, the affordability of the family and awareness about the need for safe drinking water. We have made following assumptions regarding the survey.

1. Cost of water is the amount spent by the family in fetching the water from the nearest source. This includes costs involved in physical labour, electricity cost and size of the family. It has been indicated in the survey as cost of water incurred by the household per month in Indian Rupees.
2. Accessibility and availability of only water was questioned and not about pure, safe drinking water. However, the awareness question highlighted about the issue of pure drinking water.
3. Availability was defined as presence of water source throughout the year. There have been instances where water is available for over ninety days in a year, but we have considered the same as non-

availability as it is not available throughout the year. Polluted water is considered to be as good as not having any water resource.

4. Accessibility is defined in terms of distance of the water source from the household and the hidden manpower cost or transportation cost from the water source. Anything within a distance of 500 meter has been defined as easily accessible, anything within a kilometre distance has been defined as slightly difficulty to access and over this limit we have defined as inaccessible. In case of tribal village of Maharashtra, we have considered physical barriers to the source of water such as hillocks and deep forests.
5. Affordability is defined in terms of income level of the family per month. We have classified the income levels as below thousand rupees a month, thousand to five thousand rupees a month and more than five thousand rupees a month.
6. Awareness is defined as the knowledge of the household about safe potable water and also about water related diseases like cholera, typhoid, jaundice etc.

FINDINGS AND RESULTS

Hypothesis:

The four independent variables i.e. availability, accessibility, affordability and awareness along with dummy taken for two states (Maharashtra & Tamil Nadu) explain the cost of water which is considered to dependant variable in the study or these variables influence the variation in cost of water.

Null Hypothesis:

The four independent variables i.e. availability, accessibility, affordability and awareness along with dummy taken for two states (Maharashtra & Tamil Nadu)do not explain the cost of water or these variables do not influence the variation in cost of water.

The F-stat is significant ($p < 0.05$) at 5% level of significance which imply that the variation in cost of water is explained by the above said variables. However, these variables explain the cost of water to the extent of 85.4%. Adjusted R square that is 84.2%, which is also close to R square. Hence our function which is,

Cost of the water= F (Availability, accessibility, affordability, awareness, state factor) can be mathematically represented as

Cost of the water

=11.040 +3.102(availability)+2.711(accessibility)+16.56(affordability)-0.751(awareness)-21.96 (Dummy_MH) -10.30 (Dummy_TN)

If we look at significance level of these variables, it clearly indicates that affordability is the most significant factor followed by accessibility other than dummy. Availability and awareness have little influence on cost of water. Tolerance factor is another indicator of multicollinearity. It is apparent from the table (see Annexure 1) that availability and accessibility have very less tolerance contributing very less information to this model. It is also evident from the model that the states of Maharashtra and Tamil Nadu are having less cost of water than AP as AP has been taken as benchmark. Standardised Coefficients also highlight some information about model rather more. It is also obvious that a change in the standard deviation of affordability causes change of 0.673 times standard deviation in the cost of water.

So, it might be possible that availability and awareness cannot define cost of water as because water may be available and people are also aware but as long as they do not have proper income to afford will not be able to access safe drinking water. It pins down to the fact that only availability will not play significant role until and unless it is within the reach of the villagers not in terms of physical accessibility but in terms of monetary accessibility as well. Hence any sustainable intervention in the field of drinking water should be such that the cost of water is within the reach of the public aspiring to access the same. However, present interventions in the country are mainly aimed at making water available to the rural and poor population.

FRAMEWORK

The findings clearly show that the cost of water is significantly dependant on the four variables availability, accessibility, affordability and awareness (from now referred as 4A) taken together. Hence a model that could be an optimal solution to these four variables would tend to decrease the individual marginal cost of water per household and there by increase the affordability of the household for safe drinking water. The model would be a hybrid structure between the market regulated and collective models. Hence we propose **Collective Oriented Market Based Sustainable Initiative** (COMBSI) for drinking water. When water resource is available in plenty, there is always an incentive to organise for drinking water individually. However as detailed in the

earlier sections of the paper, there is a growing demand for water and the resource is stressed (As depicted in Figure 1). Hence the incentive for collectively organising would be more economical than individual. However the collective consciousness would emerge when the marginal collective cost of drinking water is lesser the marginal individual cost of drinking water. Hence the proposed model should supply drinking water to the members of collective at a cost which is individually acceptable and is equal or lesser than the marginal individual cost of drinking water. For a collective consciousness to emerge we need a critical mass "n" from the population to come together to make the model sustainable. This critical mass "n" would be a decisive factor in deciding the cost of factor. As "n" tends to increase, the cost of water decreases and hence affordability of each household for safe and potable water increases. (As depicted in Figure 2)

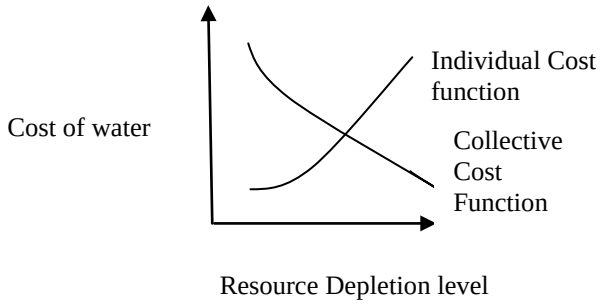

Figure 1: Incentives to Collectivise

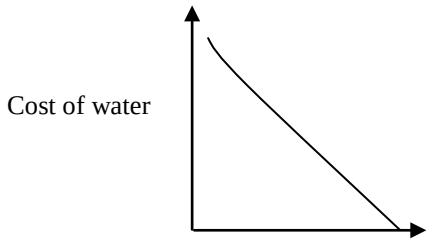

Figure 2: Critical Mass "n" to collectivise

COMBSI model

COMBSI model for drinking water would overcome the difficulties in the existing models where there are issues of investments and ownership. The model would also overcome the lax norms of a collective and incentives to override as individual has to pay per litre of water that he fetches to his household and hence problem of resource allocation would also be solved. Technology required to make water potable is a major cost element. Other activities like transportation of water, maintenance of the machinery will not attract any major cost. Hence critical mass 'n' is dependent on cost of relevant technology and affordability level of a particular village or hamlet. When 'n' reaches to optimum number, investment required from each individual to become equity partner will be optimum for that particular region/village. Accordingly cost of water would vary and it would be affordable to all those 'n'. In fact, actual cost of water becomes less than the price paid by each individual if health benefits of drinking pure water are considered. A study conducted by John Livernois in 2001 says that tangible economic cost of the Walkerton water crisis is $64.5 million.

Major shift in COMBSI model when compared to franchisee or investor centric models is with respect to profit seeking behaviour of the owners. COMBSI model puts sustainability in limelight rather than profit as all owners and only owners are user of drinking water. Any profit generated will subsidise the cost of water which in turn benefits the owners or the stakeholders. Hence the orientation is from profit to sustainability in the present

model. Cross subsidisation issue related to initial investment as an equity and daily water requirement of a stakeholder will not arise due to magnitude of investment required per person is insignificant.
Though the 4A regression model has proved that affordability and accessibility are two most important variables, we need to identify a proper source available for setting the initiative. However the cost of water may not get influenced drastically because of availability. Similarly, awareness which is another variable is a key factor in building the critical mass for the collective action in this initiative, without which the project may not take off.

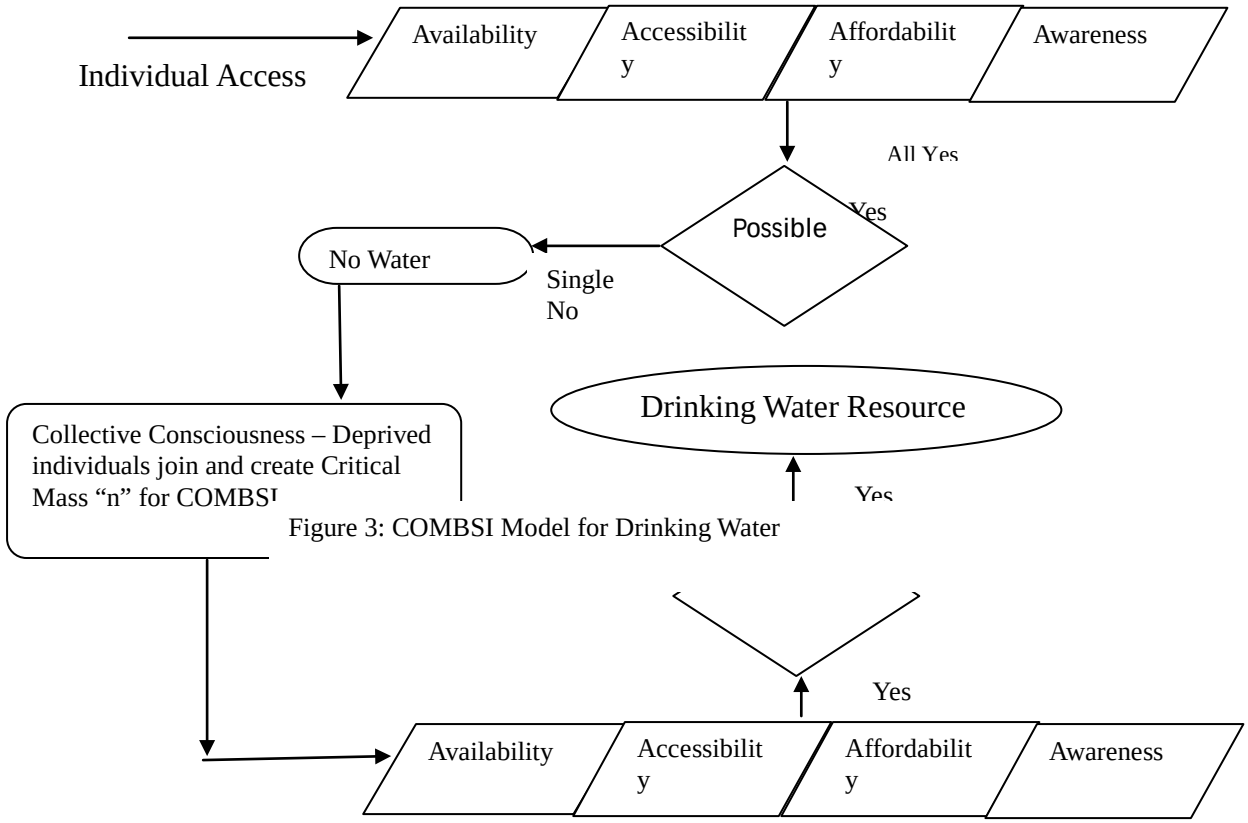

Figure 3: COMBSI Model for Drinking Water

CONCLUSION

COMBSI model thus integrates the ideas of Demsetz for efficient, equitable and sustainable model for sharing of water resource and the alternative market regulated approach of Howe et al. to encourage investments from each users of the resource and also adds flexibility in allocating the supplies of the resource based on long term or short term requirements. The model emphasises sustainability as price of water would vary depending on the critical mass and equation of 4A variables from one village to another. This is contrary to the standardised water supply models built by many NGOs in rural India. Present interventions have kept same price of water across the villages, which would be difficult preposition for sustainability. Also the model envisages the need for awareness among the population of the native villagers to join the collective since the equity share would be more affordable to the poorest of the poor.
COMBSI model provides a firm footing for environmental friendly solution to the climate change prone and conflict stricken subject of water and in particular drinking water in a sustainable and replicable way.

REFERENCES

1. Ballabh V., R.Prabhakar, M Dinesh Kumar, Vina Vani, Arun Mudgerikar and Bishwas Joshi (2000) "Western Region Consultation on Freshwater Issues", report of the Workshop held at Institute of Rural Management Anand, October 11-12
2. Frederick, K.D. (1993) "Balancing Water Demand with Supplies: The role of Management in a World of Increasing Scarcity," Technical paper 189, Washington DC: World Bank

3. Glieck, P.H. (1997) “Human Population and Water: Meeting Basic Needs in 21st Century”, in R.K.Pachauri and Lubina F. Qureshi (eds.) Population, Environment and Development. New Delhi: Tata Energy Research Institute. pp. 105-121
4. Howe, Charles W., Dennis R Schurmeir and W. Douglas Shaw Jr. (1986) “Innovative Approaches to Water Allocation: The Potential of Water Markets”, Water Resources Research, 22(4), April, pp 439-445
5. Kumar, Dinesh (2001) “Demand Management in the face of growing water scarcity and competition in India: Future Options” Working Paper 153, Institute of Rural Management Anand
6. Livernois, John, (2002), “The Economic Costs of the Walkerton Water Crisis”, Ontario Ministry of the Attorney General, Toronto
7. Rosegrant, M W., C. Ringler and R V Gerpacio (1999) “Water and Land Resources and Global Food Supply”, in G H Peters and Joachim Von Braun (eds) Food Security, Diversification and Resource Management: Refocusing The Role of Agriculture” Ashgate Publishers
8. Seckler. David, Upari Amarsinghe, David Molden, Radhika de Silva and Randolph Barker (1998) “World Water Demand and Supply 1990 to 2025: Scenarios and Issues.” Research Report 19, Colombo, Sri Lanka: Interntaional Water Management Institute
9. Shah, Tushaar (1993) Water Markets and Irrigation Development: Political Economy and Practical Policy. Bombay: Oxford University Press
10. Singh, K (1994), Managing Common pool resources, Oxford University Press, New Delhi
11. World Bank – GoI (1998) “Inter-Sectoral Water Allocation Planning and Management,” World Bank-Government of India, India Water Resource Management Sector Review, Volume 1, New Delhi

ANNEXURE

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.924[a]	.854	.842	7.189	2.550

a. Predictors: (Constant), DTN, Accessibility , Awareness, DMH, Affordability , Availability

b. Dependent Variable: Cost of Water (Rs./month)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21731.295	6	3621.883	70.076	.000[a]
	Residual	3721.312	72	51.685		
	Total	25452.608	78			

a. Predictors: (Constant), DTN, Accessibility , Awareness, DMH, Affordability , Availability

b. Dependent Variable: Cost of Water (Rs./month)

Coefficients

Model		Unstandardized Coefficients		Stand. Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	11.040	5.355		2.062	.043					
	Availability	3.102	2.847	.079	1.090	.280	.242	.127	.049	.382	2.621
	Accessibility	2.711	1.598	.119	1.697	.094	-.285	.196	.076	.410	2.441
	Affordability	16.557	1.638	.673	10.105	.000	.791	.766	.455	.458	2.181
	Awareness	-.751	2.173	-.020	-.346	.731	.480	-.041	-.016	.588	1.700
	DMH	-21.958	2.163	-.563	-10.154	.000	-.679	-.767	-.458	.661	1.512
	DTN	-10.296	2.106	-.267	-4.889	.000	.134	-.499	-.220	.682	1.466

a. Dependent Variable: Cost of Water (Rs./month)

Correlations

	Cost of Water (Rs./month)	Availability	Accessibility	Affordability	Awareness	DAP	DMH	DTN
Cost of Water (Rs./month)	1							
Availability	.229*	1						
Accessibility	-.283*	-.696**	1					
Affordability	.758**	.235*	-.429**	1				
Awareness	.480**	.220	-.263*	.608**	1			
DAP	.519**	-.218	.041	.162	.021	1		
DMH	-.686**	-.096	.124	-.338**	-.334**	-.512**	1	
DTN	.142	.320**	-.164	.164	.308**	-.527**	-.459**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

BRIEF PROFILE OF THE AUTHORS

Nagachethan SM

Nagachethan S M graduated in Bachelor of Engineering (Information Science and Engineering)from the Visweswaraiah Technological University, Belgaum in 2004. He obtained PGDRM(Post Graduate Diploma in Rural Management) from Institute of Rural Management Anand (IRMA) in 2008. From 2008 to 2010 he worked with ICICI Bank under Rural and Agribusiness Banking Group involved in structuring economically viable financial products for farmers and rural poor. Presently he is working with IndusInd Bank Ltd. in Small and Medium Enterprise (SME) division. He has presented the paper at International Conference on Chronic Poverty in India – Policy Issues & implementation at JNU, New Delhi

Prashant Hegde

Prashant Hegde graduated in Bachelor of Science (Agri.) from the University of Agricultural Sciences, Dharwad in 2006. He obtained PGDRM(Post Graduate Diploma in Rural Management) from Institute of Rural Management Anand (IRMA) in 2010. From 2010 to 2011 he worked with IFMR Ventures under Rural Drinking Water Network Enterprise vertical involved in structuring economically viable business model to set up water plants in rural areas. Presently he is working with Axis Bank Ltd in Small and Medium Enterprise (SME) division.